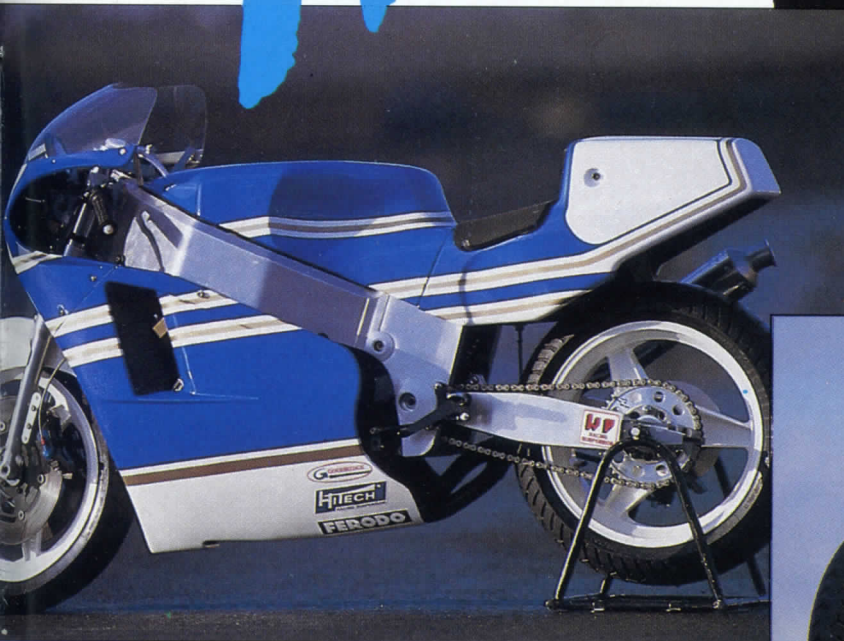


PHOTOGRAPHY PHIL MASTERS



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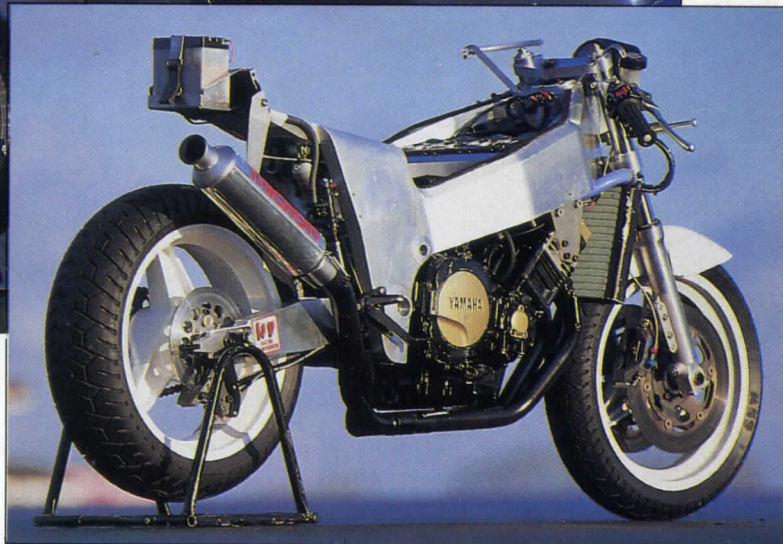
There's far more to the Morespeed AV-1R's chassis than meets the eye. Roland Brown gets first ride

Parked behind the Donington Park pit lane, the little blue-tanked bike looked neat, functional and unexceptional; it provoked virtually no interest among the handful of racetrack employees and construction workers who hurried by on this unseasonally mild January morning. Weak sun reflected from the flat alloy expanse of a frame whose design owed much, it appeared, to the extruded twin spars long employed by Bimota and by Yamaha themselves to support the tuning-fork company's FZ750 motor and its derivatives.

But the similarity to such conventional design was literally little more than skin deep. As the small, bespectacled figure of Stephen Moore rocked the bike off its stand, took a few steps and bumped the engine into

raucous life before riding his prototype machine cautiously across the empty paddock, he was creating a small piece of history. Those first few wobbling yards marked the arrival not only of the Morespeed AV-1R motorcycle but of a new direction in two-wheeled chassis production.

