cal photographic example is the faint red dwarf star Ross 614, which has a perturbed motion first discovered, in 1935, by D. Reuyl at the McCormick Observatory. Twenty years later, from subsequent studies at the Sproul Observatory, the location of the companion star was predicted, and the companion was both seen and photographed with the 200-inch Hale telescope at Palomar Observatory. A number of other perturbations have since been discovered at the McCormick Observatory and await further analysis. Various other aspects of double-star work were carried out under Mitchell's directorship.

In 1926 Mitchell initiated the taking of first epoch plates of Cepheids for the purpose of ultimately testing the zero point of the period luminosity curve. A similar program on long-period variable stars was also begun some time later.

The second area of Mitchell's activity was visual observation of variable stars. Again assisted by Olivier, Alden, and others, Mitchell observed a large number of long-period variable stars; with the McCormick telescope, stars down to the 15th magnitude or even fainter could be observed. This work included the determination of standard magnitudes for the comparison stars, used now by the American Association of Variable Star Observers. Mitchell also established visual photometric standards in selected areas of the sky.

Thirdly, Mitchell devoted considerable time to the observation of total solar eclipses. Between 1900 and 1934 he traveled to observe some ten total eclipses and obtained excellent photographs of several of them. He was particularly proud of his photograph of the "flash" spectrum of the chromosphere, taken when he was in Spain in 1905. With the collaboration of E. T. R. Williams and of Rupert Wildt, Mitchell derived important astrophysical information from these spectra. His book *Eclipses of the Sun*, published by the Columbia University Press, has gone through several editions.

Numerous other phases of astronomical work were started under Mitchell's directorship, such as Vyssotsky's discovery and study of nearby red dwarfs from objective-prism spectra taken with a 10-inch refractor. The same instrument has been used to supply spectral classifications of over 100,000 stars to several other observatories.

For several years, Mitchell was chairman of Committee A, on Academic Freedom and Tenure, of the American Association of University Professors and contributed to the work of this important committee.

Upon reviewing my 14 years' association (1923–1937) with Mitchell, I am impressed by the prodigious amount of work that was done under his directorship. Over the years, he gathered around him a number of dedicated astronomers who, operating on a small budget, with a minimum of secretarial and computational assistance, reached a vigorous rate of productivity. In addition to the enthusiasm of Mitchell and his co-workers, the fine quality of the 26-inch objective and the Virginia climate, one of the best for astronomical observation along the Atlantic seaboard, were factors in this productivity. That the small staff of the McCormick Observatory achieved so much was due, in no small measure, to the organizational qualities and the energetic directorship of Samuel Alfred Mitchell.

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Science in the News

Thinking about Disarmament: The Search for a Policy Turns Up Several Apparent Paradoxes

There has been a general increase in research on the problem of disarmament, dating from 1958 when the apparent progress being made at the Geneva test ban negotiations led to a feeling that the time might be right for at least some modest progress in other areas of arms control. The research has reflected a new and still evolving attitude among policy makers, who have tended in the past to regard disarmament negotiations as something which has to be undertaken for the sake of impressing the world with a nation's peaceful intentions but from which no real progress is to be expected. Interest in research on disarmament continues, despite the collapse of the Geneva disarmament negotiations and the present precarious state of the talks for banning nuclear weapons testing.

One fundamental difficulty in obtaining disarmament, as has been pointed out by Hans Morgenthau, of the University of Chicago, is that, without an international judiciary with the power to enforce its decisions, a nation is able to protect its interests, ultimately, only by the use or threat of use of military power. Consequently, disarmament can only follow, not precede, a relaxation of the tensions which have brought on an arms race. The value of such arms limitation agreements as might be reached is likely to be wholly illusory, as was, for example, that of the widely hailed Kellogg-Briand pact of 1928, which pledged its signatories to renounce war as an instrument of national policy.

Currently, research on disarmament is being conducted at the Rand Corporation, Santa Monica, California, which is a nonprofit organization supported primarily by the Air Force, and at several centers of international affairs at leading universities, with support by government and private grants. Until recently the program at Rand involved the part-time efforts of 12 men, but the research is being expanded.

The Traditional View

The goal of disarmament is part of the larger goal of seeking ways to reduce the likelihood of war. In the pursuit of this broader goal, the traditional emphasis has been less on disarmament and more on striving for a stable balance of power—that is, a balance in which no nation or alliance would be tempted to start a war since it would be opposed by an alliance strong enough to make the war extremely costly, strong enough to make the aggressor nation realize that there was a good chance it would lose the war. The trouble with the balance of power theory, according to some students of the problem today, is that nations do not behave as rationally as one would wish. A war can begin without either side really wanting it.

