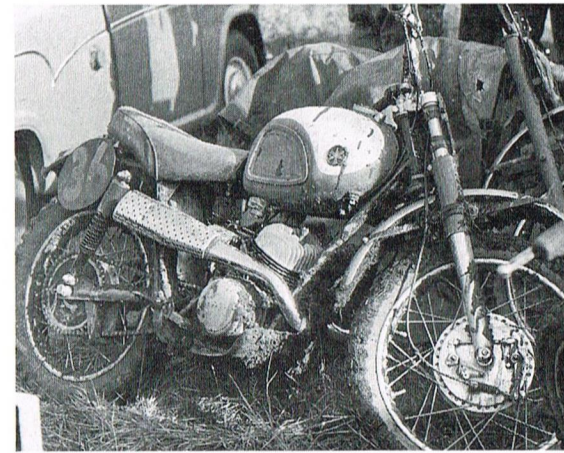




1 The DT1—an American vision



Above This YDS3-CM is a rare beast, being a TD1-B road-race engine in a YDS3 chassis, with upswept exhausts and a bash plate the sole concessions to off-road riding. Note the twin-leading-shoe front brake

Left Fumio Ito on the rough stuff during Yamaha's first international 'road-race' at Catalina in 1958

Yamaha's links with the world of off-road competition, in fact, date back to the days of their first participation in motorcycle competition of any form. During 1954, construction had begun of the first production-line Yamaha motorcycle. The YA1, or Red Dragonfly as it was affectionately named, was a 125 cc two-stroke single modelled heavily on the most influential 125 of the period, the DKW RT125. At the time of the YA1's launch on to the market, its success was not assured. In fact, the odds were against it competing successfully in a market swamped by the products of more than 40 native manufacturers. Many of these companies placed their hope of survival not only in the production of what they felt to be high-quality machines, but in the demonstration of their superiority over the others through the emerging medium of racing.

In 1953, the first post-war Japanese road-race had been held on the slopes of Mount Fuji. The term 'road-race' was a bit of a misnomer as the track surface was actually of hard-packed volcanic ash, with not a trace of tarmac to be found. The philosophy behind the event had been to foster and encourage the home motorcycle industry with the view that racing improved the breed. To this end, the entry was restricted to standard Japanese machines. The race was a huge success, although not able to prevent the manufacturers of the winning Auto-bit from slipping into oblivion not long after their triumph.

The following year two classes were introduced and Suzuki started their roll of honour with a win in the 90 cc lightweight class. The same 90 cc and 250 cc class divisions were to be used for the 1955 event, putting Yamaha at a large capacity disadvantage. Their 125 Red Dragonfly would have to do battle against machines twice its size. The company was so anxious to prove their product in the public arena that they took the chance and entered the race. They needn't have worried, for the power-to-weight ratio of the YA1s seemed to be perfect for the muddy surface and a Red Dragonfly flew round the track to take it and Yamaha's first race victory.

A second race was planned for 1955, at a change of venue. A track similar to that on Mount Fuji was found on Mount Asama, just north of Tokyo. The Nippon Motorcycle Race Association wanted to stage regular events at this location and 1955 would herald the first. Yamaha were anxious to confirm the quality of the YA1 by again defeating all-comers. What ensued was the now legendary Asama race, for which the Yamaha team had achieved a couple of hours' practice on the actual circuit while the competition was still imbed! The first four places were taken by the Yamaha team members. The famous link between the company and motorcycle competition had been forged.

The race victories in 1955 had the desired effect. Sales of the YA1 were very strong and provided enough income to enable the company to grow and begin development of what was to be their first twin, the YD1. The second Asama Plains race meeting was to be yet another Yamaha triumph with the first two places in the newly introduced 125 class for the YA1 and first three in the 250 class for the YD1. Although not billed as such, these were really dirt-track events, for Japan didn't get a tarmaced road-racing circuit until Honda built their Suzuka test track in 1962. The only concession that was made to the inhospitable terrain was the provision of

knobbly tyres for improved traction, and flat handlebars for better control. The first bikes raced in the US were similarly kitted, but it wasn't long before they began looking more like the road-racers they were.