Much of the AV-1R is conventional, albeit cleverly designed and expertly hand-crafted, but the frame is unique for what will soon be a roadgoing bike. The smooth alloy surfaces of Moore's creation are not hefty extrusions but flimsy sheets, just 1.5mm in thickness, separated by a support structure of fine aluminium honeycomb. There are no welds joining the frame together and, apart from those attaching ancillaries like footpegs and the carefully-curved radiator, no bolts



Top: Stephen smiles sweetly in the knowledge that his honeycomb design really is the bee's knees. **Above left:** Fully-clothed AV-1R looks conventional but the whole frame (above) is made from two glued-together sheets

either. The whole frame, including the milled-billet section at the steering head, swing arm pivot and engine mount areas, is held together by glue.

The frame's raw material is 35mm-thick prefabricated aluminium board. This composite structure gains its rigidity from the way in which the strength in one direction of the two outer sheets combines with the crush-resistance in a perpendicular direction of the even thinner walls of the honeycomb 'sandwich' trapped inside. The combination gives the advantages in strength and lightness of the deep, thin wall

members without the tendency to buckle they'd have if unsupported by the honeycomb.

The complete frame is enormously stiff yet weighs just 8.5kg, which is, Moore says, a little over 3kg lighter than Suzuki's 1987 factory Formula One bike equivalent. The similarly-constructed swing arm saves almost as much again. Moore should know. If his face is vaguely familiar it's because the 31 year old from Worthing in Sussex spent seven years as a mechanic for Suzuki's Formula One and grand prix race teams, travelling the world to prepare machinery

for riders from Graeme Crosby to Kevin Schwantz.

In retrospect, Moore's career can be seen to have led almost inevitably to his decision to manufacture a composite-framed motorcycle. After being made redundant from his first job, as an apprentice engineer at the local Shoreham airfield, Stephen worked for 2½ years as a cabinet maker, constructing bookcases and shelving in wood. It was here that he learned the techniques he would later adapt and use to fashion the composite board for his frame.

Disliking the dust and noise of the furniture factory, he left to work for Suzuki, first respraying damaged Lambrettas that the firm had imported (he admits to racing the scooters, too, before taking briefly to the track on a 250cc X7 proddy bike) and then servicing Suzuki's fleet of press demonstrators. That taught Moore plenty about four-stroke motorcycles, and led to a job twirling spanners on the GS1000-based racers ridden by flying Kiwi Croz and the late John Newbold in the new world F1 championship.

Stephen found preparing the four-stroke racers enjoyable but limiting. "We had a good laugh but apart from rebuilding the engines after every race there wasn't a whole lot you could do to the bikes. After a while there wasn't enough excitement with the four-strokes for me. The 500 grands prix seemed to be where it was at so when Suzuki got back into GPs in 1984 I joined the team to mechanic for Rob McElnea."

Moore's introduction to composite materials came that year with the revolutionary 'white bike', designed by Nigel Leaper and ridden by Rob Mac at the Silverstone GP and elsewhere. "The white bike's frame was made of inch-thick, aluminium-skinned honeycomb N-board and when I first saw it in '84 I was quite astounded to think that all that was held together with glue! But once you get over the disbelief that it can be strong enough for a motorcycle then it's no problem, because it is so strong compared to a normal chassis."

By the end of that season Leaper had progressed to designing a carbon-fibre composite frame for Suzuki's reed-valve RG500 square four. Although the engine could never be made competitive, the 'black bike' proved its worth on the scales and in the catch-fencing: "The

whole black frame weighed about 6kg and the white one 8kg, which at the time was a lot less than the other chassis that were around. And they survived *such* bad prangs – you wouldn't believe the number of times the black bike used to go down the road. . ."

The brilliant Leaper, who now works for the all-conquering McLaren F1 car team, did the main designing but was helped and guided by Moore and the rest of the team. "Everybody had input into the finished product – we'd discuss ideas and which components to use to make the thing as cheap and as easy to work on as possible. That was how I got experience in composites: racing them, modifying them, smashing them up and then repairing them."

