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# Lethal lasers for the battlefield

By David C. Morrison — *Washington, DC*

SELDOM MENTIONED in the debate raging today over the laser battle-stations that may one day patrol the heavens is a more down-to-earth class of battlefield beam weapons likely to enter superpower arsenals long before that real-world 'Star Wars' previews.

Low-powered directed-energy (DE) devices are already widely used by the military as adjuncts to conventional weaponry: laser rangefinders on tanks, laser target designators aboard helicopters, fighters, and remotely-piloted vehicles, and ring-laser gyro inertial navigation systems on aircraft and missiles. The US Army even uses lasers for realistic score-keeping in war game exercises at the National Training Centre in Fort Irwin, California.

The next evolution in military directed energy, already in advanced development, will see more powerful versions of these laser adjuncts coming into use as offensive antimateriel and antipersonnel weapons. 'Technology in both the East and the West is rapidly approaching the point where tactical directed-energy weapons can be mass produced,' Major Clark Campbell predicted in a late 1983 issue of the Army professional journal, *Infantry* (Nov-Dec. 1983). Major Campbell has served with the Combined Arms Combat Development Activity as Project Director for Directed Energy Concepts.

Among the DE weapons reported by Campbell are mobile lasers that could 'destroy the eyesight of soldiers'; particle beams that could penetrate sandbags or armor, killing all targets in their range; sonic waves that could 'blur vision and cause nausea, fear and confusion'; and radio frequency weapons that could produce 'intense pain from burned skin or heated bones.'

Some of these high-tech weapons are unlikely to be deployed soon. Campbell says, for example, that research into sonic wave weapons 'has been limited,' but suggests that the atmospheric compression waves generated by high-powered sound projectors could one day be harnessed by the military, if not as antipersonnel devices, then for such antimateriel missions as mine clearing. Because of their bulkiness and high power requirements, he says, the 'technology seems to be a long way from producing a tactical particle beam system.' Radio-frequency weapons, on the other hand, are somewhat more likely to emerge within the next two decades, the Pentagon having already expressed concern about Soviet research in this area.

The blinding laser is the only tactical DE weapon likely to be deployed in the near future by the US. The military has been exploring directed energy since the 1950s and building prototype DE weapons for over a decade. A 1984 study by the Frost & Sullivan market research firm predicts growth in spending for military lasers — across the spectrum from laser designators to 'Star Wars' research — from $2.5 billion in 1984 to $4.2 billion in 1987.

In the mid-1970s, Army engineers built the Mobile Test Unit, a 30,000-watt carbon-dioxide laser which was installed in a Marine Corps LTVP-7 armored personnel carrier. The dome-turreted test vehicle shot down fixed-wing and helicopter drones in a 1976 test series. Considered unwieldly and tending to overheat however, the MTU was soon retired. A few years ago, the MTU's electric-discharge gas laser was donated to NASA's Marshall Space Flight Centre to test laser propulsion for rockets.

In 1982, the US Army experimented with a lower-powered battlefield laser, the close-combat laser assault weapon (C-CLAW). It had planned to mount the C-CLAW laser on a Bradley armored personnel carrier in a $212 million prototype project code-named Roadrunner. Following sensational press reports in late 1983, the Army announced cancellation of the Roadrunner program.

## The Stingray laser

A MORE promising technology is being developed under the code name Stingray, which the Army terms an 'optical and electro-optical countermeasure system.' Stingray is a low-energy, tank-mounted device. Funding for Stingray is set at $21 million for 1985, with a similar amount for next year. The Army plans to field a Stingray prototype in 1986 and the weapon system itself early in the 1990s. Martin Marietta is the prime contractor for Stingray while General Electric is developing its laser.

Stingray 'will 'disrupt enemy target acquisition and tracking' Army Lt General James Merryman, Deputy Chief of Staff for Research, Development and Acquisition, said early this year in heavily censored testimony before a Congressional subcommittee. 'The concept is, you would put something like this on a tank and you would have the capability to scan about 45 degrees. You could do that at the same time that the tank main gun would be firing at another tank.'

Modern tanks, such as the US M-60 Patton and M-1 Abrams, are equipped with a variety of electro-optical systems: thermal imagers for night vision, assorted periscopes for commander and driver, and auxiliary telescopes for magnification. Laser illumination can attack these devices either directly, by distorting or fogging lenses and overloading thermal imagers, or indirectly, by using them as conduits to focus intense laser light into the eyes of the tank's operators.

