

Technology clothes the soldier

by Gina Gillespie

Uniforms by design meet specs for form and function

CLOTHE THE SOLDIER (CTS) is a \$287 million program with a mandate to equip 50,000 Canadian Forces soldiers. The project, which began in 1996, employs 26 personnel, plus an army of scientists, laboratories, contractors, and even the occasional robot, all working towards a common goal – clothing Canada's soldiers. To date, 75 percent of the 24 CTS items have been delivered, with project completion expected by 2007.

Maj Doug Palmer is the project director. His team deals with a wide range of issues and industries – the boot industry, textile industry, printing, ceramics, ballistic textiles, helmet industry, and a wide range of technologies, including moisture management, fire resistance and infra-red technology.

There's a thousand tiny details to look after, from the gussets in the boxer shorts to the ballistic fibres in the fragmentation vests. Clothing must be available to fit all sizes (there are 72 sizes of boots alone), and both sexes. And in addition to standard concerns like comfort and cost, CTS personnel must be concerned with extremes of weather and temperature. There's a lot of work that goes into making military uniforms, uniform.

"There's a whole spectrum of jobs that you see the Canadian soldiers do, right from the very extreme [to the very mundane]: standing at an observation post, filling sandbags in Winnipeg, fighting fires in Kelowna, dealing with floods in Saguenay, Quebec, or going to Haiti or Bosnia or Afghanistan. All the equipment that we buy has got to be capable of operating across that full spectrum of need for the infantry soldier," says Palmer.

Behind even a simple set of camouflage pants and shirt lies a huge body of technology. For instance, the camouflage pattern is anything but arbitrary. The Canadian Disruptive Pattern Temperate Woodland (CADPAT™ (TW)) was born in the temperate forests of North America, as scientists with digital cameras took photos for later analysis by computers. Scientists then laboured to re-create the colours and patterns of nature. But camouflage material goes further than merely blending the soldier into the environment. Dyes incorporated into the fabric respond to infrared light in the same way a leaf does, deceiving enemy forces' infrared detection devices.

"Every textile takes up the dye differently, and reacts differently to the incorporation of the infrared dyes. So there's very much a master chef at the printing house who plays with the recipe in his lab," says Palmer. In fact it took three years of intensive dialogue, communication and effort between the Department of National Defence (DND) and the printing and textiles industries within Canada to come up with military specification capable clothing.

"You can't go to Wal-Mart and pick something off the shelf that's going to work for a soldier," says Catherine Andersson, lead scientist, Safety and Protective Equipment, Quality Engineering Test Establishment (QETE) in Ottawa. She's currently working with boot leather, to be printed in CADPAT instead of traditional black. "That's a new thing, and QETE has been involved in helping specify performance and to do some evaluations or coordinate evaluations of that new leather," she says.

At Defence Research and Development Canada (DRDC) in Toronto, LCol Linda



A Dynamic Load Carriage Simulator tests a Load Carriage System (webbing, load-bearing vests, patrol packs and rucksacks) – critical wear for soldiers.

Bossi tests military equipment to see how it functions in the soldier's world. "We'd go for a week with a group of 24 soldiers. We'd have them march, do obstacle courses with a vest on; we'd have them fire on the range, checking to see if they can access their [ammunition] magazines quickly enough on the vest," she says.

Back in the lab, utilizing environmental chambers, she'd monitor soldiers as they lit stoves or loaded magazines while wearing their equipment. And although the soldiers' input was an important part of the process, technology also played a role. Researchers at Queen's University and DRDC Toronto developed an instrumented, articulated manikin that mimics the movement of the human torso while running, falling, walking, ducking and climbing. The system, the first of its kind in the world, measures exactly how a piece of equipment impacts body functions under various conditions. Another piece of technology, a Thermal Manikin Head, is used to assess the thermal insulation of headwear measuring heat loss from four separate zones.