In 1986 Paul Lewis rode in the GPs using the carbon-fibre frame fitted with a new reed-valve RG engine, still without the success the chassis deserved. By the end of that year Leaper, in consultation with Stephen Moore and others, was busy working on the doomed project of a black chassis to house Suzuki's long-awaited V4 500 engine. "In '87 we kept pushing the factory to give us a V4 engine to test but they always wanted us to use their complete bike. It was a shame but they just wanted to do their own thing and would never give us a motor."

While Kevin Schwantz's success shortly afterwards on the standard-framed machine would perhaps justify Suzuki's caution, Moore was growing

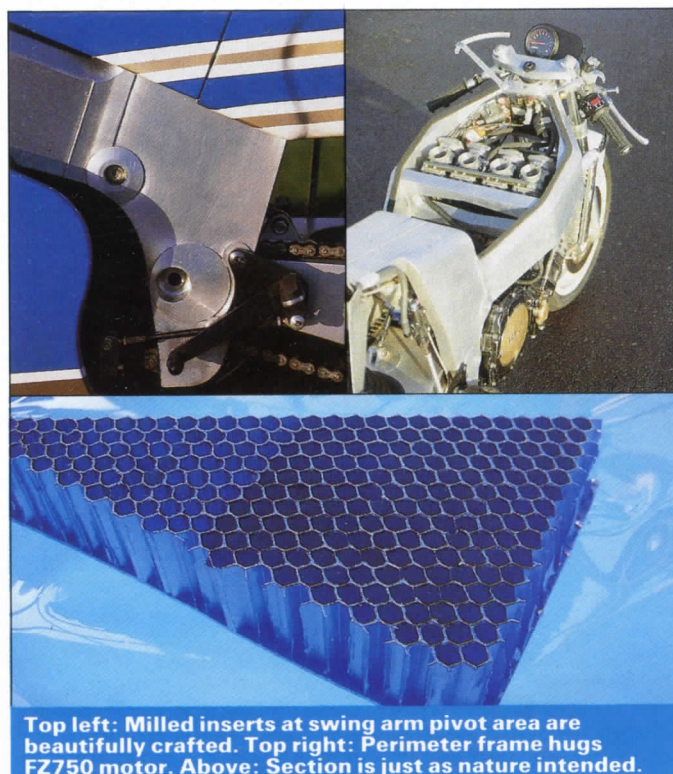


Shaped honeycomb board reveals thin cross-members until pieces of skin are glued into place along open sides

frustrated. With his confidence in composites by now far stronger than his desire to spend most of the year apart from his wife and twin children (whose names, Anthony and Victoria, give the AV-1R its initials), Stephen left Suzuki at the end of '87 to go it alone. "When I left I hadn't decided what to do; I didn't know if I wanted to get away from bikes or not. But I'd had enough of spending six months of the

year away from home and had decided that if I was going to put in the hours you have to do in a racing team, then I might as well put them into my own business."

The newly self-employed Moore's first job was back at Suzuki GB's Crawley HQ, refurbishing the neglected composite racers for sale or show. Then came short spells fitting kitchens and driving a mini-cab at nights to raise cash before he took the plunge into



Top left: Milled inserts at swing arm pivot area are beautifully crafted. Top right: Perimeter frame hugs FZ750 motor. Above: Section is just as nature intended.

MORESPEED AV-1R

Price.....	£14,000 (see text)
Manufacturer	Stephen Moore, 31 Cedar Avenue, Worthing, W. Sussex. Tel: (0903) 690983
Engine	Watercooled dohc 20-valve trans four (Yamaha FZ750)
Bore x stroke	68 x 51.6mm
Capacity	749cc
Comp. ratio	11.2:1
Carburation	4 x 34mm Mikuni
Gearbox	6-speed

CYCLE PARTS

Tyres.....	Michelin radial
Front	120/70VR17
Rear	180/60VR17
Brakes, front	2 x Lockheed or ISR discs
Rear	Disc
Suspension, front	43mm Showa telescopic, adjust for preload, comp and rebound damping
Rear	White Power or Hitech single shock

DIMENSIONS

Wheelbase	1400mm (55in)
Fuel capacity	24 litres (5.3 gal)

motorcycle design. "Bimota and everyone else were building frames of extruded aluminium sections, not composites. The reason seemed to me to be that the people building bikes didn't know enough about composites, and the people who did understand about composites didn't know anything about bikes. So I thought, okay, I'll build a street machine, the ultimate cafe racer, from a material that no-one else uses."

