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COMPOSITECMY

If only they'd had an IFF

Modern version of a World War II device could probably have prevented 'friendly fire' tragedy in Afghanistan

BY IAN STEER
SPECIAL TO THE STAR

WHEN A BOMB dropped by a U.S. Air Force F-16 blasted Alpha Company, 3rd Battalion, Princess Patricia's Canadian Light Infantry in Afghanistan a month ago, killing four men and wounding eight, some scientists and many World War II veterans and buffs wondered why there was no IFF.

IFF stands for Identify Friend or Foe, an electronic device invented by British boffins more than 60 years ago to prevent just such accidents happening.

The first IFF units were developed in conjunction with the first radar units, says Richard Rohmer, former RCAF fighter pilot, retired major-general and a best-selling author.

"Without those radars," says Rohmer, "the war might well have been lost because RAF Spitfires and Hurricanes would not have been able to intercept the oncoming hordes of Ju-88s and Me-109s. What IFF did was allow allied pilots, coming back from raids over France, to let those same radars know our aircraft were friendlies, thanks to a little black box."

The principle behind the first IFF device — and all IFF units since — was simple. It challenge d the intended target with a coded radio signal. If the target had the required IFF receiver/transmitter and decoder/encoder, it "authenticated" the target by returning the correctly coded IFF reply. Targets that didn't so respond were presumed hostile.

"IFF systems cannot do more than sort out the friendlies, " Rohmer says.

So none can tell (independently) actual foes from merely unknown and possibly innocent targets, including allied friendly forces without the right IFF or even one's own forces with malfunctioning IFF.

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> — JASON FRYE, former paratrooper

The newest IFF systems use radars or lasers, as well as radios. There are different IFF systems for the air force, army, navy and marines and, of course, different systems for different countries. Few of the dozens of systems now in use are directly compatible. Getting different allied forces — as in NATO, the Persian Gulf War and Kosovo — with different systems to work together and yet avoid such friendly fire incidents is a serious, ongoing challenge.

Even the U.S. Army's own troops do not generally — and until recently, did not at all — have any way to signal an errant air force or navy aircraft (the ones with the bombs) that they are friendly. What our troops need, then, is a ground-portable version of the IFF system used by bombers.

Within days of the accident, Stephen Trimble of *Aviation Week & Space Technology* magazine reported on the U.S. Army's newest, ground-based IFF unit. The first most Canadians heard of the new system, known as the Enhanced Position Location and Reporting System (EPLRS, pronounced *ee-plars*), was an April 23 report by The Star's Joseph Hall.

"If it works as advertised, you'd think EPLRS is something you'd want to include in your minimum kit list," says Jason Frye, a former paratrooper who served with the PPCLI and is now a Metro Toronto police officer. "One per platoon would be a necessity if you're in a battlefield."

EPLRS is more than an IFF system. Made by Raytheon Systems, it is a UHF radio a mere 25 centimetres wide, 35 cm long and 13 cm high. It's highly portable, weighing only 12 kilograms, batteries included. The units fit in tanks and trucks and can be carried by paratroopers.

Being UHF radios, EPLRS units can, through a central controller known as a master station, exchange IFF handshakes with aircraft like the F-16. Airborne IFF signals are UHF, too. A secondary benefit of transmitting at such high frequencies is their use for sending high rates of data, like the position and location of friendly troops and units, reporting in a second-by-second system even in the midst of battle.

EPLRS grew out of the PLRS, the Position Location Reporting System, still used by the U.S. Marine Corps. First tested in the late 1970s, the Marines had about 2,000 PLRS radios and 35 of the required master stations by the late 1980s.

Work began on the U.S. Army's new, enhanced PLRS in the early 1990s. Using VHSIC (Very High Speed Integrated Circuits), similar to those found in today's computers and COTS (Commercial Off-The-Shelf) technologies, they tripled performance for half the cost.

With just one of these portable radios and a master station at their base camp in Kandahar, a company of 12 troops (like Alpha Company) could travel up to 10 kilometres from base camp (about the distance they were) and have their location known at all times and protected from accidental attack.