While the company fought to establish itself as a major motorcycle manufacturer, development was concentrated on the production of good streetbikes and their road-race equivalents. The overriding priority was to establish a range of street machines that would sell in enough numbers to allow the company to expand. Only then would it be possible for the company to explore the peripheral fields of motorcycling, such as motocross. While this was undoubtedly Yamaha's philosophy for the first half of the 1960s, they did not waste the occasional opportunity that arose to produce street-based or road-racer-based machines that were intended for off-road riding.

The first of these was the Ascot Scrambler machine that appeared in 1963. It was basically a hybrid machine constructed from the YDS2 streetbike. This was Yamaha's first real worldwide-selling street 250 twin, from which had been derived their first production road-racer, the TD1. The Ascot Scrambler was an amalgam of the two. The chassis came straight from the streetbike, with most of the street electrics removed and a fully tuned road-race engine was slipped into it complete with chromed expansion chambers. Yamaha produced the machine in very small numbers for use on half-mile oval tracks and for desert races and American TTs over hard-packed smooth surfaces. There were no modifications made to help the machine perform better in the dirt, and it cost Yamaha virtually nothing to develop. The few that were produced were quickly sold, since it was undoubtedly the fastest, if not the most reliable, 250 machine available at the time.

When the next 250 twin appeared during 1964, Yamaha went one step further, by producing the first of their 'Street Scramblers'. This was

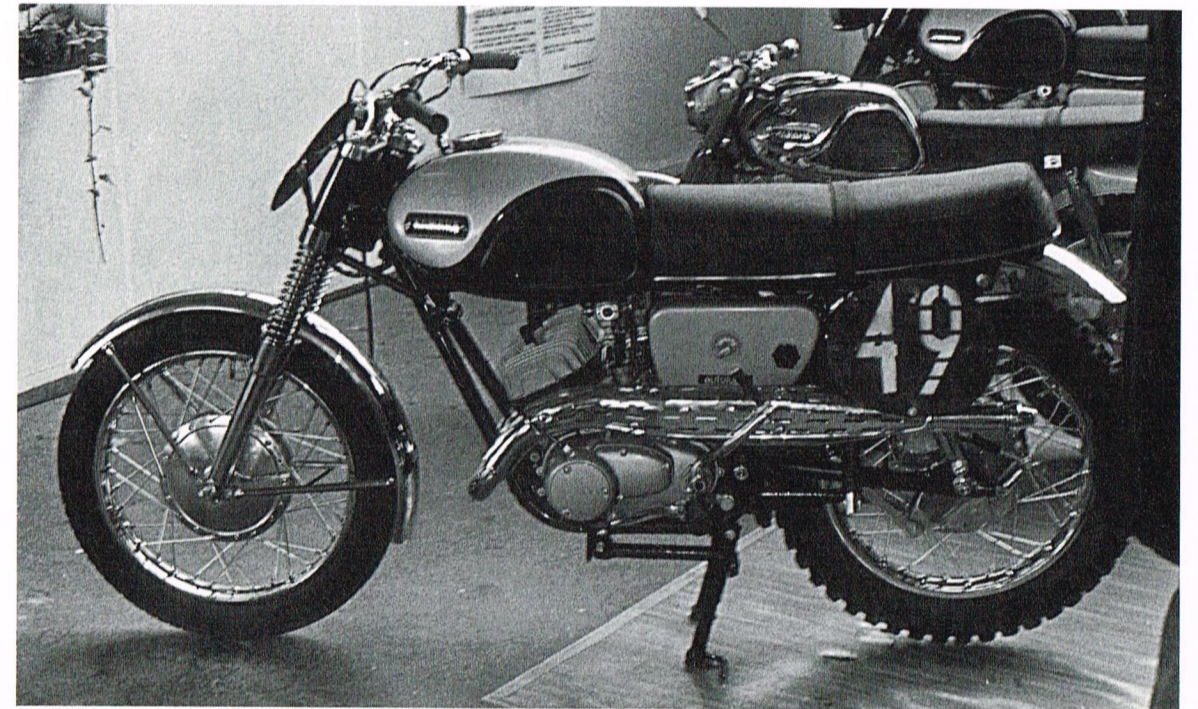
a concept that gave the first indication of the growing movement towards dual-purpose motorcycles in the US. Street scramblers were street machines through and through, but an impression was carefully nurtured that the bike could actually perform on the dirt, by fitting it out with upswept exhaust pipes and a bash plate under the engine. In 90 per cent of the cases this was all that was changed on the machines. Understandably, they were hardly suited to anything but the gentlest trail ride, which could as easily have been ridden on the standard street machine. Where they did perform well, was in the building of an image for the owner, and for that reason they sold well.