While Stephen's wife Frances went back to full-time work to pay the bills, he applied for a government enterprise allowance, founded Morespeed Composites and enrolled in finance and accountancy courses at the local college. He bought a secondhand drawing board and, choosing Yamaha's 20-valve FZ/FZR engine as his powerplant – mainly because of its lack of width – picked on a 1400mm wheelbase (slightly shorter even than that of Honda's RC30) and began drawing. The cylinders ended up placed at 40 degrees from the vertical, two degrees more upright than in Bimota's YB4 but coincidentally identical to their position in the new Yam OW01. Rake and trail figures are 25 degrees and 96mm although, as on the Suzuki GP black bike Moore cut his teeth on, these are adjustable independently using a series of calibrated inserts in the steering head.

Moore drew the shapes flat and cut them out by hand from the door-sized sections of board he buys for £500 a time. (The stuff's used in everything from buses to aeroplanes.) "The beauty of it is that in future the board can be routed on a programmable NC machine. Eventually it will be cut before I even see it, but getting to that stage has been very time-consuming. It took me five months of working long hours every day to get the design so I was happy with it."

The frame itself comprises two pieces of board which meet and are joined in the centre, under the seat (and via a milled insert at the steering head). For the expert, shaping it is ludicrously simple. "To bend the board you cut a piece of skin away on the inside; the amount you remove determines how much it bends. You fill the cut section with glue, then cap it to continue the skin strength over the join." Strips of similar skin are glued, with ruthless accuracy, along any open edges of board. The epoxy-

type glue is cured for an hour at 60 degrees C, courtesy of an electric fan-heater and a home-made cardboard oven in the Moore garage.

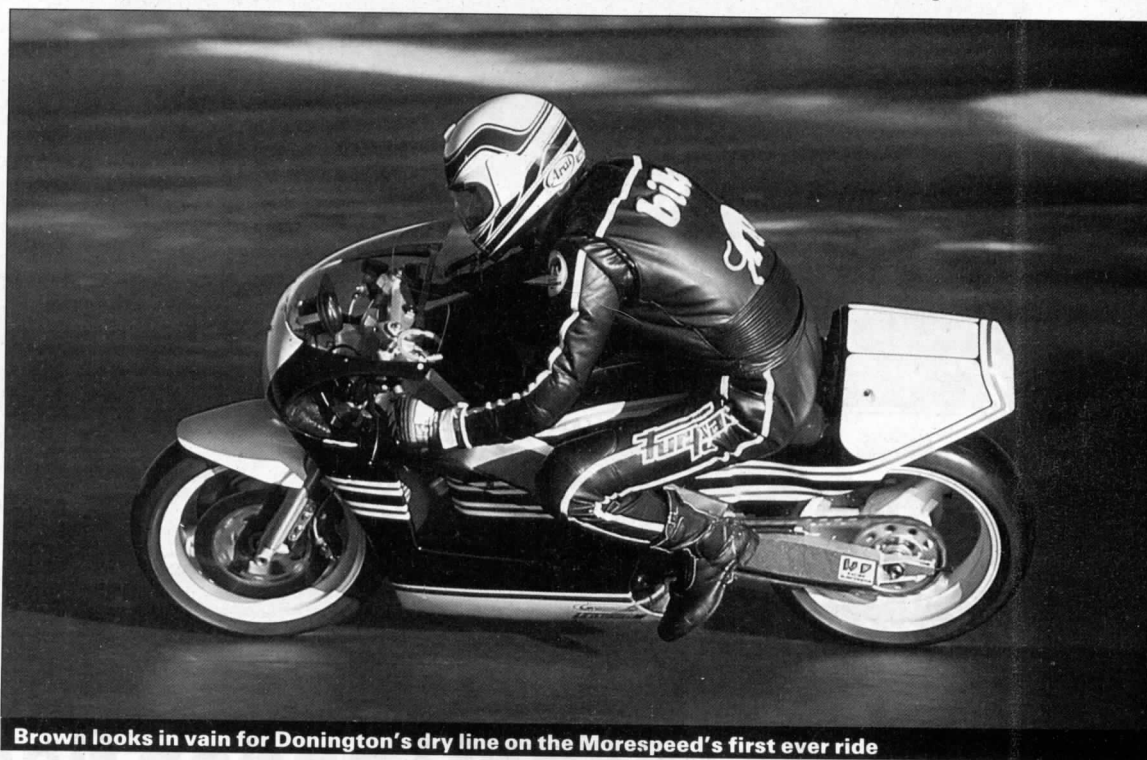
Even modifying or repairing the honeycomb chassis is easy, Stephen says. "At first I didn't have enough wheel clearance for the radiator so I just cut a bit off and altered it, which is something you could never do on a normal aluminium chassis. To change or modify it you just clean the hole out to round or square, cut and glue in a new piece of honeycomb, put a new piece of skin over

