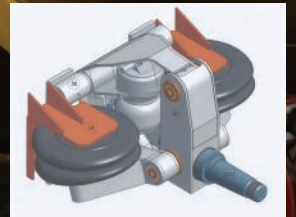


Tucked away beneath expensively designed bodies that define vehicles' form and function, it's easy to forget truck and trailer running gear. Brian Tinham uncovers a potentially industry-changing development



# Independent revolution

**T**ruck running gear isn't renowned for its fast pace of engineering innovation, much less acceptance of change by an industry with an understandably conservative outlook. Mid-lifts on 6x2 tractors were available more than 25 years ago, but widespread uptake by the OEMs was a long time coming. Small mid-lifts, pioneered among tanker fleets for weight saving, are still viewed by many as novelties. It's a similar story with multi-axle semi-trailer rear-steer systems on lowered frames: despite the clear advantages of electro-hydraulic systems for urban trailers, they remain rare beasts. And don't get me started on disc brakes.

So it's interesting to come across a novel British design for truck suspensions being hailed by developer Phoenix Axles and Suspensions as a "world beater that will make all other systems – drive, steer, tag and mid, including lifters – obsolete". Interesting, but also slightly depressing. Because, no matter how ingenious, how cheap, how cleverly it beats existing designs, or how impressive its developer's credentials, it's unlikely to come to fruition anytime soon. Or is it?

Phoenix is run by inventor John Davis, who has a pedigree in transport engineering longer than most fleet engineers' arms. He is widely credited with introducing the first mid-lift axles back in the early 1990s with then converter Southworth Engineering. Before that, he was the man responsible for getting Ministry of Transport approval for running steel and air on 38-tonners in the mid-1980s. In the late 1990s, Davis also developed one of the first electro-hydraulic rear-steer systems. Latterly he has been among top-name troubleshooters for OEMs and bodybuilders wanting solutions to challenging vehicle suspensions – including most recently for Navistar Defense on a drive axle steer system for its MXT armoured car.

**No more axle beams**

His latest invention purports to solve current suspension problems, such as lift axles fouling typically short trailer necks in the Far East, and compromising ground and/or chassis clearance on modern European low-ride height units. It also frees up centre chassis space, so significantly improving cube carrying capacity, including at reduced body height. Additionally, it's much lighter than conventional air systems – dealing with the Euro 6 weight penalty. And Davis claims it will also be significantly cheaper to produce.

The secret: Davis' design fundamentally does away with axle beams – instead turning to compact, independent chassis-mounted air suspension units. It also makes trailing arms, springs, spring seats and 'U' bolts redundant, he says, removing weight but also deleting common maintenance points. Just as important, his single suspension design is modular

and appears ready for adaptation to fit virtually any vehicle in any position (near- or off-side, tag, mid, lift, steer or drive), with stub axles able to accommodate the vast majority of hubs, brake assemblies, etc, while maintaining optimal geometry. That makes everything from component stocking to specialist vehicle conversions easier and faster than ever before.

"This design will appeal to operators concerned about fuel consumption, because fitting independent suspension allows vehicles to be lowered four or five inches while retaining compensation and ground clearance – which reduces wind resistance, especially on motorways," enthuses Davis. "The compact assembly also enables larger fuel tanks to be fitted. And on rigids, because there's no axle beam, it's ideal for LPG [liquefied petroleum gas] tanks or electric vehicle applications."

And there's more: Davis says his design does not require a roll bar because mounting the bellows outboard of the chassis "gives extremely good stiffness". And he adds that when two bellows are fitted, line fuses mean that if one fails the remaining bellows supports the vehicle while it delivers its load. Furthermore, conversion of a standard non-steer assembly to a steer unit is quick and easy, he says, and they are also identical whether installed as mid or tag – with easy adjustment of stub axle caster and camber – making the system ultra-flexible. Just as important, Davis reckons his new design lends itself well to lineside vehicle fitment, but also retrofitting for converters.

