

# A safe pair of trousers

Some three years after the initial idea, and following more than 18 months of extraordinary perseverance and determination, ZT Safety Systems has passed all of the required testing and obtained an independently verified CE certification for its radical new fall arrest harness. The design also won the recent IPAF award for 'contribution to safe working at height' and was runner-up in the best designed harness for women competition last year.

The quest to design a better type of harness was driven by frustrations over the lack of real development in the harness market, this in spite of the fact that many users find harnesses uncomfortable, restrictive and a challenge to put on and correctly adjust. Even more of a concern are the suspension trauma issues and the serious and grossly unpleasant groin injuries inflicted by poorly adjusted traditional harnesses.

ZT is the brain child of Gordon Leicester, founder and owner of Hickstead, UK-based access rental company Facelift and also the originator of the IPAF Clunk Click harness campaign. He says that having tried all manner of ideas he woke from a deep sleep in 2008 with the solution in his head - a true Eureka moment - in the manner of Samuel Taylor Coleridge and his Kubla Kahn.

The basic concept centres on the harness supporting the chest area/torso in the usual way, but rather than grabbing the groin, it grabs the calf muscles, via sliding straps and self-tightening cuffs. This pulls the falling person into the foetal position which provides a

shock absorbing effect as well as supporting the person in a comfortable manner and that does not induce suspension trauma.

The challenge then was how to bring the two support areas together in a practical way and this was achieved by building the two parts into a pair of trousers. The trousers are not actually a structural part of the harness - they simply work as 'carrier' and support medium for the straps that extend down to the calf grippers/cuffs which are 'tacked into the legs. As a result the harness can be built into any pair of trousers that have a lower leg wide enough to accommodate the cuffs. This can range from a pin-stripe suit to a favourite pair of jeans, or more practically an overall such as a bib and brace or boiler suit.



The ZT can be incorporated into any trouser or overall

## Crazy or brilliant?

Having drawn the concept on a scrap of paper Leicester spoke to Facelift's operations director - Frank Page. Why? It turns out that Page is an indentured tailor and highly accomplished dress maker who confirmed that the 'garment' could be made, that it would work and proceeded to produce a rough



prototype by hand. Once made and subjected to rudimentary tests, patents were applied for to cover the key design ideas. Leicester then started showing his idea to others - including Vertikal Press which had been partners on the Clunk-Click campaign - to increase the use of harnesses and lanyards in boom lifts. Given that the prototypes looked a little like the trousers from the Wallace and Gromit 'The Wrong Trousers' cartoon you can imagine that the reception was mixed at best... In fact many in the industry thought that he had finally lost his marbles.



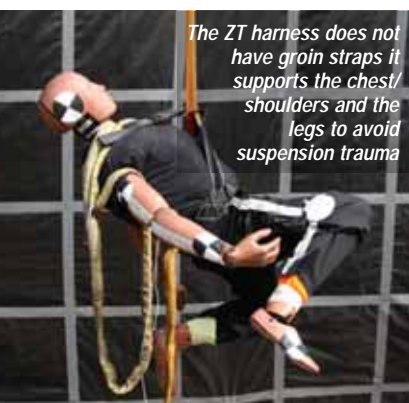
Gordon Leicester suspended in the ZT harness

around the big show in his invention. He says: "It suddenly dawned on me several hours later that I had been wearing a harness all day and had virtually forgotten about it - it was so comfortable and easy to wear in spite of wearing the normal trousers making it a touch too tight. It was then that I realised this product really had a future and that it was definitely the way to go."

## Getting it made

Having had this second Eureka moment he and some of his key colleagues went to work in earnest to turn the harness into a commercial product. The original plan was to contract the production out to a supplier in the developing world, talking to companies that he knew with relevant experience. He was warned against China and encouraged to look to more towards India. Visits were organised to a

Leicester also began to have some doubts himself... However while visiting the Vertikal/Cranes & Access stand at Bauma 2010 we coaxed him into putting on the sample pair that he was carrying around. In spite of them being a tad too small for him he managed to squeeze into them and kept them on and spent the whole day walking



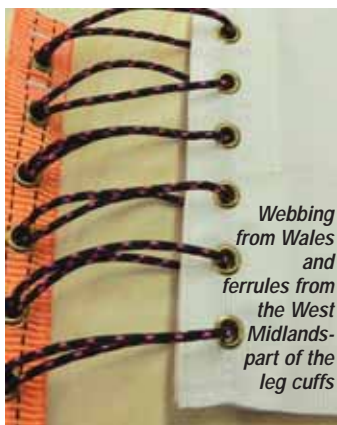
The ZT harness does not have groin straps it supports the chest/shoulders and the legs to avoid suspension trauma

number of specialist manufacturers in India, but the more companies they spoke with the clearer it became that finding someone able to make it for them did not exist. The problem was the wide range of special tooling required for what, in garment terms, would always be low annual volumes.