The Army will not describe specifically Stingray's laser, but it is known to be an optically-pumped, solid-state 'slab' laser and to be somewhat lower-powered than planned for C-CLAW. The C-CLAW laser was reportedly based on the M-1 tank's laser rangefinder, which employs a 100 millijoule laser. Damage to electro-optics could probably not be effected at line-of-sight distances farther than five miles, although eye injury could be sustained at greater ranges.

The US Air Force has a similar program underway, code-named Coronet Prince, which will be slung on a pod underneath aircraft. The descendant of an earlier program called Compass Hammer, Coronet Prince will use the same laser as Stingray, but cranked up to higher intensities because of the greater distances it must cover to 'paint' enemy tanks, aircraft and missiles. Coronet Prince could be used to damage electro-optical display systems and forward-looking infrared (FLIR) imaging devices of aircraft, spoof the infrared guidance of anti-aircraft missiles, or injure the eyes of pilots. Funding for Coronet Prince is currently planned at $20 million between now and 1988, when a prototype will be fielded.

Coronet Prince should not be confused with the Air Force's now-defunct airborne laser laboratory (ALL). Initiated in 1974, the ALL was a 400,000-watt carbon dioxide laser carried by a KC-135 military transport aircraft. It failed during a public test-firing in 1981 but two years later shot down five Sidewinder missiles, only to be consigned to mothballs in 1984 as a technological dead end. The Congress and the Pentagon concurred that the 10.6-micron long-wavelength ALL laser had 'no potential application,' and that research funds would be better spent on shorter-wavelength, sub-micron lasers.

While Defence Department officials argue that tactical DE weapons such as Stingray and Coronet Prince are designed solely for destroying enemy electro-optics, the eyesight of enemy troops is unavoidably a secondary target. For many years the Army has recognised the danger of unintentionally blinding its own troops with laser rangefinders and target designators, relatively low-powered devices widely deployed on a variety of weapon systems to track targets and guide missiles and artillery shells.

'Compared with viewing a tank searchlight 100 metres in front of the tank,' a 1979 Army Environmental Hygiene Agency study noted, a laser rangefinder 'would appear more than 100 million times brighter.' Another study, conducted two years later by the Army's Combat Analysis Agency, found that troops sharing a battlefield with low-power lasers stood a 'better than 100 per cent chance of being illuminated.' Depending on the wavelength, lasers inflict varying degrees of harm to the human eye. Visible and near-infrared laser light passes through the eye and focuses on the retina, or fovea, causing blind spots or total blindness. Ultraviolet and far-infrared laser radiation is absorbed near the surface of the eye, causing corneal burns, blisters or cataracts.

'Because of the lasers coming on to the battlefield, both ours and the Soviets' in the 1985-90 timeframe,' then-Army Chief of Staff, General Edward Meyer, told a Congressional panel in 1983, 'we project a large number of injuries to the eyes. Every soldier on that battlefield is going to be wearing goggles like tankers do, and we will have to protect them from lasers all around because you never know when you are going to get lased.

'It is going to be a problem with soldiers on the battlefield wearing goggles all the time,' Meyer concluded. 'It is hard enough to look a guy in the eye and tell him "Get up that hill". Now you will have to look through two rose-colored glasses, I guess. That is going to be a change in wars.'

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# *Help Limit Funding For Star Wars*

Sometime in May the House of Representatives will take up the Reagan administration's proposal to spend an additional $3.7 billion in fiscal year 1986 on research for the "star wars" missile defense program. That figure is almost three times the $1.4 billion Congress approved for fiscal year 1985.

Deployment of a missile defense system by either superpower could deprive the other side of the ability to make a retaliatory strike. As a result, continued U.S. development of a ballistic missile defense system threatens to spark a dangerous turn in the nuclear arms race, destabilizing the delicate nuclear balance by escalating the arms race into outer space and provoking a new buildup of nuclear arms.

President Reagan contended in his March 1983 "star wars" speech that his star wars program would render nuclear weapons "impotent and obsolete" by developing an impenetrable defense system able to destroy Soviet-launched missiles before they reached U.S. territory. But the administration's proposal is flawed for a number of reasons.

First, because of numerous technological limitations, many scientists, including astronomer Carl Sagan, say it is unlikely the star wars program could ever be 100 percent effective. Even if the system were successful in knocking down 90 to 95 percent of the total Soviet intercontinental ballistic missile (ICBM) arsenal, this would still allow some 400 to 800 nuclear warheads to "leak" through—enough to level all major U.S. cities, kill half the U.S. urban population and injure most of the rest.

