



# SNEAK AND PEAK

by Pierre Pelletier and Kelly Clemmer

**Dateline Afghanistan, February 2002**—Two Chinook helicopters and their American crews sit stranded in the middle of heavily mined enemy territory. Low on fuel and blinded by a sandstorm, they wait in the desert under a shroud of darkness some 35 km northeast of the air base at Kandahar, a region known for hostile Taliban activities. Americans quickly assemble a rescue team and choose two Canadian “Coyote” light armoured vehicles to take the point. Leading a pair of heavily armed Humvees carrying U.S. troops, the Coyotes combed the dusty terrain with their high-tech sensors before bringing the force to the grounded choppers.

“The Canadian Coyotes were an integral part of that security force. Because of their (night vision) capability, they were able to provide an accurate observation forward of that response force... which resulted in the response force arriving at the site safely,” said a U.S. military spokesperson at the air base.

Before newspaper accounts like this, the Coyote was known mainly to soldiers and military experts. They knew the vehicle had already proven its technological edge and heavy mettle—in the Balkans. Here’s what it was like for Bravo squadron, Lord Strathcona’s Horse (Royal Canadians).

**T**he hulking, tank-like vehicle stopped behind the only remaining building left standing in the Bosnian village. Rubble littered the war-ravaged area. It was close to midnight.

Quickly, four soldiers jumped out and installed a sensor array to the surveillance mast that was raised above them. Twelve minutes later, the surveillance equipment was peering over the wall and onto a bridge. The infrared camera performed a sweep of the area. Sensors picked up a lone truck 300 metres away. The licence plate

matched the truck the soldiers were assigned to locate. The surveillance operator looked back at his monitor. Thermal imaging detected “hot spots” on the hood. By the size of the hot spots, he knew the truck had been turned off for a few hours. They sat and waited.

It was three hours before the night scope picked up some movement. A lone individual was caught on the monitor walking towards the truck. A VCR inside the soldier’s vehicle began recording the action. The suspect opened the door, hopped in, started the truck, and drove

towards the bridge—headlights off—and hurried past the concealed soldiers.

Inside the vehicle, the surveillance operator watched the entire situation develop on his monitor. He radioed his crew commander, who passed the information to an awaiting group of soldiers less than two kilometres down the road. The mast was removed and they moved on.

Impressive. However, what will amaze you even more is the “military power” that lays claim to this marvel. Americans? British? How about the Russians? Try looking in the mirror.



**LEFT:**  
Surveillance operator Cpl. Glen Slauenwhite takes a peak at thermal imaging data inside the Coyote.

**BELOW:**  
The sensory array on its tripod for remote deployment.

Developed in Canada in the mid-'90s, the Coyote is a light-armoured vehicle that changed the way armies look at reconnaissance, or the exploratory survey of enemy territory. What made its surveillance system possible and gives Canadians a reconnaissance edge over other nations was innovative engineering. Bill McKeen, P.Eng., program manager of advanced projects for General Dynamics Canada in Ottawa, was the lead systems engineer on the project. "The magic of the Coyote is that it gives the surveillance operator access to a large sensing spectrum—all with a flick of a switch," he says. "This was the first time that this had ever been put together."

#### INTO THE BREACH

On January 7, Canadian Defence Minister Art Eggleton called a press conference to announce that the country would be sending ground troops to Afghanistan as part of Operation Apollo, Canada's commitment to the war on terrorism. The *Washington Post* reported that they were "being dispatched after a lengthy debate in Canada about combat readiness and the potential risks of war." But the Chief of Defence Staff was firm: "The mission is not without risks," he said. "But these troops are trained, equipped and ready to carry out these important tasks." One reason for confidence, Eggleton pointed out, was that "the Americans specifically requested the proven state-of-the-art capabilities of the Coyote, making the Canadian contribution extremely valuable to the task force operations."

"Before the Coyote, a lot of recon (reconnaissance) work often involved

standing in a hole, looking through binoculars," said Cpl. Glen Slauenwhite, surveillance operator for Bravo squadron, who spent seven months with the Coyote in Bosnia. "Now, we can see in no light, low light, regular day or even stare right into the sun and see or hear everything from 50 metres to 24 kilometres. If I find something on my radar, I'll hit 'Radar' on my keypad and the cameras will swing to where my radar is looking. I can 'laze' (lock in with a laser) the object using the button on top of the joy stick, and I can tell the crew where it is and how far away, regardless of the weather or time of day." Swiftiness is also a feature of the 14-tonne, eight-wheeled beast. It can reach speeds of 100 km/hr. over most types of terrain and has a 660 km range before the need to refuel.

Typically, a four-person unit is assigned to the Coyote: a crew commander, surveillance operator, gunner and driver. Not without drawbacks, it is quite large for a recon vehicle, says MCpl. Glen Boulter, crew commander for a Coyote in Bravo squadron. At 6.39 metres long and 2.69 metres high, it's larger than its predecessor, the Lynx. A tracked vehicle, the Lynx carried less surveillance equipment, and was not as effective as the new Coyote. Slauenwhite would like to see a colour monitor instead of the green monochrome screen, which would be helpful in picking out vehicle colours during surveillance. "But as it stands, the system is very capable. There isn't a whole lot more that I would ask for," he says.