Interestingly, Yamaha's YDS3-based street scrambler did have a slight tune-up over the pure street engine. A higher compression head was fitted and the exhaust port timing was raised by means of a slot cut on the exhaust side of the piston. The extra power this generated would

have been useless on the dirt with the weight of the YDS3 to haul around. But Yamaha had thought of that one as well, for it was possible to buy a YDS3CM kit, that basically converted your street scrambler into a TD1-B road-racer-based machine. Almost half the engine was replaced in the kit, with different cylinders, heads, carburettors, pipes and ignition included. The resulting power output would have been around 35 bhp, but the excess weight of the rig would have severely compromised the kit's effectiveness.

Yamaha continued to produce street scrambling variants of some of their twins up to the end of the 1960s, but these were limited to the cosmetic changes of upswept exhaust pipes and were intended for the boulevard posers and not the true dirtbike enthusiast. A completely separ-

A typical example of the 'Street Scrambler' concept was this 1965 YDS3-C, although this one has been stripped of electrical equipment ready for competition



ate range of motorcycles had been developed for him marking one of the most stunningly successful developments of a motorcycle genre the industry had ever experienced.

Like many of the earth-shattering decisions that were made in the motorcycle industry, there is a very simple human story behind it. It is told very well by the current editor of *Cycle*, Phil Schilling, in his book *The Motorcycle World*. The story is so important in showing how successfully the knowledge of a group of Western experts could be combined with the enormous drive and resources of a Far Eastern company, that the salient facts are repeated here.

The concept of a dual-purpose motorcycle crystallized around the contact between two men working for the US Yamaha concern in 1966, Jack Hoel and Dave Holeman. Hoel was Yamaha International's head of research and development and in a unique position to be able to influence the Yamaha product line. The mid-1960s was the golden time of proliferation for all the Japanese manufacturers and it was their success in the US market that was largely responsible. Any ideas for new products that were likely to improve their market share in the US would be guaranteed a receptive ear. Hoel's meeting with Holeman sparked off just such an idea. Holeman, then head of technical publications with the company, was in the process of picking up a new sport—desert racing.

This was a minority sport if ever there was one. Basically classified as enduro riding, the term encompassed two very different forms of off-road competition that had evolved due to the startling environmental contrasts encountered in the continental US. In the north and east of the US, enduro racing had developed in the European style of timed trials through rocky woodland, where the skill lay in matching the time allocated for sections rather than going Wide Flat Out (WFO) to get to a given location first. In many of the southern states, the more erudite skills of balance and pacing had been rejected

for the more physical skills of controlling 150 kg of raw power as it flew over the wide open spaces of the desert surface. The two environments had led to different machines being developed as most suitable for the riders of each type of enduro. Desert sleds, as they were termed, required two main qualities that took complete priority over everything else: blistering speed and tramline stability. In contrast, the woods enduros needed lightweight machines with quick steering and an engine that would lug them out of trouble. The resulting machines were big four-stroke twins based on street models in desert racing and smaller two- or four-stroke singles, that were close to trial machines, for the woodland enduros.

Interestingly a change was taking place at the beginning of the 1960s, that was most evident in the desert racing world. More and more lightweight motocross-based machines were finding their way into leading positions in desert races, where their slight lack of top end performance was more than compensated by their agility and ease of riding, causing the rider less fatigue than the white-knuckled wrestling match often encountered with the monster desert sleds. The ground between the two variants of enduro racing was beginning to close as Dave Holeman began his initiation into the sport.

Hoel was curious enough to tag along a couple of times when Holeman went to his desert race meetings. After seeing the machinery being used, he became increasingly convinced that a market would exist for a machine that was a perfectly respectable street machine from Monday to Friday, and could easily be turned into a reasonably competent rough-terrain vehicle at weekends. Anxious to bounce his idea off someone possibly more tuned into the domestic Yamaha attitude, he shared his concept with two native Japanese on detached duty at Yamaha International in Los Angeles. Both Mike Sekine and Ike Kono considered the idea worthy of being brought to the attention of the long-range

project team in Japan. So at the next project planning meeting in Japan, Hoel put his case for starting a development of a dual-purpose motorcycle capable of being used in both environments. He left the meeting with the commitment for production of an initial prototype, based on input he would provide. Mindful of the development method of 'design by emulation' that had so successfully produced the first Yamaha single and twin, the best initial input to the design was considered to be suitable machines that already existed.

