ment. Barrow went on a temporary basis but encountered equally grave problems and agreed to act as a court witness on Spicer's behalf, should this be necessary.

Needless to say, we can document, or refer to witnesses, to substantiate all of the foregoing. Other senior members of the ETH Institute of Astronomy were shocked at the treatment that we received. We know of at least two other scientists who, within the past three or four years, have encountered similar problems working with one of the groups that now make up the Institute of Astronomy and who have since departed as a result of these.

We wish to emphasize that, generally, we found life in Switzerland to be interesting and pleasant. We encountered many very agreeable and helpful people both within ETH and outside. We would, however, strongly recommend that anyone considering a position should check the conditions very carefully and ensure that these are clearly stated in writing before making a final committment.

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RESPONSE FROM ETH: The case described by D. S. Spicer and C. H. Barrow in their letter is strongly distorted, as I will try to clarify.

For Spicer, who was employed as a regular staff scientist, I spelled out *in writing* the exact salary that he would receive in Swiss francs, a year in advance of his employment (letter of 27 June 1980, start of employment 15 June 1981). Later I arranged for Spicer to be moved up to a higher salary grade, which took effect on 1 January 1982. It was only several months after this salary raise had come through that Spicer expressed to me his strong dissatisfaction with his employment conditions, and started to take legal actions.

As a Visiting Scientist on a temporary position financed from several different sources, the salary of Barrow cannot be judged by the same criteria as those of the regular staff scientists of corresponding seniority.

In their letter, Spicer and Barrow compare their salaries with that of a "technician in the Institute who was still working on his doctorate." The person they refer to, who received his PhD in 1981, was, however, in a high salary grade because he had over a number of years played the key role of chief engineer within the Radio Astronomy Group, not because he was making a scientific career. The salary received by Spicer was considerably higher than what could be payed to Swiss postdocs on an academic track.

In spite of these inaccuracies, there is also some substance behind the dissatisfaction expressed by Spicer and Barrow, and their case revealed to us some personnel problems within the institute. We have therefore (before Spicer and Barrow wrote their letter) reorganized the Radio Astronomy Group to prevent such problems from occurring in the future.

I can assure you that many foreigners, most of them not German-speaking, have stayed or are still staying at our institute without having the feeling of being "used as cheaply as possible." Indeed, I am a foreigner myself (Swedish, with an American wife), who has been living in Switzerland for $3\frac{1}{2}$ years now.

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Nuclear test ban again

In the debate on a comprehensive test ban published in PHYSICS TODAY (August, page 24), both parties—pro and con—focus on weapons reliability. "Pro" says we can have reliable nuclear weapons without continued testing; "con" says that continued testing of the weapons is required to assure their reliability. Both parties imply that reliability of nuclear weapons is a "good thing"—as physicists, we always strive for reliable tools. I wish to make the point that it is reliability of the entire system—the international security system—of which nuclear weapons are only a part, which is the "good thing"; that reliability of nuclear weapons is *not* to be desired and that, therefore, a comprehensive ban on the testing of nuclear weapons is a very desirable goal of the entire world community—scientific and otherwise.

Reliability is required of a weapon if one plans to use it; the planner needs assurance that his plans will be carried out precisely. The planned use of nuclear weapons implies the fighting of a nuclear war. In addition to large segments of the American and West European populations, there are many generals—the professionals who will have to fight any war—who have publically stated[1] that nuclear war cannot be fought, that nuclear weapons can have no role in war, that they are political and not military tools.

It follows that the only anticipated use for nuclear weapons is as a deterrent to an opponent's first use of such weapons.

Planned first use of nuclear weapons requires absolute reliability. The initiator of an exchange puts himself way out on a limb, which he must anticipate will be strong enough to hold him securely. The role of a nuclear first strike is to obliterate the opponent's capability to strike back or to reduce it to a "tolerable level." Failure to accomplish all of the goals of the first strike—nonreliability of the tools of the first strike—leaves the initiator open to fatal reply; he may succeed, partially, and thus murder his opponent but, in the process, commits suicide.