"One OEM I spoke to reckons this design would enable his next-generation trucks to carry another 400 litres of fuel. Another said he could see £980 of

**Left: Phoenix Axles' owner John Davis and (below) with North East Truck and Van engineering and homologation manager Walter Wheeldon (left) and engineering director Norman Whitaker**



**Centre: new mid-lift based on a fabricated structure attached to the axle via a new crimped sleeve design**

**Below: the new Ultimaax for tippers shaves 250kg off OEMs' mechanical parabolic systems**

cost savings per vehicle," boasts Davis. "It's about listening to OEMs but also to hauliers' fleet engineers. For example, a problem for low chassis with smaller wheels is that the lifting axle beam hits the frame – so why not do away with the tube? And for rigids on distribution work there's the issue of tail-lifts standing up on one side when lowered, so why not use the suspension to compensate? What I've designed is an independent suspension without unnecessary complexity. And it's British."

**Independent corroboration**

Too good to be true? No: independent experts believe Davis is on to something. Their only caveats: the Phoenix design has several moving parts, so durability needs examination; and roll stiffness could

be a problem in the absence of an axle tube – although air springs widely spaced and outside the frame do look promising. Those aside, our specialists agree that the inherent ability to drop the deck height could save significant fuel – either by increasing payload volume for the same overall height, or by reducing height and hence aerodynamic drag.

To an extent, the opportunity is reminiscent of that achieved by Boots five years ago, with its award-winning MUD (multi-deck urban delivery) trailer. That vehicle harnessed the load space between the landing legs and rear wheels by



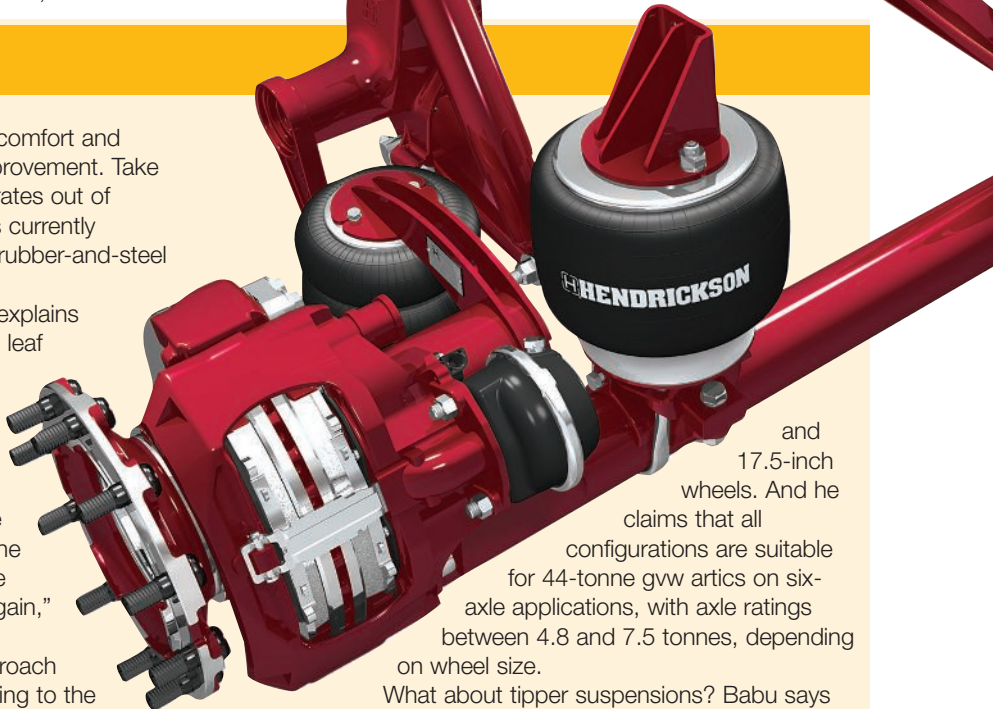
**Light weight, light ride**

Lightweighting and improving truck stability, comfort and longevity are key drivers for running gear improvement. Take axles manufacturer Hendrickson, which operates out of impressive facilities in Wellingborough, and is currently launching a new mid-lift axle and a range of rubber-and-steel suspensions for tippers.