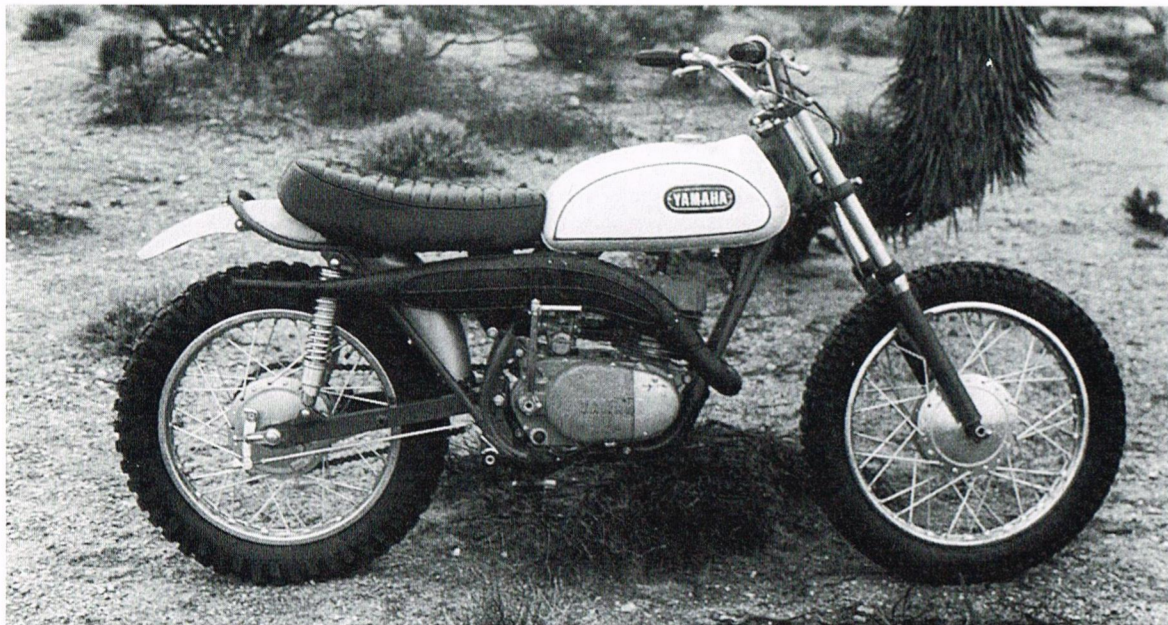
This was a tricky point, since nothing quite like the intended machine existed at that moment. The closest any came to the concept were the Spanish dual-purpose machines that had begun appearing a couple of years before. Montesa had produced a 250 cc Scorpion in 1964, and Bultaco had followed with the 153 cc Campera in 1965 which was enlarged to 175 cc for 1966. In 1967, Bultaco added the 250 cc Matador, a four- (later five-) speed 250, that was close to the design objective of the Yamaha machine. But they were doomed to failure. Without the support of a comprehensive dealer network, they would never sell to anyone but die-hard enthusiasts who were happy enough if there was a dealer in their state, let alone city. Needless to say, apart from the Japanese, there was only one group of motorcycle manufacturers that might have been able to make the idea work, and that was the large British companies. With their extensive dealer network, and with their reputation still surprisingly intact, they would have been well placed to have made the idea work. But one can easily imagine the derision with which such a suggestion would have been greeted in the company boardrooms back in the UK. As it was, all the Europeans could do was look on impotently as their machines were plagiarized to produce a new generation dual-purpose motorcycle.

