Book Reviews

The Nuclear Infrastructure

Nuclear Battlefields. Global Links in the Arms Race. WILLIAM M. ARKIN and RICHARD W. FIELDHOUSE. Ballinger (Harper and Row), Cambridge, MA, 1985. xx, 329 pp., illus. $28; paper, $14.95. An Institute for Policy Studies Book.

Last August the Australian Defense Ministry issued a press statement that Australia would be assisting the United States in checking the performance of the U.S. Navy's GEOSAT satellite. Data from the GEOSAT program would, it was explained, "significantly improve the forecasting of weather and sonar conditions in the areas surrounding Australia where Royal Australian Navy units routinely operate." There was no hint in the press release that the primary mission of the GEOSAT program was to collect gravitational data about the earth to help increase the accuracy of submarine-launched ballistic missiles. Nor was it revealed that GEOSAT was funded from the Trident missile program.

Ministerial response to parliamentary questions revealed ignorance about the links between GEOSAT and U.S. war-fighting policies—policies to which the Australian Labor government of Prime Minister Robert Hawke is officially opposed. This ignorance—on the part of both the government and the public—about GEOSAT's role is a perfect illustration of the central thesis of a meticulously researched new study by William Arkin and Richard Fieldhouse of what they call the global nuclear infrastructure.

Nuclear Battlefields provides the most comprehensive review to date of the infrastructure that supports and sustains the nuclear strategies and armories of the five recognized nuclear weapons powers. It describes the arsenals themselves, their storage and production complexes, and the strategies that would determine the use of the weapons should deterrence fail.

Fully half of the study is taken up with highly detailed appendixes that list all the known locations of the nuclear infrastructure installations of the five powers in question. These range from nuclear-weapon combat units to relatively obscure scientific installations that provide support—direct or indirect—for the nuclear forces.

The existence of an infrastructure that binds non-nuclear states into the nuclear war-fighting strategies of both superpowers has implications that are often far-reaching but are rarely understood. Australia, for example, hosts data processing ground stations for vitally important intelligence and early warning satellites—America's eyes and ears in space.

Some of the functions of these satellites, for example, arms control verification, are unambiguously stabilizing, Others, Arkin and Fieldhouse argue, are an integral part of a U.S. war-fighting policy that is quite as destabilizing as that of the Soviet Union. For example, the Defense Support Program early warning satellite that peers down at the U.S.S.R. from geostationary altitude carries nuclear detonation sensors (NUDETS) in addition to its missile launch sensors. In a nuclear war, NUDETS will tell the Pentagon exactly where U.S. warheads are exploding over the U.S.S.R.—essential information for retargeting follow-up strikes.

Australia thus finds itself locked into collaboration with nuclear war-fighting policies that the Hawke government officially rejects. Critics argue that the presence of these "bases," which play so indispensable a role in U.S. nuclear war-fighting plans, is totally at odds with the spirit of the South Pacific Nuclear Free Zone Treaty that Australia promoted with enthusiasm. Arkin and Fieldhouse agree and fault the various proposals for a nuclear-free zone for ignoring the question of the nuclear infrastructure.

Nuclear Battlefields demonstrates that the nuclear infrastructure is both more pervasive and more important than is generally realized. Meteorological, geodetic, oceanographic, and astronomical research plays a critical role in enhancing the war-fighting capabilities of both superpowers. For example, access to accurate geodetic data such as those collected by GEOSAT is necessary for precision nuclear targeting since gravity effects can account for up to 25% of the "accuracy error" of a missile.

The strategically vital functions served by some elements in the infrastructure make them priority nuclear targets for the other side. Enemy satellites facilities may be more important targets than enemy nuclear weapons systems. Countries that have no nuclear weapons stationed on their soil may still be targets in a nuclear war.

The work of such researchers as Arkin and Fieldhouse, Desmond Ball, and Jeffrey Richelson and of such investigative journalists as James Bamford, Dan Ford, and Duncan Campbell has greatly increased public knowledge about the nuclear infrastructure. The growing public awareness, along with widespread unease about the directions of superpower nuclear strategy, has stimulated growth of the so-called "nuclear allergy," a global phenomenon to which Arkin and Fieldhouse devote their last and most speculative chapter.

"Nuclear allergy"—aversion to collaboration with superpower nuclear policies—is mostly a Western phenomenon, but it is not exclusively so. In 1981 Romania refused to accept the deployment of new Soviet missiles on its soil, and Bulgaria, like eight of the 16 NATO nations, refuses the basing of nuclear weapons on its soil in peacetime. The best-known symptoms of the allergy, however, are decidedly Western—New Zealand's ban on nuclear ships, Greece's opposition to U.S. bases on Greek soil, the European peace movement's campaign against the deployment of intermediate-range nuclear forces, and so forth.

Arkin and Fieldhouse see the emergence of the nuclear allergy as fundamentally healthy; the Reagan Administration sees it as a major cause for concern—peace movements can undermine Western defenses, not those of the U.S.S.R.

Interestingly, there were no comparable manifestations of nuclear allergy in the mid-1970's—a period when, rightly or wrongly, most people in the West believed that genuine progress was being made in arms control and disarmament. Few people believe that to be the case today. The best antidote to nuclear allergy would seem to be a serious commitment to detente and genuine attempts to achieve disarmament.

Like other studies with which Arkin has been associated, *Nuclear Battlefields* is meticulously researched and highly informative. It is likely to be referred to repeatedly.

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Fractals

On Growth and Form. Fractal and Non-Fractal Patterns in Physics. H. EUGENE STANLEY and NICOLE OSTROWSKY, Eds. Nijhoff, Dordrecht, 1986 (U.S. distributor, Kluwer, Hingham, MA). x, 308 pp., illus. $44.50; paper, $14.95. NATO Advanced Science Institutes Series E, vol. 100. From an institute, Corsica, June 1985.

Fractals are self-similar objects, objects that look the same under different magnifications. Fractals are ramified; the mass M of a fractal within a cube (or square or segment) of linear size L grows as a power $M \sim L^D$ with a non-integer fractal dimensionality D (smaller than the usual $M \sim L^d$ in uniform systems, where $d = 3$, 2, or 1 is the Euclidean dimensionality). Since $D < d$, the density decays to zero as $L \to \infty$. Fractals were considered an abstract mathematical oddity until Benoit Mandelbrot showed