Different perspective

Military vehicles may be based on commercial truck technologies, but the differences demand some alternative thinking. Brian Tinham reports

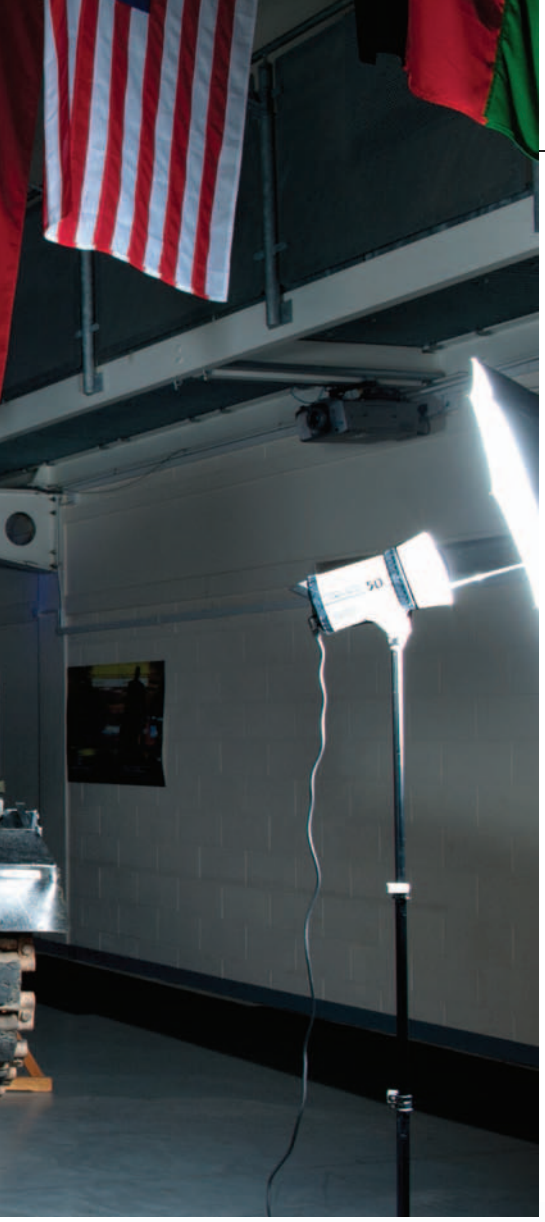
There are many obvious, but some relatively obscure, differences between commercial and military vehicles – and, for that matter, their respective fleet operators' views of what's important. So says Dave Simner, who runs the Military Vehicle Technology masters course at the Defence Academy, Shrivenham. Some, he adds, stem from military vehicles' more demanding operational roles, but others relate, for example, to maintenance. However, when it comes to emerging technologies, Simner says there is more crossover than many might realise.

Looking at variances, Simner first points out that, from a maintainability perspective, defence chiefs will see an ability to replace whole powertrains on armoured vehicles in the field as more important than sophisticated diagnostics. "Worrying about what's wrong is the job of the maintenance depots back at base," he explains. "And there are issues about the amount of data you can generate with these systems: most of the time, there's more important stuff than that to be communicating over your radio systems."

What matters, what doesn't

So, apart from, for example, Land Rovers and trucks from the logistics fleet, derived from commercial vehicles, a lot of military equipment is designed for the whole power assembly to be lifted out and replaced as one, in order to get damaged vehicles back up and running fast. Indeed, Simner indicates that, on some armoured wheeled vehicles, the approach extends beyond the engine, gearbox and transfer case to include even the cooling system.

That brings us to combat support vehicles, many of which may look, at first glance, very like their commercial truck counterparts – except for their armour. "Most cabs will have some protection, but traditional commercially-derived cabs are quite difficult to up-armour, because the construction doesn't easily allow it," states Simner. "So, if you look at the British army's most recent



truck acquisitions, they have a distinctive military cab, fabricated to accommodate heavy protection."

He points, for example, to door hinges, door panels and the overall cab structure, all of which are beefed up to carry protection panels that can weigh many hundreds of kilograms. And the theme continues when it comes to the chassis: although many support vehicles are based on conventional, ruggedised ladder frames, with beam axles, the latest in-theatre military vehicles harness quite different structures.

"The vee shaped hull approach, for instance, on the Ocelot [light protected patrol vehicle] does both a protection and a structural job, and gives significant benefits with each."

Even wheel assembly choices can be different, with twin wheels unpopular, because of their poor off-road performance, compared with large diameter super singles, which work well even on soft ground.

But that's not to say commercial truck engineering is irrelevant: far from it, says Simner, staying with tyres and pointing to the high uptake of run-flats, aimed at getting vehicles back to base when it matters. "A lot of the equipment we might see on future vehicles – such as braking systems, suspension, gearboxes, engines and emission controls – will feed through from the commercial trucks world."