The prized retractable Canadian mast is a periscope-looking pole about 7 metres

long. Attached to the top of it is the sensory array, a multi-spectral surveillance system housing a day and night camera, laser range-finder and doppler radar. Inside the Coyote and attached to the ceiling just above the driver's seat is the mast controller. The driver flips a toggle switch upwards to raise the mast and downwards to lower it. When the driver holds the toggle switch, there is a read-out that indicates the height the mast is extended. To begin surveillance, the driver will raise the end of the mast a few feet above the vehicle. The gunner, surveillance operator and the driver have to climb on top of the vehicle and mount the sensors to the mast. Then everyone goes back inside the vehicle and the driver elevates the mast to the desired height. The surveillance operator sitting in the back of the Coyote is now ready to peek.

However, to get the Coyote engineered to work its magic wasn't quite as easy as "flicking a switch." One of the items on the army's wish list was the ability to drag a cable 200 metres away (commonly referred to by the soldiers as a 'whiskey 10' cable) that is plugged into the Coyote, where they could remotely deploy the surveillance equipment and transmit quality visual images back to the vehicle. "We wanted to take advantage of fibre-optic technology to allow us to bring the signal back (to the Coyote) without any loss of signal integrity," says McKeen.



But two major problems faced McKeen. The first was that optical fibre connectors are not very robust and must be kept extremely clean—something difficult to maintain when soldiers are dragging cable through dirt, grass and mud. The job for McKeen was to figure out a way of taking advantage of optical fibre (low signal loss), but get around the fact that you have this troublesome connection. "So what we did was to build a convertor in-line with the cable to convert from the optical fibre light signal to an electrical signal and then use the standard electrical connector to actually mate with the vehicle system." The convertor exists at both ends of the cable, so the cable is connected electrically to the sensor pod at one end of the tripod and again at the other end of the Coyote.

The second difficulty was that a lot of power would be required originating from the Coyote to make the sensor pad operable 200 metres away. If copper wires were used, you'd need heavy gauge copper wire—making it too heavy for soldiers to handle. The answer was to use a much lighter gauge wire and get around the resistance loss of the cable by elevating the voltage at the vehicle end. Then McKeen and his team converted the voltage back down to the operating requirements at the sensor end. "Then we had to ensure safety interlocks and current interrupts. We developed a fairly sophisticated measuring technique applied to the power lines so that if the cable got broken or stabbed with a bayonet, it would automatically cut out without injuring anyone. So we had to be careful to keep the sensitivity of the current extremely low."

Whether on the mast or 200 metres from the Coyote, the beauty of the sensor package is the access to a multiple spectrum of information. "The surveillance operator can look in the daylight camera-type technology, he can look at infrared image of the same area, he can look at the electro-magnetic spectrum with the radar, and listen to doppler signals. Better yet, he can switch back and forth between these technologies and make adjustments with each one. So he has the whole spectrum available to him at a flick of a switch," says McKeen. This allows the surveillance oper-

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ator to get clues about what's happening from one sensor. But if he can't quite make out what's happening, with a flick of a switch, he can switch to another technology, and see how it looks in that spectrum. He can continue to switch back and forth and build a picture of what's going on.

For example, says McKeen, "even though the heat sensor in itself doesn't give him a complete picture, he can synthesize one in his mind because he can hear certain things on the doppler radar, he can see certain tracks, he can 'laze' and get ranging and he can see infrared and in visible light." Each one of these sensors gives him clues about what's happening. That's the magic of the multi-spectrum sensor pod.

#### VERY CANDID CAMERA

Furthermore, he can record everything that's happening. The surveillance operator can play it back to someone who is more experienced observing a particular type of target or certain outside conditions. The images can be played over and over again, allowing everyone involved to get a better understanding of what the surveillance operator actually saw. Surveillance is no longer a matter of thinking you saw something—now you can press rewind and see it again.

But while fibre-optic cables, doppler radar and integrated thermal imagery sound good when presenting your PowerPoint proposal to Canadian military brass, will soldiers be able to attach and take down the sensor array quickly in a hostile environment?

Simplicity was the key. McKeen's team developed a new camera mount with instrument grade, accurately bore-sighted equipment that could withstand being assembled and disassembled by soldiers, not technicians. "That was tricky," says McKeen. "It had to be a clip-on, clip-off mount, because we realized that they sometimes would have to bug-out quickly." With that in mind, they engineered a self-aligning and self-locking camera mount without any mechanical bore-sight adjustment. "We

wanted to maintain precise alignment between sensor and the laser," says McKeen.

"It's probably fair to say that it is a unique vehicle and certainly one of the best reconnaissance vehicles available, if not the best in service at the moment," says Ian Kemp, news editor of *Jane's Defence Weekly*, the world's most authoritative military hardware publication. Kemp speaks about how valuable the Coyote was during its 1999 deployment in Kosovo, when the Canadians, positioned outside the airport, were able to monitor what the Russians were doing—even though we were on the same side, at least operationally. "Until now, reconnaissance vehicles had their sights mounted in the turrets of the vehicle, incorporated into the commander or the gunner sight. So you are only 10 or 12 feet off the ground. What makes the mast-mounted sight so valuable is that you can elevate the mast six or seven metres. If you are behind a ridge line or a forest, you can elevate it so you can still maintain contact and keep the vehicle under cover."

It was the integration of the various components, from the multi-spectrum sensors to the clip-on, clip-off camera mount to the 'whiskey 10' cable that has made the Coyote the envy of armed forces around the world. "Every time I see the Coyote on TV or in the newspapers, it gives me great satisfaction," says McKeen. "There is still nothing like it." ♦

**Pierre Pelletier is a reporter for *Ft. McMurray Today*. Kelly Clemmer is editor of the *Wainwright Review*.**