What's amazing is that a full division of 10,000 to 20,000 troops, deployed with up to 1,500 radios available per master station, can cover up to 150,000 square kilometres, an area one-quarter the size of Afghanistan. Networked together, the radios not only protect, they also form a wireless WAN (Wide Area Network), through which the newest versions communicate at speeds fast enough to allow video conferencing and "live eye" aerial views through unmanned aerial reconnaissance vehicles of "enemies behind the hill."

By 2000, the U.S. Army had at least 2,000 of these radios. Another 3,000 are either delivered or on order and over the next few l years, total sales for all services and allies is expected to reach 30,000. Thanks to Jane's Information Group, perhaps the public's best source of military information, we also know at least some EPLRS units, and/or their PLRS predecessors (just as capable IFF-wise) were deployed to the Persian Gulf War, Bosnia and elsewhere. It is hard to believe such systems are not now serving U.S. forces in Afghanistan.

As retired Maj.-Gen. Lewis MacKenzie, who commanded U.N. forces in Bosnia and once commanded the PPCLI, says: "If members of the American brigade (part of the U.S. 101st Airborne Division) our Canadian troops are attached to have access to this equipment, then certainly the equipment should have been provided to our troops as well."

EPLRS radios are not currently in service and have not been ordered for Canada's defence forces, confirmed Lt.-Cmdr. Phil Anido, spokesperson for acquisitions at National Defence headquarters in Ottawa. Why? "Partly because of money."

According to Jane's, 6,000 such radios could earn Raytheon $450 million. So they could cost something like $75,000 each. That doesn't include service and spare parts, or the optional PC Ruggedized Laptop, probably around $75,000 itself. For a laptop? Yes, because "ruggedized" is military-speak for "bulletproof" and inside is a National Security Agency micro-miniature supercomputer, capable of scrambling and unscrambling coded communications that are otherwise unbreakable, including IFF.

With no plan to outfit Canada's forces, other more immediate options might be to buy or borrow a few new EPLRS radios from the U.S. Army or buy some used PLRS radios from the Marines.

"The solution could be as simple as merely attaching a couple of guys from U.S forces with these radios to serve with our Canadian troops," MacKenzie says.

Asked about EPLRS in the House of Commons, Defence Minister Art Eggleton replied: "It's not being used in this particular operation yet."

Ian Steer is a Toronto freelancer.