LCol Jacques Levesque is project manager for the CTS project. "CTS has had an impact on industry and DND much bigger than the project itself because it has



The Thermal Manikin Head, used to access the thermal insulation of head gear, measures heat loss from four separate zones.

changed the way of doing business,” he says. “[Traditionally] armed forces would be in a ‘build to print’ scenario to buy things.” If the army wanted a new boot, the army would design the boot, buy the lasts, moulds and dies, and give them to a contractor.

For the CTS project they simply gave a list of requirements to industry. Minor details and manufacturing methods were left to the discretion of the manufacturer. The finished product underwent field trials, with the soldiers’ feedback being a major factor in awarding the contract. Often the soldiers liked different features from several different products, so the new specifications went back to industry to create a hybrid. Eighty percent of the soldiers had to give a thumb’s up before a product was approved. “That was a novel way of doing business,” says Levesque.

The most difficult items to procure, and the most heavily engineered were the Load Carriage System and ballistic protection items. But there were no simple procurements. Even boxer shorts gave them problems. Soldiers tested several commercial designs and found they liked the elastic from one design and the gusset from another. Add in the request for a specific leg length and elasticity, and difficulty replicating the consistency of the knit fabric, and the specs became so tight that nobody was compliant. “So something as simple as

boxer shorts became a very big headache in the procurement cycle,” says Levesque.

Treating the soldier as a system, and buying not just a boot, or a glove, but an entire fleet of 24 items lent strength to the project. So, when they fielded a boot with no insulation, just a GORE-TEX® membrane, they were able to compensate by buying thicker socks to provide insulation. “This synergy wouldn’t have been possible if we hadn’t been doing trials on boots and socks at the same time,” says Levesque. In the same manner the tactical vest, fragmentation vest, rucksack and small pack system all work together because they were all designed by the same team, and the field trials were all done together.

In addition to having an impact on the way industry deals with DND, the CTS project has boosted business for several Canadian suppliers. There are 32 contracts for the manufacture of the 24 CTS items. All but two went to Canadian companies.

Raber Glove, a family-owned, Winnipeg-based, glove-manufacturing firm, has been selling gloves to the Canadian military for close to 70 years. The \$2.2 million contract to supply 102,220 pairs of specialized gloves was the largest seen by Vice President Howard Raber in two decades. The firm expects to hire eight extra workers to fill the contract. FELLFAB Limited, a Hamilton-based manufacturer of engineered textile products hired approximately 30 new em-

Tailoring by technology

TECHNOLOGY HAS streamlined the process of outfitting soldiers as tape measures give way to a touchless, body measuring and sizing system. The BOSS 21 System uses two digital cameras connected to a computer to measure 37 different body dimensions. The process takes seconds, and the software program then recommends the correct size.

Each year the military expends money on uniform alterations, re-design and costly last minute acquisitions due to inventory management needs. Using BOSS 21 reduces the high return rates of ill-fitting uniforms, and lowers the costs for alterations.

Manufacturing errors, fabric substitutions and other variances can be taken into account before the items are delivered to the end user. Inventory can be kept at minimum levels, and updated on an as-needed basis. The Canadian Forces plans to have the system working at all its major bases within two years.



ployees after landing a \$10.7 million contract to make 50,246 tactical vests. Eighteen months later a second contract came their way – this time \$18.9 million to manufacture 65,360 small pack systems.

For Revision Eyewear Inc. in Montreal, their \$2.9 million contract led the company in a new direction. Originally developing a new concept for use in the sports protective field, they changed direction when they read the specifications for military

Clothe the Soldier (CTS Contractors)