Moreover, even if a perfect missile defense system could be built, it would not be able to stop bombers armed with nuclear bombs or cruise missiles, both of which fly low enough to evade a space-based defense system.

Critics say that the Soviet Union is most likely to respond to the U.S. development of a missile defense system by increasing the size of its offensive missile force—land-based ICBMs and submarine-launched ballistic missiles—and by further developing its own star wars program.

Even Paul Nitze, the administration's senior arms control adviser, concedes that deployment of a missile defense system might "encourage a proliferation of countermeasures and additional offensive weapons to overcome [our] defenses."

The next phase of research in the administration's program would lead to operational testing in outer space by the end of the 1980s or early 1990s. Such testing would be a direct violation of the U.S.-Soviet Anti-Ballistic Missile (ABM) Treaty, which prohibits any testing of space-based defense systems or components.

Finally, the administration's star wars program is not only dangerous, but expensive. If approved, it would cost the U.S. some $30 billion over the next five years and billions more in later years. Former Defense Secretary James Schlesinger believes a full-fledged nuclear defense system would cost "well over half a trillion dollars and probably [over] a trillion" to deploy.

In March Common Cause joined with other groups in sending a letter to members of the Senate Armed Services Committee stating that the pending star wars proposal is costly and destabilizing and threatens to undermine the ABM treaty. CC is calling for Congress to restrict star wars funding at last year's level or lower and to eliminate all funding for demonstration projects that will result in violations of the ABM Treaty.

The proposal to authorize money for the program is now being considered in Congress. CC will also be lobbying later this year when both the House and Senate vote on proposals to appropriate money for the program.

## ACTION

*All CC members*: Please write to your representative today urging him or her to strongly oppose President Reagan's request for $3.7 billion for the star wars program. Ask your representative to restrict funding for the star wars program to last year's level or lower. Point out that the president's program would dangerously escalate the arms race and threaten to violate a major arms control agreement —the ABM Treaty. Also point out that its enormous cost would add to the ballooning federal deficit.

**The address for all representatives is: U.S. House of Representatives, Washington, D.C. 20515**

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ARMS RACE...CONTINUED

tary and political consequences.

The history of the arms race is much more complex than I have suggested here, for it has involved Soviet challenges to the United States as well as U.S. challenges to the Soviet Union. Moreover, the ABM Treaty shows that in the past both sides have been ready to close off some areas of the strategic arms competition and to keep it under some kind of control.

Nevertheless, the Soviet atomic bomb and strategic missile decisions are relevant to any attempt to understand the likely consequences of the SDI, for they show the Soviet determination to compete with the United States. The Reagan Administration's approach to strategic defense seems almost designed to evoke just this kind of atavistic response from the Soviet Union, rather than to elicit Soviet cooperation in controlling and restraining the arms race. □

1. Harry S. Truman, *1945: Year of Decision* (New York: Doubleday, 1965), p. 458.
2. Election speech, Feb. 9, 1946, in I.V. Stalin, *Sochineniia*, vol. 3, 1946–1953, Robert H. McNeal, ed. (Stanford, Cal.: The Hoover Institution, 1967), p. 20.
3. Alexander Werth, *Russia at War 1941–1945* (London: Pan Books, 1965), p. 925.
4. Quoted by A. Lavrent'eva in *'Stroitel novogo mira'*, *V mire knig*, 9 (1970), p. 4.
5. *Pravda*, Jan. 15, 1960.
6. V.D. Sokolovskii, *Voennaia Strategiia* (Moscow: Voenizdat, 1962), p. 237.
7. Ibid., p. 16.
8. *Krasnaia Zvezda*, Sept. 23, 1983.
9. *Pravda*, March 27, 1983.
10. Interviews, Radio Moscow (May 23 and 25, 1984), *Foreign Broadcast Information Service* (June 6, 1984), USSR International Affairs, pp. AA9, AA11.

LASERS...Continued

Work continues on laserproof goggles, but most filters badly obscure vision and few are effective across the range of possible laser frequencies. Indicating the severity of the visual interference problem is a request for contract proposals issued early in 1984 by the Army for the development of goggles, good against visible and near-infrared laser light, that would retain at least 50 per cent of normal vision. That, apparently, is the best result the Army can expect. An additional problem is that as reds are filtered out, a soldiers's ability to distinguish natural and camouflage green is dramatically diminished.