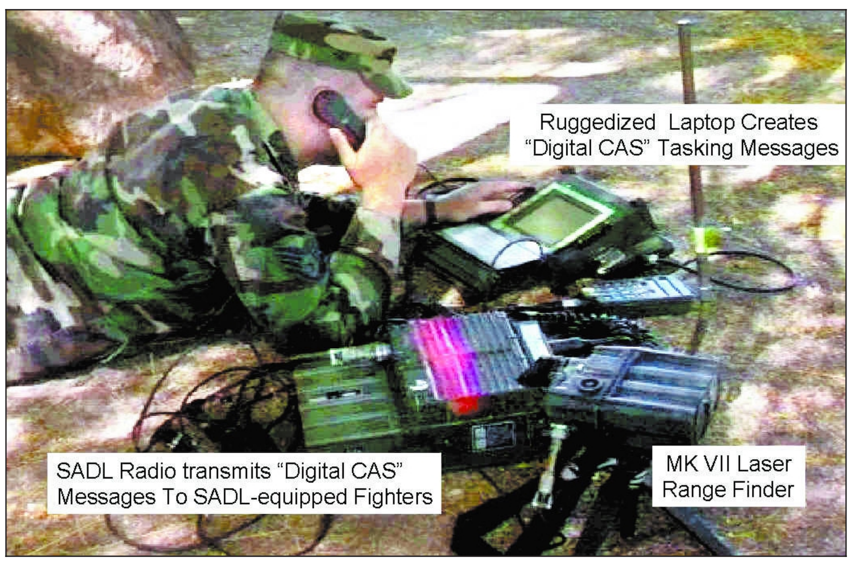
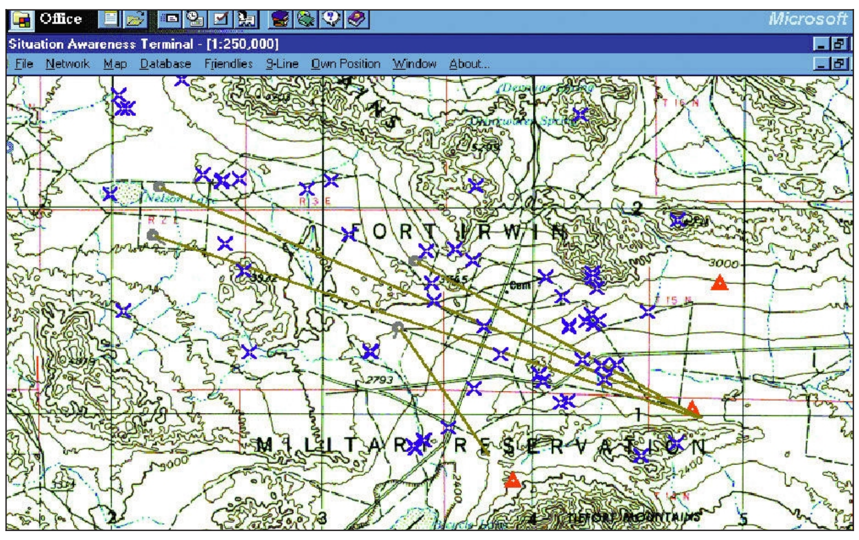


PHOTO COURTESY OF RAYTHEON SYSTEMS

LAVISH LAPTOP: A U.S. soldier demonstrates the EPLRS radio identification device and the "ruggedized" laptop, compatible with IFF systems. Below, a laptop screen displays friendly troops (blue Xs) and possible foes (red triangles).



AP FILE PHOTO

Gator aids

The nerve-packed bumps on the jaws of this hatchling alligator are so sensitive they can detect ripples from a single drop of water, says a new study by Daphne Soares, who recently finished work toward her doctorate at the University of Maryland. Half-submerged alligators rely on the sensory array to pinpoint splashes, whether caused by a fallen hatchling or an animal stooping for a drink. "These are armoured creatures but they have developed this elegant way to be sensitive to their environment," Soares says.

Jupiter has nine-moon lead in satellite race

The Universe

TERENCE DICKINSON

On Friday, astronomers using the Canada-France-Hawaii Telescope (CFHT) announced that they had discovered 11 more moons orbiting Jupiter, the largest planet in the solar system. This brings to 39 the total number of natural satellites known to accompany the giant planet.

The 3.6-metre CFHT is equipped with the largest digital camera in the world, a monster with 140 million pixels. This means it can image a large area of the sky in a single exposure, ideal for searching for faint moons orbiting distant planets.

The procedure is to take several images of the region around Jupiter, then have a computer examine each of millions of star images on them for faint specks that move like moons of Jupiter ought to move. The suspects are then examined carefully to confirm the discovery, which takes a couple of months. Two years ago, the same procedure with the same telescope was used to find the previous 11 moons of Jupiter. Several recent computer and equipment upgrades led to the current successful attempt.

The new moons are the smallest yet found orbiting any planet, just two to four kilometres wide. They take between 557 and 773 days to orbit Jupiter. Nothing is known about their surface properties but they are presumed to be rocky objects like the asteroids. The discovery places Jupiter firmly in first place in the moon sweepstakes. Saturn has 30 known moons, Uranus has 21, Neptune eight, Mars two and Earth and Pluto one each.

Researchers think all the smaller satellites were captured when Jupiter was young, possibly still in the process of condensing to its present size from a more bloated stage that existed more than 4 billion years ago, soon after the solar system formed.