Present research on the problem of reducing the likelihood of war, although widely known as "disarmament research," differs chiefly from the traditional concern with the balance of power in replacing that concept with the concept of the balance of terror—that is, a balance among nations any of which has the power to pour devastation upon any other nation even if it is itself the victim first of a devastating surprise attack.

Some students of international affairs have now come to believe that a nation may find it in its own interest to work actively with its potential enemy to achieve a stable balance rather than seek only to maximize its own power and leave the potential enemy to keep pace. This school also believes that, given an apparently stable balance, rival powers may be able to work much more consciously than they have in the past to lessen the chance of war by accident, by misunderstanding, or by miscalculation.

What is being sought today under the heading of "disarmament research," accordingly, is not so much a decrease in the likelihood of war through disarmament as a decrease through an increase in international stability. In the short run at least, according to some students, serious proposals for reduction in armaments may play only a minor role in the effort to reduce the likelihood of war. This state of affairs is partly the result of the great difficulty of working out adequate inspection measures to insure that the provisions of a disarmament treaty are obeyed and partly the result of uncertainty concerning the effect of certain types of arms reductions on the goal of increasing international stability. In fact, it has been argued that disarmament, unless carefully planned, could, paradoxically, increase rather than decrease the danger of war.

Difficulties Facing Disarmament

It has been argued, for example, that the most promising areas for arms control today are not those which involve the dismantling of nuclear stockpiles and missiles; that, on the other hand, it is the very existence of massive and invulnerable deterrent forces that is the best safeguard against a nuclear war, since no nation can wish to start a war which it can be certain will lead to the inevitable devastation of its homeland. This view suggests that general nuclear disarmament may decidedly increase world tensions, since in the absence of an absolutely foolproof inspection system, which would probably be impossible to achieve, each nation would be stricken with fear that its rivals might be secretly assembling a nuclear striking force before which the nation observing the weapons ban would be defenseless. In any case, it can be argued that general nuclear disarmament, even if it could be achieved, would in one sense be illusory. For the technical knowledge of how to build bombs and missiles would still exist, and the outbreak or perhaps even the threat of outbreak, of war would be quickly followed by a race for nuclear rearmament; a nation might even be tempted to strike before the other fellow had a chance to assemble a nuclear force.

The weight of such arguments, plus the enormous difficulties of working out adequate and acceptable nuclear inspection systems, has led the researchers to think primarily in terms of stability-enhancing proposals with far more limited objectives than general disarmament and even to suggest that, in the short run at least, stability might be increased by additional armaments, including certain types of nuclear weapons.

The new research on "disarmament" involves attempts of political scientists, physicists, military experts, students of international law, and experts in still other fields to formulate proposals for promoting stability and to think them through carefully so that their implications may be understood as thoroughly as possible—H.M.

News Notes

Another Round in the Test-Ban Talks: The Pool Proposal

The United States has attempted to meet the Soviet demands for "safeguards" to insure that the U.S. seismic research program to improve methods of policing small underground nuclear explosions would not also serve to develop new weapons. At the Geneva test-ban talks on 12 July, James J. Wadsworth, the U.S. delegate, proposed the creation of a pool of early Western and Soviet nuclear devices that would be open to inspection and use by both sides.

This latest attempt to break the deadlock in the proceedings, which have been stalled for weeks over the method of carrying out a research program to improve existing seismic detection of small-scale underground tests, was acknowledged by the Soviet delegate, Semyon K. Tsarapkin, with a promise to refer the proposal to Moscow for study.

The terms of the proposal provide (i) that the three nuclear powers would supply approximately the same number of early nuclear weapons; (ii) that these devices would be inspected externally and internally (without destruction) by all three parties at the time of deposition; (iii) that the devices would be placed under international guard; and (iv) that each country could then withdraw from the pool devices to carry out research programs which had received the approval of the three parties. Each nation could use nuclear weapons of the other two nations for research purposes.

Soviet Reaction

Soviet reaction to the plan, while unofficial, has perhaps indicated the position that Moscow will take. Tsarapkin, addressing the summer school of the World Federation of United Nations Associations in Geneva on 19 July, did not object to the relaxation of American nuclear-secrets legislation to allow inspection of the test devices by the Soviet Union, but he denounced the proposal of international contribution to the pool as "fantastic" and "nonsensical." As the Soviet Union is perfectly satisfied with the existing detection system and intends to conduct no research, he asserted, there is no