

# Labour of LOVE

A vehicle designer and a lubricant OEM have seen a prototype low-cost 4x2 for poor rural areas around the world begin testing in India, reports Will Dalrymple

Asked to describe the prototype of an off-road-capable 4x2, Britons would probably say the Land Rover Defender, which ceased production in 2016. Americans might say the Jeep, which came out of two 4x4s made for the US military's WWII war effort. But neither was the inspiration for vehicle designer Gordan Murray of Gordon Murray Design (GMD) when conceptualising a vehicle that could help rural communities worldwide transport goods and people on unpaved roads.

His model is the humble Renault 4L, which he describes as the most successful two-wheeled off-road drive vehicle (eight million were built over its 30 years of production ending in the early 1990s). It featured 'massive' wheel travel, virtually independent suspension between left and right, big diameter (but narrow) wheels and tyres, and a lightweight frame. Murray was responding to a specification developed by Sir Torquil Norman (pictured above, left, with Murray), founder of the Global Vehicle Trust, who devised the original commission. Murray recalls: "Basically, I took that formula and made it into a truck. And the ride is just phenomenal."

The result is the Ox, a 3.5-tonne light commercial vehicle whose chassis design employs GMD's lightweight 'iStream' body technology. While a chassis cab frame would usually have longitudinal I-beams welded to cross-members, the Ox frame is made of rolled or folded steel sections attached to body panels. Other vehicles using this design, such as the new TVR sports car, would use lightweight honeycomb polyurethane-fibreglass-paper composite panels, but they would not withstand the heavy usage expected of this vehicle.

Instead, the body is made of wood. But not just any wood: this is WISA engineered plywood made in Finland by UPM (whose UK base is in Altrincham). The waterproof panels, also used in trailers and for van panelling, are rigid and tough, as well as easily machineable, according to Murray.

The drivetrain is based on a 2.2-litre, four-cylinder 16-valve Ford Transit PT22 turbodiesel engine (capacity: 100bhp at 3,500rpm; 385Nm peak torque) mated to a Ford five-speed manual



transmission. It was chosen specifically because it is well-established and available worldwide, simplifying supply and maintenance for far-flung countries.

Moving down the drivetrain, four-wheel drive was ruled out on cost, infeasibility of maintenance and weight grounds; also, the design places the engine above the front-wheel drive axles to improve traction. Front driveline and steering system are also made by Ford, as well as the uprights, brakes, hubs, bearing carriers and wheels. The vehicle sports a centre-mounted driving position, with bench seating (and seatbelts) for two other cabin passengers. Total vehicle weight is 1,500kg, leaving a theoretical payload of 2t for goods, or people sitting on bench seating in the rear, for example.

The only non-standard parts are the suspension arms and spring and damper struts, says Murray. They are important for providing independent suspension from left to right wheels, vital to smooth the ride on bumpy, rutted roads.

## SPECIFICATIONS

Length (mm) .....	4,681
Width (mm) .....	2,070
Height (mm) .....	2,385
Track (mm) .....	1,788
Wheelbase (mm) .....	2,955
Turning circle (m) .....	11.9
Wheel size .....	16in
Tyre size .....	205/80 R16
Load area (mm) .....	2,865 by 1,863
Powertrain ground clearance (mm) ....	250
Chassis ground clearance (mm) .....	400
Wading depth (mm) .....	1,300
Approach angle (deg) .....	45
Departure angle (deg) .....	55
Ramp break-over angle (deg) .....	19
N1 homologation class	



Another design alternative sees the vehicle being produced somewhere distant from point of use, and flat packed into containers - four per unit - and then shipped.

In December, Shell exhibited Ox prototype number four at its inaugural 'Make the Future' event in Chennai, India. Following that, Shell was planning to validate the vehicle concept in a real-world setting, as well as organise a second presentation event last month.

In Chennai, Nitin Prasad, chairman of Shell Companies in India, said: "The Ox is a very promising technology that has immense potential to broaden access to transport possibilities." **TE**

One Ox prototype underwent a suite of combined corrosion and durability testing at the Millbrook proving ground normally carried out on commercial vehicles. Punishment meted out over a period of months included rolling over cobbles, like the Belgian-style pave found on the Tour de France, chassis twist ramps, charging through salt water and volcanic ash and straight into sharp gravel. Not only did the vehicle survive, but also it is still running today. Murray summarises: "We know it's durable."

The road to production has been almost as bumpy as the roads it is meant to travel on. He would not state how much has been spent in the project so far, partly because it has been funded by GVT, GMD, crowdfunding and, latterly, multinational oil firm Shell.

GMD, which is looking to license the design to multiple manufacturers worldwide, estimates that the vehicle could be sold for about \$20,000. Factory tooling and kit-out costs based on a quotation for a major OEM for a site in southern Africa - which sadly fell through - was only \$4-\$5 million for production capacity of 10,000 per year.

Most of the vehicle can be assembled by hand with an 8mm hex key and a set of a few spanners. Body panels are CNC-machined. Glass is flat and requires no tooling. The only exception is for the suspension arms; there is also a little fixturing required for the frame. Repeated productionisation studies have found that three operatives could complete assembly in 11.5 hours.