In mid-1966, the first prototype arrived in the US for analysis, having been built based on the information gleaned from the European mach-

ines Hoel had sent to Japan. It could hardly be said that it was right first time, but at least the engine was all right. Fortuitously, the company had started to develop a 250 cc single-cylinder engine with which they had intended to power their first attempt at producing a motocross machine. A detuned version of this was an ideal power unit for the new dual-purpose machine. The chassis was not quite so suitable, but that could be more easily developed in tests in the wastelands of southern California. In order to help with the development, Neil Fergus, a successful desert racer, was brought into the team and together they set about producing a chassis that had the special qualities necessary for the rigours of off-road riding. Weekly reports were sent to Japan detailing the changes that were being made and recording the results. Although the development was being done in the US, Yamaha Japan was holding the budget purse-strings and wanted to be kept right on top of the progress being made.

The story goes that the team completed the tests towards the end of 1966, and crated the finished product up and despatched it to Japan for analysis. Two days later, the first pre-production models arrived from Japan. Based on the reports sent back to Japan, prototype models had been assembled and would be used as a model for the production of the first model year. Japan had not waited for the final machine before committing themselves to a production model. The version they had built was not as good as the final team product but adequate enough to justify production. The first DT1s had been assembled.

Despite the startling impact the bike would have on the motorcycle world, the DT1 was not a remarkably radical machine. It was a soundly engineered motorcycle employing contemporary two-stroke technology, in which, it must be admitted, Yamaha were world leaders. The engine had the largest displacement cylinder Yamaha had ever built, but this caused no prob-



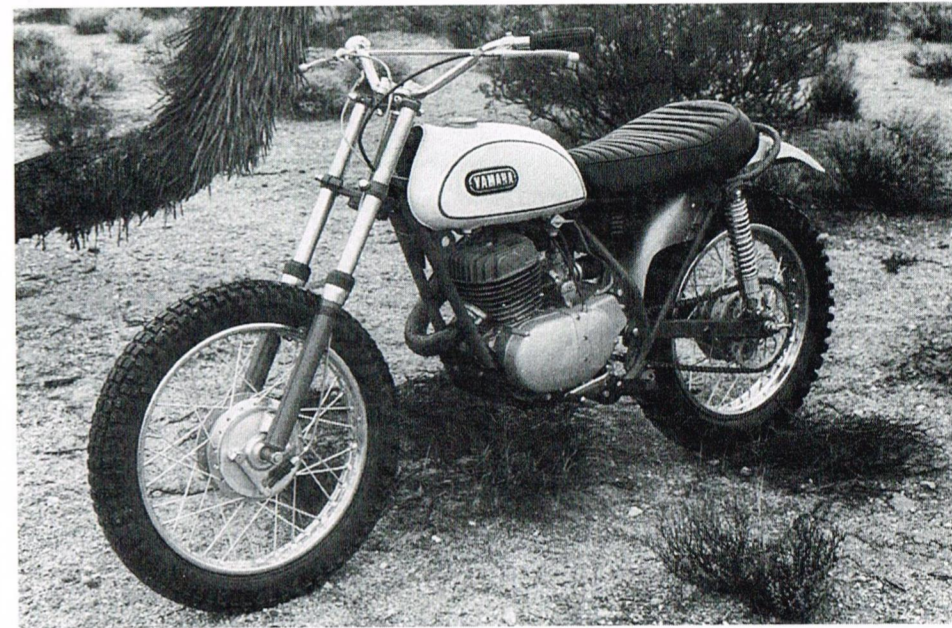
lems. Although the cylinder dimensions of 70 mm x 64 mm represent an engine with a slightly short stroke, the DT1 was not built to rev. With a conservative compression ratio, and a simple exhaust pipe, the peak power was delivered at a lowly 6000 rpm. For this range of engine speed, the engine was really over-engineered. The result of this safety margin was an absolutely reliable, completely bullet-proof, mill, which was just as well when it is considered how hard it was thrashed.

The crankcases were split vertically, as was always the case with single-cylinder machines. The alloy cylinder had a shrinkfit iron liner into which the ports had been cut before assembly. Four long-reach studs screwed into the crankcases and held both barrel and cylinder head in place. The combustion chamber featured a spark plug whose position was offset towards the left-hand side of the cylinder. It is difficult to understand the reasons for this since it would not have eased the thermal loads on the piston crown, the usual reason for moving the plug from its central

position. Four rubber pellets were inserted between the fins of the cylinder head in an attempt to reduce their ringing. The fresh charge was fed to the engine by a 26 mm round slide Mikuni carburettor, fitted with a choke lever that enriched the fuel/air mixture via an extra starter jet, as was standard Mikuni practice at the time. The air filter was not easily accessible behind the exhaust pipe. The pipe exited straight from the exhaust manifold for about 20 cm, before sweeping up and to the right-hand side of the bike, keeping well out of harm's way. The matt black pipe was fitted with a heat guard along its length under the fuel tank and seat to protect the rider's legs from its high surface temperature. Since the exhaust design was not too critical for the generation of high-power outputs, Yamaha were able to tuck the pipe well out of the way by flattening the sidewalls in the section passing under the rider's legs. It was a well-designed piece of equipment, and full credit to Yamaha for resisting the temptation to chrome it!

