Information

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BVS10 & CV90 – CLASS-LEADING MOBILITY AND PROTECTION TECHNOLOGIES

DSEI, ExCel, London: The traditional “iron triangle” of mobility, protection and firepower may be increasingly augmented by new technologies but it remain absolutely vital in the pursuit of armoured fighting vehicle effectiveness.

While modern vetronics based upon an open electronic architecture will increase crew effectiveness by allowing the integration of new situational awareness, target acquisition, active protection and other battle-winning systems, a stuck vehicle is still a sitting target and active protection systems cannot guarantee protection against roadside bombs.

BAE Systems’ CV90 and BvS10, while aimed at very different niches, represent best in class for both mobility and “traditional” protection, according to BAE Systems Hägglunds mobility specialist Dr Anders Bodin.

“We have user groups for both vehicles and, through them and our own R&D we have built up a lot of experience in both areas. We are also able to pull across expertise from one platform to another, while both vehicles are benefitting from operational feedback.”

Mobility: not all tracked vehicles are created equal

Low ground pressure and the correct weight balance are the two most important factors in a vehicle’s ability to cross soft ground. While tracked vehicles are recognised as being significantly superior to wheeled platforms in such circumstances, not all tracked vehicles are created equal, according to Dr Bodin

“Both BvS10 and CV90 are designed to keep moving through the snow and bogs we see in Sweden. Both have relatively wide tracks and both have carefully calculated centres of gravity.”

It’s not just fore-and-aft weight balance which is important he stresses. Unlike some competitors, the two vehicles are designed to have their C of G on the centre-line to prevent slewing and ensure straight tracking when the ground turns soft.

The number and placement of road wheels is import, as are the “attack” angle of the tracks as they meet the ground at the front and the “departure” angle at the rear of the vehicle.

“With the focus many countries are beginning to place on arctic operations, we believe these factors are increasingly important,” he says.

While all-terrain vehicles such as BvS10 have used all-rubber tracks for more than 30 years, advances in technology are allowing composite track use on heavier vehicles such as CV90. Steel inside the guide lugs means these are less likely to be thrown than conventional tracks while fabric reinforcement is giving life expectancy which can exceed 4000km.

The rubber track system is jointly developed by Soucy International in Quebec, Canada and BAE Systems in Sweden: Soucy designs and produces the tracks and BAE Systems qualifies the system in full-scale trials – track design and integration onto the vehicle are equally important. CV90 is on its ninth year of trials and the seventh generation of rubber tracks.

The Norwegian Army began using rubber tracks in northern Afghanistan in December 2010 on 28-tonne CV9030 infantry fighting vehicles, the heaviest to have used them on operations.

The experiment proved so successful that Norway specified rubber tracks for the whole fleet as part of the £500m new-build/regeneration contract announced in June 2012. Denmark has also specified rubber for the tracked vehicles in its current APC trials.

BAE Systems Hägglunds trials at 35 tonnes, jointly funded by the six-nation user group - the System Development Board - began in 2011 and are due to conclude soon. They have looked at a full life-cycle cost analysis taking into account factors such as ergonomics, fuel cost and the service life of electronics and ammunition.

Early conclusions are that vehicle weight is reduced by more than one tonne compared with conventional steel tracks. Noise is reduced by a massive 10dB-plus and vibration levels by 60-80 percent, resulting in a doubling of crew efficiency.

“The reduced vibration levels are also increasing the life expectancy of electronics, optronics and ammunition, which will significantly reduce vehicle running costs,” said CV90 platform manager Dan Lindell.

“The tracks have a bigger footprint than steel, which increases mobility in most conditions, particularly on soft ground. The Norwegians also told us they were able to get to observation posts in the Afghanistan mountains which they couldn’t reach on steel.”

The tracks can be fitted with the equivalent of grousers for ice but the trials are showing that they are more efficient without than steel tracks with! The one area steel may have an advantage is over tree roots.

The tracks are performing better than expected in desert conditions. “Sand acts as a coolant, we have found,” says Lindell.

Another surprise came from mine blast trials which showed the rubber tracks are broadly comparable with steel, according to Lindell. “Bad track damage usually means other damage,” he points out. “Rubber tends to soak up the blast and doesn’t create secondary projectiles as steel can.”

Another Hägglunds mobility development is semi-active suspension, featured on the CV90 Armadillo in the Danish APC trials.

“It’s a very robust and simple system,” says Bodin. “It has helped us actually increase mobility and crew comfort despite the overall weight of the vehicle creeping up due to protection requirements. It also increases stability for firing a mortar or large-calibre gun on the light tank variant.”

Hybrid electric drive technology (HED) can also provide significant improvements to vehicle mobility, as well as a wide range of other advantages, including improved survivability fuel economy and future proofing for power-hungry new electronic systems.

Hägglunds, initially developed HED for the SEP programme and has found two customers in the civil sector. Recent tests on a hybrid drive forestry vehicle based on the BvS10 are proving highly successful too. This civil work is helping to reduce the cost for potential military users.

“HED has so many advantages for a military vehicle besides mobility that we believe it is only a matter of time before it becomes the standard propulsion system,” says Dr Bodin.

As with CV90, BvS10’s four user nations share operational feedback and co-operate in various ways. For example when Sweden needed a stop-gap measure for Afghan operations before its new vehicles were delivered, Hagglunds mated Dutch front cars with UK rear units and supported them in theatre.

At the most recent User Group meeting, customers discussed cost sharing on weight reduction to improve amphibious capabilities through alternative materials and design changes.

For the future, active damping (used on the latest version of CV90) and new power sources to extend silent watch are being investigated.

Protection

CV90’s incremental growth from the initial design for the Swedish army through five export customers means that each new operator benefits from the combined training and operational experience of all six user nations. Wherever possible, these upgrades are made retrofittable.

Nowhere is that more true than in the case of protection, particularly the threat from mines and roadside bombs. The latest versions of the vehicle have better than Stanag 4a/4b for blast and 5+ for ballistic protection.

But the design team is not stopping there. 2011 blast trials using “home made” explosives and work with incident investigators is leading to significant improvements in protection against improvised explosives devices.

Ph.D work by Bjorn Zakrisson has fed into Hagglunds’ proprietary blast simulation model and resulted in major accuracy improvements in key areas, cutting development time and costs.

“Conventional RDX/TNT has a detonation front of 10,000 metres per second while many IEDs detonate at about a quarter of that speed,” says CV90 platform manager Dan Lindell.

“Broadly speaking, while high explosives are particularly effective against “soft” targets, occupants of armoured vehicles can be more vulnerable to explosives with slower rates of detonation such as amatol or home-made mixes.”

The slower detonation and larger gas content of these compositions cause greater rates of vehicle acceleration and can tear off armour and other components.

Design changes as a result of the trials and operational feedback include changes to materials and fuel line design and routing.

“Close to a hundred IED strikes on CV90s in service in Afghanistan have resulted in just three casualties. With this new modelling work and real-life battlefield experience we are making CV90 even better protected and safer,” says Lindell.

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