Company	Product(s)	Quantity
A&W Uniforms (Toronto, ON)	rainsuit jacket and trousers CADPAT(AR)*	2,925
Able Clothing Inc. (Scarborough, ON)	CADPAT(AR) trousers	33,800
Apparel Trimmings Inc. (Scarborough, ON)	wide-brimmed combat hat	74,363
	neck flaps	3,000
	UN blue hats	5,000
	temperate combat hat (AR)	8,200
Canada One Sourcing (Nepean, ON)	cold weather socks	395,222 pairs
Consoltex Inc. (St-Laurent, QC)	cloth, twist, nylon/cotton CADPAT(AR)	69,918 metres
FELLFAB Limited (Hamilton, ON)	small pack systems	65,360
	tactical vests CADPAT(TW)*	50,246
Gallet Security Internationale (Saint-Romuald, QC)	operational ballistic plates and carriers	7,222
	training sets	7,232
Group VR2 (Asbestos, QC)	lightweight thermal neck gaiter	59,362
	lightweight thermal balaclava	59,362
H.H. Brown Shoe Co. (CANADA) Ltd. (Richmond, QC)	wet weather boots	235,686
	cushion inserts	150,000
	laces	50,000 pair
	cans of paste	150,000
LEGERE Industrial Supplies Ltd. (Ottawa, ON)	Gerber Multi-Plier® tool	53,853
Les Chaussures STC (Anjou, QC)	wet weather boots	6,500 pair
Les Entreprises Albert Cloutier (St-Raymond, QC)	cold wet weather gloves	68,603
	combat temperate gloves	70,142
Malden Mills Industries Inc. (Massachusetts, USA)	cloth: polyester, nylon, spandex	25,000 yards, option 5,000 yards
McGregor Industries Inc. (Toronto, ON)	liner socks	424,020 pairs
	temperate socks	424,020 pairs
Ostrom Outdoors (Nolalu, ON)	fitting jig, Technical Data Package, small pack/rucksack	
Pacific Safety Products (Kelowna, BC)	fragmentation vests	31,000 option for max. 15,000
Peerless Garments Ltd. (Winnipeg, MB)	Coat Converge CADPAT (AR)	48,200
	improved environment clothing system (IECS) sweatshirts	128,179
	sweatpants	123,212
	combat coats	60,386
	parkas	60,140
	combat trousers	59,758
	IECS CADPAT(TW) combat coats	16,810
	IECS CADPAT(TW) combat trousers	16,810
	IECS CADPAT(TW) parka	16,810
	IECS CADPAT(TW) overalls	16,810
Raber Glove Manufacturing (Winnipeg, MB)	CADPAT(TW) sweatshirts	33,820
	CADPAT(TW) sweatpants	33,820
	lightweight thermal glove	102,220
	CVC Glove	24,178
Revision Eyewear Inc. (Montreal, QC)	cold wet weather glove	33,700
	ballistic eyewear	80,000 pair
SOG Specialty Knives and Tools Inc. (USA)	multi-tool	21,274 option 10,000
Stanfield's Ltd (Truro, NS)	underwear (LWTU)	118,726 sets
	lightweight thermal underwear	45,000 rescope sets
	temperate underwear	461,618
Stedfast (QC)	cloth rainsuit CADPAT (AR)	15,000

*Acronyms: CADPAT™(AR) Canadian Disruptive Pattern Arid Regions; CADPAT™(TW) Canadian Disruptive Pattern Temperate Woodland
Source: CTS Project. Contracting information presented here is a 'snapshot in time' in the continuing procurement of uniforms and equipment.

ballistic eyewear. They modified their research to increase their product's ability to withstand abrasion and chemical resistance. To test the eyewear, DND performed 14 different tests ranging from impact and abrasion resistance, to flame retardancy.

"What [receiving the contract] meant to us was a new business strategy," says Jonathan Blanshly, CEO of Revision Eyewear Inc. "Once we had Canada, a lot of other countries came knocking. We found that

Spain, the Netherlands, the US, the UK and a bunch of other countries within NATO have been waiting patiently on the sidelines to see who Canada would select. It's kind of opened some doors that way," he says.

While DND determines requirements and specifications, the actual procurement is done by Public Works and Government Services Canada. They turn the specifications into requests for proposals, which are published online on the MERX system.

"Their aim is to make sure it's done competitively and get best value for money. Our aim is to ensure the customer's requirements are met. The army's aim is to get the best kit for the army," says Levesque. "Everybody brings their own part of the puzzle to the table, and it works very well. The strength of the project has been just that." *mm*

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