The pressed-up crankshaft ran on two main

Left and right One of the final DT1-prototypes stripped for competition in the way Hoel and Holeman envisaged many DT1s would be used



ball bearings, with a roller bearing at the big end of the conrod and a needle bearing at the small end. Initially, two flat rings were fitted to the piston and the first 3000 engine units were assembled without expander rings but after some seizure problems these were added. Later, the Keystone ring, that Yamaha so wholeheartedly embraced, was used. Ignition was by magneto with the flywheel keyed to the right-hand end of the crankshaft. On the opposite end was the helical primary drive, and the gear for the Autolube oil pump. Autolube had first started appearing on Yamaha motorcycles in 1964, as Yamaha attempted to make the two-stroke more socially acceptable. It was quite simply a small oil pump driven from the crankshaft, that passed oil from a tank under one of the side covers via a banjo bolt to the inlet tract of the cylinder. The amount of oil that flowed was dependent on the engine speed, and hence a more accurate and much simpler means of lubricating the engine was provided. By 1966, its use had become universal.

The clutch was of conventional design with an actuation rod running the length of the transmission mainshaft to free the 14-plate sandwich of friction and metal plates. Somewhat wary of the kind of shock loads the transmission might be exposed to by the abuse of the clutch so often performed during off-road riding, Yamaha included a cush drive in the clutch basket/primary gear connection by means of six short springs arranged in the same plane as the primary gear. Five well-chosen ratios were used in the gearbox, with a high first gear and top gear providing moderate overdrive for street use. Three forks were used in the selection mechanism, two running along a rail, driven by pins following the track cut in the surface of the selection drum, and the third fork mounted on the drum itself and running along its length driven by an internal guide pin. Primary kickstarting, allowing the bike to be started in gear with the clutch in, showed the thought that had been put into the functionality of the machine.

The main frame consisted of a large diameter



The premier of the DT1 took place at the October 1967 Tokyo Motorcycle Show

single backbone tube running from the top of the headstock above the engine, before curving down, behind the engine, and a duplex engine cradle running down in front of the engine, under and behind to join the backbone. The rear sub-frame to which the seat and top of the rear shock absorbers were attached, was a single loop of rail from the backbone of the main frame, with two rails running from the main frame behind and under the engine to the damper mounting lugs. A bracing tube tied the backbone to a plate between the two front downtubes just under the headstock. Extensive gusseting was used around the headstock. Constructed from mild-steel, the diameter of the tubes was a little excessive, adding significantly to the overall weight of the DT1. A steel bash plate protected the bottom of the engine from any rocks encountered on the trail.

The massive box-section swinging-arm pivoted on a plain bush without any provision

for *in situ* lubrication. A sheet aluminium chainguard helped protect the exposed section of chain from low-level branches that might otherwise derail it. Ceriani-style front forks were provided but no attempt was made to extend the amount of wheel travel above the standard 100 mm or so available on streetbikes. Three-way adjustable spring preload was possible on the rear dampers. Both front and rear wheels used full-width hubs running on ball bearings with single leading-shoe drum brakes. The rear brake was full-floating with the brake shoe backing plate tied to the frame by an aluminium rod. A second transmission cush drive was provided in the rear hub with the rear sprocket mounting plate meshing with six rubber segments in the hub.