In fact, the defence industry relies heavily on tier one and two truck component manufacturers,

Clockwise from top left: Dave Simner, who runs the Military Vehicle Technology masters course at the Defence Academy, Shrivenham; Iveco Trakker self-loading dump truck; Supacat Coyote patrol vehicle, based on standard truck powertrain componentry, but highly bespoke; US Oshkosh wheeled tractor unit; Iveco Trakker UOR variant, with mil spec Terex crane; Trakker training in action

Training technicians on the Iveco Trakker

PDM Training and Consultancy recently completed technician training on behalf of ALC (SPC) for the British Army's (Royal Engineers and REME) new fleet of Iveco Trakker 6x6 and 8x8 lorry loaders, dump trucks, self-loading dump trucks, volumetric mixers and well drills – including the UOR (urgent operational requirement) armoured variant.

Anton Mitchell, who headed the course, explains that these were the first with AdBlue systems to enter military service. So, even though they are disabled in active service – the trucks drop from Euro 5 to Euro 4 emissions, but with no power reduction and no OBD warning light – training for both operator/drivers and maintainers had to incorporate the injector system and SCR (selective catalytic reduction) equipment.

"These technicians would never have come across AdBlue on military vehicles. They probably wouldn't have come across the Wabco EBS either, but these are now standard on the Trakker fleet, so they needed to know," says Mitchell. "We taught them to drive and operate the vehicles with no load, and how the systems work and integrate with each other. That's important, because it helps understanding and also means they can fit test equipment without a vehicle operator."

Unit injectors, turbo brake and VGT

For Mitchell, other novelties included the Iveco Cursor 13 engine, with its unit injectors, turbo brake and variable geometry turbocharger technology, giving good power and braking assistance, irrespective of speed. "With the VGT, we showed them what it does, before breaking it down into its component items, and then showing them how it works with other vehicle systems. For example, these are very large turbochargers, but we show them there's no turbo lag, because they're on boost all the time."

His point is that, if there's degradation in the field, these technicians will understand what's going on, so they're better prepared to start fault finding, without blind reliance on the diagnostics. "It might be something indirectly involved with the VGT. It's controlled by air pressure, a PWM solenoid valve and the engine management system, so there could be several reasons for a malfunction, including some basic stuff."

And it's much the same with all the other modern vehicle systems. Mitchell cites the 14 ECUs (compared to most military vehicles' maximum of four); hydraulic systems; ADM (automatic drivetrain management) on the 8x8s, controlling the inter- and cross-axle diff locks, according to ground and driving conditions; EBS; AS Tronic automated transmission; and the fuel system unit injectors – the latter having only appeared on military vehicles in the last few years.

"If technicians have been attached to a transport unit, with MAN SVs [support vehicles], they may have come across unit injectors, but if they were with a tank or infantry regiment on Warriors or Challenger 2s, then they wouldn't necessarily know that engine technology. So, again, we taught them the principles of unit injectors, how they work – and that you can't service them as you used to. It's a replacement and then update the software to tell the EMS you've changed it."

Mitchell explains that his courses put a lot of emphasis on fault scenarios – including what the driver would see and the effect on the vehicle. "A classic example is you're driving a combination and every time you press the brake, the trailer brakes lock up. It might not be the EBS. It could be as simple as a leaking seal in the coupling, forcing the system to keep upping the pressure to deal with what it senses as brake deterioration – until it applies the emergency brakes."

Quite apart from the training value, he says the importance of this approach is in helping technicians to remember procedures. "Applying basic principles when carrying out failure diagnosis is probably the area most susceptible to skill fade," he asserts, "along with relying on diagnostic equipment to give all the answers. Sometimes, the most basic points are overlooked."

As Mitchell says, working on the same few vehicles inevitably invites complacency, as the same faults appear regularly and technicians can shortcut processes with a few checks to confirm the failure. "On an unfamiliar vehicle displaying similar symptoms, this approach may lead them down the wrong path. The skill comes in being able to apply the same basic principles and logical steps to every diagnosis."

especially for wheeled vehicles. "ABS algorithms might be re-tuned and suspensions beefed up and selected to allow travel rather quickly off-road, but, apart from tracked vehicles, it's essentially about improving robustness."

Indeed, Simner agrees that, particularly with support vehicles and modified Land Rovers, if you look underneath, you'll see something similar to the original rigid. "For example, we may well go up an axle size for any given vehicle weight, but that doesn't mean adopting construction vehicle techniques. In defence situations, we can't control the environment, so that wouldn't be appropriate."

Similarly, from an operational perspective, specifications tend to follow current trends in commercial trucks. Gearboxes, for instance, are almost always fully automatic to ensure good vehicle controllability and reduce driver workload.

And, in the end, there is no escape from country legislation, such as European emissions regulations, for all vehicles not on combat missions. The only debate is about how appropriate technology is fed into the military vehicle fleets.

"Think about MoD contracts spanning years, where legislation is enacted in the middle of the build phase. Do you fit everything with the appropriate technology, or get a waiver?" TE