There are two leading theories for the capture process. In the gas-drag hypothesis, passing asteroids are slowed by friction with proto-Jupiter's bloated atmosphere; those that don't burn up in the atmosphere are trapped in looping orbits like those of the new-found satellites. In the mass-growth hypothesis, the rapid growth of Jupiter as it gains mass from the primordial nebula leads to gravitational capture of nearby objects.

After their capture — perhaps even billions of years later — some of these bodies collided and smashed each other into smaller pieces, which could account for some of the small moons seen today. Evidence for this is that many of the new-found moons travel in suspiciously similar orbits.

The four largest moons of Jupiter were discovered by Galileo in 1610, within months of the invention of the telescope. Each is about the size of Earth's moon. The remaining moons are much smaller bodies. One was found in 1892 when an astronomer spied it while looking through a large telescope. All the other moons were detected during the past 98 years by photography or electronic imaging.

Terence Dickinson is editor of Skynews magazine and the author of several books for backyard astronomers.

Jay Ingram

Chimps, us and brain differences

One of the most intriguing puzzles that the unravelled human genome might solve is the difference between us and chimps. If you look at the genetics of both, there is a scant 1.5 per cent difference. But surely, for all the humanness of chimps, the gulf between the two species should be much, much wider than that. What gives?

First things first. Measuring percentages of genetic difference between species is misleading. If the chimp comparison startles you, how about the fact that the ordinary mouse shares about 95 per cent of its genes with us? Pick a mammal — any mammal — and it will share all kinds of genes and groups of genes with us, most of them concerned with the basic housekeeping of a mammalian body.

Add to that the fact that genes don't correlate one-to-one with anatomy. Dozens of genes are employed simply to maintain the ability of our blood to clot when we're cut and we share those genes — or ones very much like them — with tigers, whales and anteaters. On the other hand, a single gene can regulate the activity of several others. And altering a gene like that can change the shape and size of an animal. So matching genes between animals is a misleading exercise to begin with.

Even so, the 1.5 per cent difference between chimps and humans is still puzzling and important, whether you want to emphasize our differences or reaffirm our similarities. Two recent studies have addressed this subject and they show just how far away we are from understanding what's going on.

The first was a study published a few weeks ago that took a first stab at identifying differences in gene activity between the two species. Using tissue samples from humans and chimps that had died of natural causes, the researchers found that the genes from both were equally active in the blood and liver but the human genes were much more active in the samples of brain tissue. It wasn't a case of gene difference but gene productivity. So these differences, which might be crucial to the species disparity, wouldn't even count as part of the 1.5 per cent difference.

There were two interesting sidelights to this research. One, that two mouse species as genetically distant from each other as we are from chimps showed no such brain differences. That just reaffirms that something happened in our brains over the last few million years that sets us apart from the chimps. The second point is that these are all averages; surprisingly, the gene activity in one of the human samples was actually within the chimp range.

A second chimp/human study was just released by neuroscientist Dean Falk of Florida State University. In something of a technological tour de force, she overlaid 3-D brain images of chimps and humans to get an idea where the significant differences were.

It was tricky work because Falk and her colleagues weren't able to put live chimps into the scanner. They had to submerge chimp skulls in water, then create an image of the water inside the skull as if it were the brain. Then those images and the human counterparts were merged.

The comparison showed that there were five main areas of the brain that have expanded in humans since our lineage split from that of the chimps. Three were more prominent on the right side of the brain than the left. To complicate things further, Falk compared these modern skulls with an array of fossil skulls of human ancestors and saw that these key areas of difference gradually became more prominent as the human line moved toward the present and left the chimps behind.

It would be tempting to correlate these two studies. Did a set of highly active brain genes in humans lead to bigger — or at least lumpier — brains? But it's way too early to be confident of that. And there are still major questions to be answered: What are the genes actually doing? What are these brain areas doing? How important is it that some areas of the brain are enlarged?

It's a start and it's reassuring that brain differences have been found; after all, that's where we differ most significantly from chimpanzees. But in the end, if indeed this puzzle is ever completely sorted out, these early results will only be a small part of the solution.

Jay Ingram hosts the program @discovery.ca on the Discovery Channel.