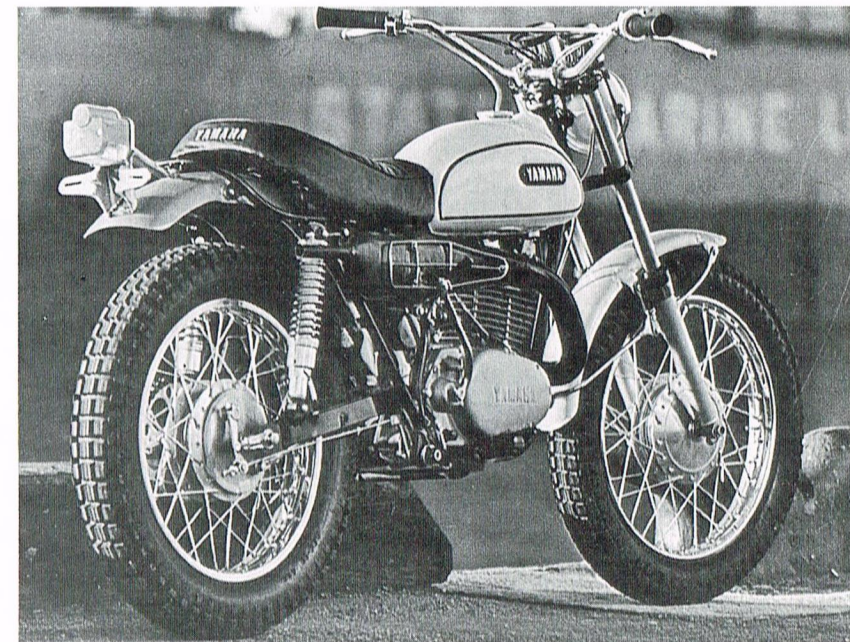
The miscellaneous equipment was all solidly designed. The footrests were spring-loaded and the brake pedal had a serrated surface to improve grip with a muddy boot. A grab-rail was provided to help lift the 105 kg machine out of quagmires or to help the passenger hang on to the rather short dualseat. Actual passenger footrests were not provided as standard but optional extras that were bolted on to drilled and tapped holes in the swinging-arm. Full electrical equipment included a 35-watt headlight and a tail-light. No indicators were fitted. Both speedo and tacho were mounted above the headlight, with a resettable odometer located within the speedo. The first DT1 came decked out in white with a lettered Yamaha badge on the sidewall and as the DT series progressed it was always referred to as the 'white tank' model. A decal on the left-hand sidecover proudly announced the capacity and enduro function of the DT.

The performance of the DT1 was quite satisfactory, with a top speed on the open road of 70 mph and sufficient torque to allow all-day chugging along the trail. Clearly there were serious limitations to the abilities of the standard DT1 in the dirt, but it performed better than any other street-based motorcycle ever produced.

Yamaha quickly realized the potential of the DT1 in amateur-level motocross competition and US-style TT and scrambles. A Genuine Yamaha Tuning (GYT) kit was hastily assembled, which added a whacking 10 bhp to the power output and a further 1500 rpm to the top end. It consisted of a chromed cylinder, head, piston, 30 mm Mikuni and a properly designed exhaust pipe. The piston had a single thinner ring in place of the two standard rings. As the engine was expected to turn faster, the thinner ring would reduce power-sapping friction and be less likely to start fluttering at the 7500 rpm engine speed. The chromed cylinder was lighter, lowered piston/wall friction and had longer exhaust and inlet period port timing. The compression ratio had been raised by reducing the capacity of the combustion chamber by 27 per cent. A large selection of drive and rear wheel sprockets were available to allow changes in gearing according to the application. As Jack Hoel and Dave Holeman had expected, DT1s started showing up in open country enduros with good results, culminating in Mike

Patrick and Phil Bower's victory in the 1969 Mint 400 desert race, when they headed the 24 finishers home from a starting field of more than 200. Hoel and Holeman's vision had been confirmed.

When announced at the beginning of 1968 in the US and Australia, the demand was simply staggering, catching Yamaha completely by surprise. The initial 8000 machines exported to the US were snapped up within a couple of months. Production was stepped up from the initial 1500 per month to the 2500 maximum that the plant was capable of. Export orders were given priority leaving a starved domestic market with three-month waiting lists developing. The unit sales figures over the first model year were never exceeded before or after by another Yamaha model. Jack Hoel deserved Yamaha's Medal of Freedom or promotion to Official Yamaha Oracle, or something. Instead he simply continued in his function as head of Yamaha R & D in the US, working on the conception of another DT1 success story.



Appearing to recognize the significance of the introduction of the DT1, *Cycle World* placed this photo on the cover page of their February 1968 issue