Intensified research into the biological effects of laser weapons will be carried out at a new Directed Energy Laboratory at Brooks Air Force Base in Texas. 'The purpose of this facility,' Air Force Maj. General Clifton Wright, head of the Air Force's Engineering and Services Directorate, told Congress, 'is to conduct radiation experiments on animals to determine potential effects on humans of exposure to high-energy radiation.' The test subjects at the $9 million facility, he said, would be 'primarily rodents and sheep.'

## Psychological worries

SOME MILITARY experts are no less worried about the psychological than the physiological impact of battlefield lasers. 'For the technically unsophisticated soldier experiencing marginal damage from an unseen and unidentified source, reluctance to return to battle after recuperation might welf make him an ineffective combatant.' Lieut-Colonel Douglass Bacon, a systems manager with the Army's Training and Doctrine Command, wrote in the December issue of *Military Review*, the journal of the Army's Command and General Staff College.

'Fear is contagious, and rumors spread rapidly.' Bacon worried. 'Even if a relatively small number of soldiers experienced laser eye damage, the reports that would naturally circulate throughout the forward forces might degrade the combat effectiveness of these units.'

The push to develop battlefield lasers is driven, in part, by fears of what the other side may be doing. 'If personnel countermeasure research, development, testing and evaluation are not continued aggressively,' the Air Force warned in its funding request for the Brooks directed energy laboratory, 'our adverseries will be encouraged to develop directed-energy weapon systems with their extensive kill capacity directed against the human element of our strategic and tactical systems.'

The Soviets do deploy a variety of battlefield lasers today, but so far solely as adjuncts. According to General Wickham, 'these are primarily lasers such as rangefinders, but they also pose an anitpersonnel and antisensor threat.'

## Radio-frequency weapons

LASERS ARE not the only Soviet DE weapons the Pentagon is worried about. Soviet 'radio-frequency technology has now developed to a stage,' the Defence Intelligence Agency claims, 'where it could support development of a prototype, short-range radio-frequency weapon ... which not only could damage critical electronic components but also inflict disorientation or physical injury on personnel.'

Interestingly, British radio researcher Sir Robert Watson-Watt was approached in 1934 by the UK Air Ministry to assess the feasibility of a radio-frequency 'death ray.' Watson-Watt concluded that the 'power required was fantastically large (and) that there was no chance of a death-ray being produced by those means.' He did discover, however, that radio broadcasts at power levels that were practicable could produce detectable reflections from aircraft — and so radar was born.

Radio-frequency weapons would operate 'like a microwave oven,' according to Dr Robert Cooper, director of the US Advanced Research Projects Agency. The Soviets have used microwave energy on the US embassy in Moscow, Cooper says, and the effect of radio-frequency weapons would be similar.

The biological effects of microwave radiation are ambiguous and poorly understood, as the long-simmering controversy over the microwaving of the US Moscow embassy attests. Low-dose radio-frequency studies on animals have shown behavioral changes, immune system alterations, and neurological effects, but these findings continue to be controversial. Nonetheless, in 1982 the American National Standards Institute dramatically reduced permissable exposure limits to radio-frequency missions. The physical effects of higher levels of microwave energy are less disputed: tissue and bone burns, cataracts and — of more doubtful military utility — temporary sterility. As for antimaterıel applications, microwaves could either over-heat electronic components or, at lower intensities, interfere with signal transmission within equipment.

The US is also researching radio frequency weapons. 'High-power microwave beam weapons are the newest thrust in the DoD Directed Energy Technology Program,' Air Force Major-General Donald Lamberson, Deputy and Assistant for Directed Energy Weapons, told a Congressional panel in 1983. 'In effects-testing we have initial evaluations of microwave-induced (component damage). To support beam generation, we have under development advanced electron gun and high-emissivity cathodes and pulsed-power technology. If experiments verify that appropriate damage mechanisms exist, then the technology has promise as a weapon system.' Funding is not thought to amount to more than several million dollars per year — but a drop in the Pentagon bucket.