For the axle, chief engineer Sathya Babu explains that, whereas mid-lifts typically use parabolic leaf springs and air for vertical loading, the new arrangement is based on a fabricated structure attached to the axle via a new crimped sleeve design. This not only eliminates the springs and associated components, but also improves durability, he says, because there is no direct welding to the beam. "That also means we can reduce tube thickness by 20%, so we're saving weight again," he says.

In fact, this fabrication is similar to an approach used with trailer axles – a box section attaching to the axle at the rear, while the front connects to the chassis via a frame hanger. The concept can also be used on drive axle air suspension stabiliser bars – a system already exists in the US for bus applications.

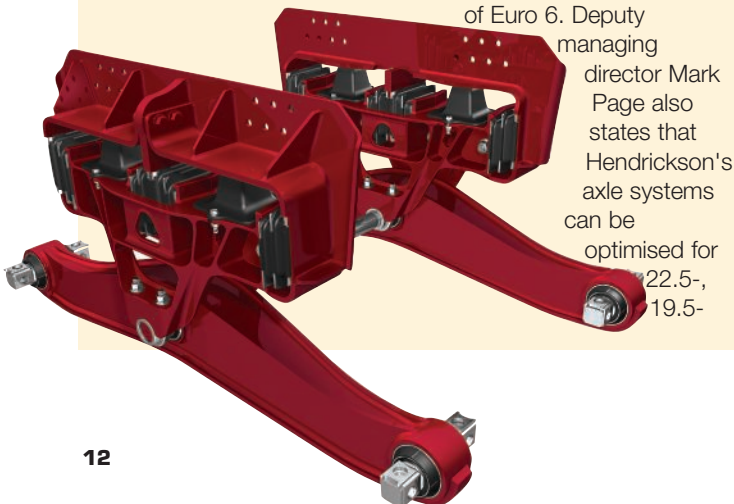
Meanwhile, the MLA3 mid-lift previewed at last year's CV Show was claimed to cut weight by 50kg, compared to the firm's current MLA2 design, helping to solve the weight issues of Euro 6. Deputy



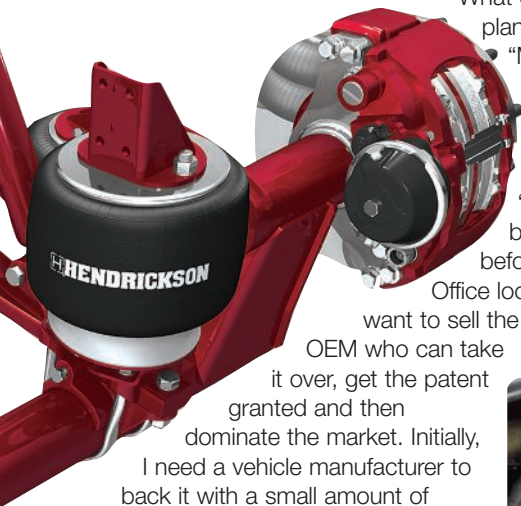
managing director Mark Page also states that Hendrickson's axle systems can be optimised for 22.5-, 19.5- and 17.5-inch wheels. And he claims that all configurations are suitable for 44-tonne gvw artics on six-axle applications, with axle ratings between 4.8 and 7.5 tonnes, depending on wheel size.

What about tipper suspensions? Babu says the new Ultimaax, developed three years ago in the US, shaves 250kg off OEMs' mechanical parabolic systems, but also offers refined driving comfort, as well as improved handling for eight-wheelers. Again he says the parabolic leaf springs are eliminated, but in this case the primary suspension is an elastomeric (metal bonded to rubber shear springs) progressive rate system with a so-called equalising beam (which distributes weight evenly between the axles) on an extended frame hanger.