"While the trip proved to be a failure we learnt an enormous amount from the exercise which has stood us in good stead through the next stage - investing in our own production unit," says Leicester. Having come to the conclusion that he would have to produce his new product from scratch, Leicester and his colleagues started to trawl the internet for suppliers for items such as the webbing, the cotton stitching, the draw-strings within the cuffs and the main metal clasp/buckle.

### Becoming obsessive

At this point, the project started to shift from one of simply manufacturing the product to a quest to produce a perfect product that utilised the very best components possible. So not only did the team trawl the internet for suppliers, and having selected what they considered to be the best, ran extended tests on the samples to see how they would stand up to years of usage. One casualty of this was the initial supplier of the webbing - after some sixty washes in an industrial machine the German sourced webbing lost its colour, started to fray and lose its strength. The shock finding resulted in the material being taken back by the embarrassed supplier and the search restarting. It turned out that the very best webbing was available much closer to home from a specialist manufacturer in Wales. This experience turned the team towards not only sourcing the best components but also trying to do so as locally as possible. In the end they have a truly all-British product,



Webbing from Wales and ferrules from the West Midlands - part of the leg cuffs

and more importantly, they are not dependent on shipping the components half way around the world - something that is becoming more desirable given the environmental issues and cost of fuel.

The passion for excellence and local suppliers continued to every small detail, including a major search for the right type of brass ferrules in the calf grippers. In the end only one supplier was found - a company in the West Midlands that specialises solely in producing ferrules. The main clasp/buckle was a challenge and as with all of the components the ZT team over-specified every aspect of the product. As a result the material used is a high tensile plated steel. The spring that closes the safety latch failed after 24,000 openings and closings by a machine that looks like something IKEA uses to test chairs and beds. By our reckoning 24,000 operations equates to a single use every day of the year for 66 years. In spite of that, the design was changed and improved so it would not fail. Sourcing the stitching involved visits to a number of manufacturers before the team found one that they considered the best available. They then specified a heavier 13 gauge thread when the smaller 18 gauge would have done. The obsessive approach that the team has used to develop the harness is infectious, fascinating and the passion great to see in a harness industry where mediocrity and low price is all too prevalent.

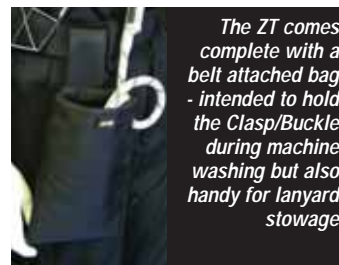


The main clasp is made from high tensile plated steel - the spring should last a lifetime

As well as all sourcing work the small ZT team - now led by Steven Morris who gave up a high flying, well paid job with American Express to join Leicester's dream on the promise of future riches once the product takes off - had to find machinery that could handle the production of the harness. The decision was made early on to buy in the trousers (as a component of



In the end ZT had to invest in its own production facility to make the new harness



The ZT comes complete with a belt attached bag - intended to hold the Clasp/Buckle during machine washing but also handy for lanyard stowage

the harness) from a specialist supplier allowing complete flexibility to suit the customer. The production equipment, a combination of specialist sewing machines cutters and presses is largely Italian and Japanese, much of it purchased second hand from company closures. This is one area where the recession provided a helping hand.