In any event, optical attack lasers like Stingray will be deployed long before radio-frequency weapons. Indeed, they may already have. Unconfirmed reports have circulated that Soviet-made laser rangefinders or target designators were used to blind Chinese troops during the 1979 Sino-Vietnamese border war. ■

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# DEFINING THE SPETSNAZ THREAT

## Gerard Holden

**Although the subject has been relatively familiar in specialist circles for some years, it is only recently that discussion of Soviet special forces, sometimes referred to as Spetsnaz, has occurred in public fora.**

**In this article, *Gerard Holden*, a researcher at the Science Policy Research Unit, looks at the background to the emergence of Spetsnaz in Western and Soviet literature, and assesses the evidence on the nature and role of these forces. He argues that the Spetsnaz question, as applied to Britain, cannot be understood in isolation as a purely military issue, but needs to be set in the context of domestic debates over defence policy.**

**The author is currently working on a research project for the United Nations University on European security questions with particular reference to the Warsaw Pact.**

During the past few years, the term 'Spetsnaz' has become an increasingly familiar one in specialist literature dealing with Soviet military strategy. 'Spetsnaz', or Soviet special forces, have been identified as an important aspect of the Soviet threat to the West, and in Britain the term has recently become more public in reports of the attack scenario drawn up for the 'Brave Defender' home defence exercise planned for September 1985. The term has entered the debate gradually, but is now firmly established, and it would seem timely to look in detail at some of the ramifications of the 'Spetsnaz' issue.

Operations conducted by special forces are often referred to as 'special operations' or 'unconventional warfare'. The terms cover a field of activities including anti-terrorist and counter-insurgency operations by small and highly-specialised units who may operate in guerilla warfare conditions where there is no easily definable front-line in the conflict. Other special forces operations may be carried out behind enemy lines for the purposes of intelligence-gathering, sabotage, or seizure of particularly important installations, all of which are seen as severely disruptive of an enemy's fighting capacity. Western units covered by the terms would include the British Special Air Service (SAS) and Special Boat Squadron (SBS), and the USA's Special Operations Forces (SOF).

Commando-type operations on enemy-occupied territory are not the only roles allotted to the world's special forces. SAS and SBS operations during the Falklands War, and the US Green Berets in Vietnam, fit this pattern, but such forces have also been used in a variety of peacetime emergencies, most notably the SAS in the siege of the Iranian Embassy in London in 1980.

The USA's Special Operations Forces include a variety of units from the Army, Navy, and Air Force. The term 'low-intensity conflict' has come into use to describe SOF fields of competence. These include dealing with 'terrorism and guerilla insurgencies' throughout the world, training forces of other nations as well as conducting their own operations.[1] They are also described as countering major conventional attacks 'through their capability to deter and defeat an enemy's rear echelons, and to engage in unconventional warfare, psychological operations, counterterrorism, and intelligence missions'.[2]

Standard British policy statements say very little about the role of the SAS. Although the regiment is listed in the annual *Statement on the Defence Estimates*, official explanations of its role are rare. However the SAS and other British special forces are known to have operated widely since the last war in Malaysia, Aden, Oman, Borneo, the Falklands and Northern Ireland.[3]

### What are Spetsnaz?

Accounts of Soviet Spetsnaz paint a picture not dissimilar to that of western special forces. Their wartime role is stressed, but there are also reports of their use in peacetime circumstances and in situations which the Soviet Union might view as 'low-intensity conclicts'. The principal accounts are by Viktor Suvorov, an ex-officer of the Soviet military intelligence organisation, the GRU (*Glavnoye Razvedyvatel'noye Upravlenie*, or Chief Intelligence Directorate). Suvorov (the name is a pseudonym to conceal his real identity) defected to Britain six years ago, and has since published three books and other articles on Soviet military affairs.[4] According to Suvorov, Spetsnaz units are part of the GRU, which is itself a directorate of the Soviet General Staff. Spetsnaz units are assigned to Soviet military districts, groups of Soviet forces in Eastern Europe, and the four Soviet fleets. There are also Spetsnaz agents serving in western countries in peacetime, who are foreign citizens functioning as 'sleepers' until they are called upon to carry out wartime duties. In wartime, Spetsnaz units are described as having five principal tasks:

(1) Assassination of enemy political and military leaders.

(2) Neutralising enemy nuclear facilities by guiding Soviet aircraft or missiles to them, or destroying such facilities themselves.

(3) Neutralising enemy command, staff, and communication centres.

(4) Destroying important enemy targets such as airfields, naval bases, and air defence installations.

(5) Disrupting enemy power supplies by attacking power stations, storage centres, pipelines, and power lines.

In order to carry out these tasks, Spetsnaz would land behind NATO lines by parachute, submarine, or boat. Suvorov claims that many Soviet Olympic athletes are Spetsnaz servicemen and women who spy out the land on trips abroad[5] and that

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