Deterrence does not require reliability—precise functioning according to plan. It just requires that a significant fraction of the weapons survive and work—more or less well. Deterrence does not necessarily imply the targeting and massive killing of civilians. Deterrent nuclear weapons can hold hostage the economic, political and military institutions of power and control of the opponent—most of them "soft targets." (Former Secretary of Defense Robert McNamara's original estimate, that 400 megatons-equivalent of nuclear explosive would be a sufficient deterrent, is very much an overestimate for holding hostage any modern society.) Given the many thousands of megatons-equivalent of nuclear explosive that are liable to survive even the most reliable first strike, the gamble taken by a would-be first-striker is very great. The gamble is even greater, and thus less likely to be taken, if his first-strike tools are of questionable reliability.[3]

Thus any procedure that can equitably reduce nuclear-weapon reliability reduces the inclination for a first-strike and hence adds to the deterrence of nuclear war. Such a procedure runs counter to the desire to use nuclear weapons for policy goals—for acquiring the ability to threaten an opponent into doing or not doing something. Such a procedure aids in preventing the opponent from doing just that to you.

We thus have another argument for a comprehensive nuclear-weapons test ban: such a ban doesn't make reliability impossible, but makes it much harder to attain. Continuous testing increases reliability, leads to faith in the efficacy of nuclear weapons, and thus increases the probability that they will be used—in some policy dispute or other. At that point we will learn, at great cost, whether or not nuclear escalation can be controlled.[2]

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3. Martin B. Einhorn, Gordon L. Kane, Miroslav Nicic, "Strategic Arms Control Through Test Restrains: Principles and Case Studies," Office of International Peace and Security Studies, University of Michigan, to be published in *International Security*.

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AN AUTHOR COMMENTS: Alvin Saperstein suggests that a comprehensive test-ban treaty would be beneficial to world stability since an equitable decline in reliability of the the nuclear arsenals of both sides would reduce the temptation for a first strike. The assumption of an equal rate of degradation of weapons on both sides is crucial to this argument, and unfortunately the assumption may not be true. The American weapons labs are quite concerned about a possible asymmetry in the stockpile degradation of American nuclear weapons vs. those of the Soviets.[1] They fear that the Soviet weapons are simpler and more robust than the sophisticated American designs, so that after some years of a test ban the Soviets might be more confident of the reliability of their warheads than we are of ours. Clearly, no American government will accept a test ban until this fear is dispelled. I pointed out in my article that if the present sophistication of American weapons designs gets in the way of a test-ban treaty, then it is time to ask why the weapons labs have not come up with proven designs that can be dependably manufactured in the future. If the Soviets can do it, then we can, too.

Reference

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I find Robert Barker's primary arguments against a Comprehensive Test Ban to be somewhat disingenuous. In his discussion of reliability—his first argument, and thus presumably his strongest one—he states that the testing of nuclear weapons already in the stockpile is necessary when inspectors find evidence of unacceptable deterioration (through non-nuclear testing). He fails to note that suspected defects thereby uncovered could simply be fixed, and components remanufactured to their original specifications. Is he really arguing that a part that fails cannot be replaced with a working part with the same functional specifications?

Modernization as a reason for continued nuclear testing takes for granted that modernization (the development of new weapons systems with performance characteristics different from previous weapons systems) is a *sine qua non* for US defense policy. Indeed, if Barker were to accept the notion of a mutual nuclear freeze, the modernization rationale would also disappear. Thus, any modernization argument against a comprehensive test ban must also include an argument as to why the US needs the military capabilities provided by modernized nuclear weapon systems. Barker does cite future needs for a penetrating bomber and for long-range nuclear artillery, but he presents no argument for their military utility. The absence of such an argument leads me to suspect that perhaps one cannot be justified.

Perhaps unwittingly, he also makes a comment that illustrates a remarkably narrow vision of US security. He argues that nuclear weapons in which the US does not have confidence have the same effect on US security as weapons which have been removed unilaterally from the US stockpile. This argument completely ignores the Soviet viewpoint, which would quite naturally be that even US weapons that have not been tested may very well pose a potential threat to the USSR. Therefore, these untested weapons will enter into the perceptions of the Soviet leadership, and thus will be taken into account by Soviet defense planners. Barker apparently forgets that our nuclear arsenal does not exist in a vacuum, and that our adversaries may not necessarily share our perspectives.

I fully support Barker's call for an informed debate on a comprehensive test ban, and indeed on all aspects of US national security interests. However, an informed debate would call for a consideration of Soviet perspectives and an explicit justification for desired new military capabilities, as well as knowledge about the maintenance of complex equipment. Barker's piece seems somewhat lacking along these dimensions.

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9/83

Appeal from India

I am an electrical engineer in India, the country of Mahatma Gandhi. His struggle against imperialistic forces to provide social justice to the common man will be remembered by all for centuries. We all are following his path and struggling peacefully to bring peace on this planet.

Gandhijee is also known for his instrument of struggle: "non-coopera-