### On to testing

Once the pre-production units were made, testing and CE marking came to the fore. As it is a safety related product, third party independent testing and certification is essential. Knowing nothing of what was required the team was surprised to find that harness industry testing

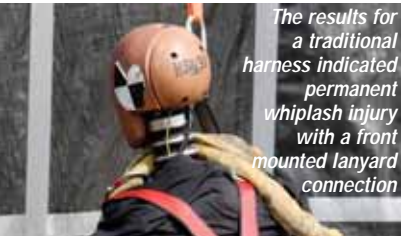
requirements were basic at best and essentially involved dropping the harness with a test-load attached - if it didn't break it passed. Given the very different nature of their product the ZT team knew that they had to do much more than this if they were to both rest easy and convince buyers and regulators. They therefore set out to rent a fully functioning crash dummy for their tests - and approached the Millbrook vehicle test centre near Milton Keynes in Bedfordshire which was very reticent to rent dummies given the cost of what is a highly sophisticated measurement tool. Instead they offered to do the testing for ZT because a) they did not want a third party playing with their 'dolls' b) as far as they were aware no one had ever done it before and they could see that this might in time become an additional revenue stream and c) they had all the other equipment required, including high speed cameras that capture the results of crash testing.



The testing programme was a true crane and access event with an Ainscough crane and a Toucan lift helping out

**A shocking result**

In order to set the parameters the team started by testing a number of ordinary harnesses including those with front and rear mounted lanyard attachment points and were shocked at the results. Watching the video of the very first test with a well-known full body harness - with front lanyard attachment - you cannot help emitting an involuntary gasp as you see the effect on the neck. The crash dummies are designed to measure whiplash and the normal tolerance level beyond which permanent damage is caused is 37N. Results in a regular harness showed measurements of up to 81N! The ZT Harness systematically recorded maximum levels of 18N -

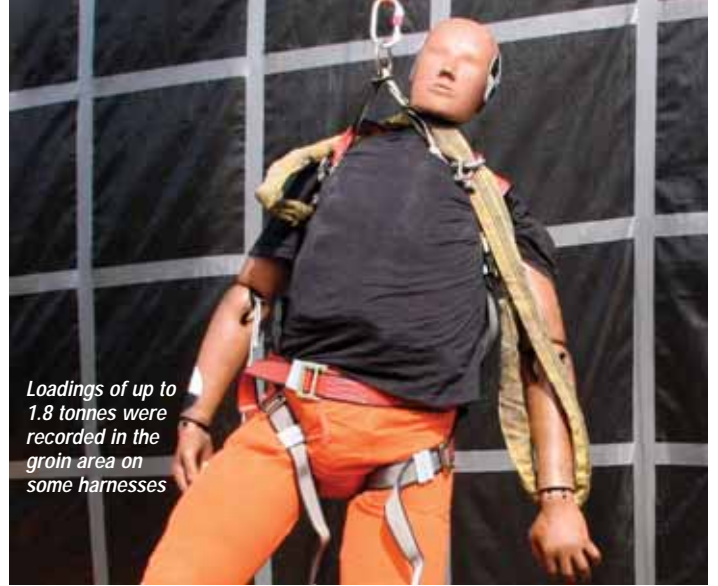


The results for a traditional harness indicated permanent whiplash injury with a front mounted lanyard connection

well within the safety margin. The other forces that the dummies were able to measure were groin loadings. This is an area of risk with cheap or badly adjusted harnesses and we have seen a number of gruesome photographs of the injuries to male 'bits' after a fall in such a harness. The testing showed typical loadings in the groin area of 1.2 to 1.8 tonnes, even with good harnesses. The key point of the ZT harness is that it eliminates the groin straps entirely.

**In summary...**

While we may have had some early scepticism, we have to admit to being totally impressed with the final product and certain of its success. Having visited the ZT production facility as part of the research for this article, we were very impressed with the passion and attention to detail that had gone into the development and production of the product - BUT according to Cranes & Access publisher Leigh Sparrow, it was only



Loadings of up to 1.8 tonnes were recorded in the groin area on some harnesses

after trying a ZT harness on that had been made to fit that he too had a Eureka moment. "I had tried one of the prototypes at last year's Vertikal Days and while understanding the benefits, the trousers were way too big and my reaction was more 'OK I see how it works yes very good'. Put on a pair that fit properly and is of course the final product - and wow you really get what it is all about. If you are serious about safety and working at height the ZT is worth every penny

of its £275 retail price."

**And in conclusion:**

No matter how you feel about the ZT product, one thing - no make that two things that struck us was 1. Always spend the money to buy a decent quality harness - this is not a place to go cheap!  
2. In preference use a rear attachment point for your lanyard (ZT excepted) and make sure you adjust the leg belts properly.

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