"The beauty of this system is that, as the load increases, the rubber-metal bonded spring members progressively stiffen up," explains Babu. "That means you get better ride quality than modern mechanical systems and you don't need roll bars, because the stiffness continues to increase with roll moments." Ultimaax is rated at up to 27 tonnes but Hendrickson will soon be launching a 21-tonne capacity version, called Haulmaax, designed for on-off highway tandem suspensions on tippers and mixers.



replacing the back axle with independent rear suspension, using designs seen on glass transporters. The team was thus able to build a double-deck, 10-metre trailer with 66 roll cage capacity – a full 50% improvement over competing urban trailers and 83% better than the then standard store delivery rigids.



What does Davis plan to do next?

“My design is covered by a patent application,” he answers, “but it may be a year before the Patent Office looks at it. So I want to sell the design to an OEM who can take it over, get the patent granted and then dominate the market. Initially, I need a vehicle manufacturer to back it with a small amount of money to build a prototype to test.”

Once tweaked, validated and marketed, Davis sees himself earning off every one sold and installed, arguing that once operators see the benefits, they won't look back. It could even be produced as flat packs, he says, by British manufacturers who know what they're doing – with parts pressed out and welded up to make the suspension assemblies. “I'm doing my best not to sell this concept to the Far East, but, so far, UK and European OEMs are running scared of what it might do to their existing investments.” <sup>15</sup>



## Steer into places other vehicles can't reach

Electro-hydraulic rear-steers – which do away with heavy mechanical turntables – have been around for years, but Netherlands-based VSE's intelligent system remains a novelty in the UK.

Arran Leatherland, commercial director of UK distributor IMS, agrees it's taking time – particularly given the system's widespread use on DAF and Mercedes-Benz tractors – but says European legislation and the system's compatibility with standard trailers are making it attractive on challenging semi-trailer applications.

How does it work? Essentially, a sensor installed on the fifth wheel kingpin sends tractor-trailer articulation angle data to an ECU installed on the trailer. This signals an electro-hydraulic pump that drives cylinders on the rear steer axle(s), with similar sensors on the axle stub ends providing angle feedback. Crucially, axle turning angles are independently programmable to suit the trailer and the manoeuvrability requirements of the application.

“The beauty of the VSE system is that it can be programmed to match the manoeuvrability requirements of the operation,” states Leatherland. “So we can look at operators' current vehicles on difficult access work, and design much larger combinations with equal manoeuvrability.” And he points to bulk blower tanker specialist Priden Engineering, which has now built several rear-steer trailers based on the system, which it calls the Priden electric steer trailer.

Two recent applications concern Argos and S&J European (part of the Palletforce network). The Argos project – which started in 2013 with discussions on how to improve capacity over rigids and 10-metre urban trailers for town store deliveries – resulted in a twin-steer, one fixed axle, 13.6-metre Don-Bur trailer. That started operating at an Argos 3PL in Bridgwater in January last year, and IMS fleet sales manager Ben McEvoy says it's a very capable trailer. “We tested it on some very tight sites in Cornwall and it worked well,” he says. “Since then, there's been building work in the South West and the trailer has been used very successfully where access was difficult. But they're also using it as a standard trailer. With continued testing through use, further investment is likely in the near future.”

S&J European's rear-steer project is similar but implemented on a 10-metre urban trailer built by Cartwright to access sites previously serviced by a Scania R420 rigid with an 8-metre body. “Performance to date has been marvellous and they almost wish they'd gone straight for a 12-metre trailer. They may look at doing so this year and then maybe they'll move up to the Argos configuration.”

What about cost/benefit? The price depends on the application, but putting two-steer capability on a tri-axle trailer adds about £15,000, while a single steered axle adds £8,000. You need only look at your potential productivity boost and fuel improvement to make the calculation. Argos achieved 40% greater capacity, resulting in payback within six months.