narrower.

Frantic work had a static, unfaired bike ready just in time to be the sleeping star of last autumn's Earls Court Motorcycle Show. The runner, predictably, took longer: Stephen arrived at Donington red-eyed from an all-night session fitting late-arriving brakes and fresh-painted fibreglass. The effort was worthwhile; the attention to detail obvious everywhere you looked. It's a measure of the man's confidence in his work that he was happy not only to take his initial brief ride that

geometry and suspension settings were no more than a calculated guess. My only real problem was at the Coppice double right-hander, where a sudden gust of wind would catch the bike and send it understeering off to the outside of the track while I fought to get it tipped in again for the second apex.

For a first try the AV-1R was quite amazing. The brakes braked hard, the Michelin radial road tyres gripped hard, the stock FZ motor pulled hard (if a little rich-and-fuzzily at the top end). I hung on



Brown looks in vain for Donington's dry line on the Morespeed's first ever ride

the top and add a cap over the top of that. It's then as strong as before."

The curved radiator was made specially by a firm called Docking Engineering from Silverstone racetrack, and other ancillaries are equally classy. Forks are the hefty 43mm multi-adjustable Showas fitted to Suzuki's GSX-R750J; four-piston Lockheed calipers (ISRs are an option) bite on 310mm discs via Goodridge hose; shock is a White Power (Hitech available) linked to a composite swing arm with no rising rate ("On the GP bikes we always came back to the minimum rate rise."); massively wide Maxton wheels wear Michelin rubber; the exhaust is a Micron four-into-one. Stephen designed and made all the bodywork himself, modifying the top half of an RC30 fairing and then carving up blocks of polystyrene until he was satisfied he couldn't get the bike a millimetre lower or

morning, but also to let your apprehensive correspondent out onto a damp track to open the Morespeed AV-1R's throttle in anger for the very first time.

For my tall body the little bike felt surprisingly roomy (far less cramped than Bimota's YB4, for example) though the high footrests tucked my knees under my armpits. Into gear with the up-for-down lever, take a few steps, drop the clutch and the FZ engine fired up with a raw cough from the Micron. (For street use, of course, the prototype's racepipe will be quietened and the bike will grow lights and an electric starter.)

If I was wary of riding a new, unique and almost untried bike then the Morespeed took barely two bends to reassure me. From the word go it felt nimble without being skittish; firm without being harsh. Steering was fast yet precise. The bike just felt *right*, although the

tight, concentrated on changing gear the right way and waited for the track to dry out so I could begin to push the chassis a bit harder. It never did dry out.

Later, Stephen Moore loaded up his camper van and headed back towards the south coast, happy that his bike had passed its first test. In the next few months he aims to finish development, hire some help and some workshop space and start building Morespeed AV-1Rs for sale all over the world. They will cost around £14,000 for a complete, standard-engined bike, with a rolling chassis available for ten grand and basic chassis kits priced at about £7000.

That puts the Morespeed in the Bimota/OW01 price bracket, it's true, but I wouldn't bet against the AV-1R's chassis being just as strong and just as light as those. And who the hell wants a bike with a boring old extruded aluminium frame, anyway? ■