

PHYSICS and SOCIETY

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PHYSICS AND SOCIETY is a quarterly newsletter of the Forum on Physics and Society, a division of the American Physical Society. The newsletter is distributed free to members of the Forum and also to physics libraries upon request. It presents news of the Forum and of the American Physical Society and provides a medium for Forum members to exchange ideas. PHYSICS AND SOCIETY also presents articles and letters on the scientific and economic health of the physics community; on the relations of physics and the physics community to government and to society, and the social responsibilities of scientists. Contributions should be sent to the Editor: John Dowling, Physics Department, Mansfield University, Mansfield, PA 16933, 717-662-4275.

Forum on Physics and Society
Physics Department
Mansfield University
Mansfield, PA 16933

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WASHINGTON FORUM SESSIONS AT THE APRIL 1984 APS MEETING

Awards Session, Tuesday, 24 April 1984 at 8 PM.

Mike Casper, Physics Dept., Carleton College, Northfield, MN 55057 will speak on "Physicists experiments with preventing nuclear war: an analysis of the data. Mike receives the **Forum Award** for promoting public understanding of issues related to nuclear weapons, arms control, and energy.

Kosta Tsipis, MIT, 20A-011, Cambridge, MA 02139 will speak on Directed Energy Weapons: the real and imaginary parts of a complex topic. Kosta receives the **Szilard Award** for applying his abilities as a physicist to understanding and publicizing both the technical and social aspects of important arms race issues.

Executive Committee Meeting of the Forum will take place on Tuesday, May 24, at 11 AM in Suite B163 of Shoreham. The business meeting of the **Forum** will take place at 7:30 PM on Tuesday, immediately preceding the Awards Session. Interested **Forum** members are invited to both meetings.

Strategic Warfare From Under the Sea to Outer Space is a special **Forum** session scheduled for Monday evening at 7:30. Ted Postol, Office of Chief of Naval Operations speaks on ASW. Marshall Eubanks, JPL speaks on Missile Accuracy. James Woolsey member of Scowcroft Commission speaks on MX. Kurt Gottfried of Cornell speaks on Space Based Ballistic Missiles.

There will also be a session featuring past APS Congressional Fellows on Monday morning.

LETTER TO THE EDITOR:

This is a comment on your modification of a cartoon printed in Pravda of 11 Oct 1983.

You said that you produced a U.S. version of the cartoon. All you did was to paste small labels on the letters of the original cartoon! But what annoyed me was that you twisted this sloppy job into something sounding lofty and profound! You stated that the two cartoons together presented a realistic picture of the status quo in the arms race. You understood nothing from the Pravda cartoon.

The Russians intended to focus the attention of the readers on the "Capitalistic Pig" sleeping soundly only under the blanket of money, needing the missiles and bombs only to defend his wealth (which was implied to have gotten by exploiting the working people of the world).

An appropriate U.S. version of the cartoon would have shown a bald man with regular eyeglasses (not sunglasses) holding a machine gun in his hand, crouching on a bed, unable to sleep and hence piling up more and more missiles all around him, (and even then unable to sleep). At least, you could have changed the dollar sign on the blanket to the sign of a machine gun! You did not do even this simple necessity to the claim of 'status quo'.

Perhaps, this incident itself shows how shallow and ignorant the so called advocates of arms control are! If the 'an eye for an eye' attitude of these people is of this nature which substantiates and reinforces the essence of the U.S.S.R.'s view of U.S.A., then I say that these people are very dangerous too because of their naivete!

Dr. Vijay Sreedhar
100 Graham Road, 9D
Ithaca, NY 14850

REPORT ON THE APS COUNCIL MEETING HELD IN SAN ANTONIO ON 29 JANUARY 1984 by Kenneth W. Ford, **Forum** Councilor, Molecular Biophysics Technology, Inc. 3508 Market St., Philadelphia, PA 19104.

The January Council meeting was my first. I carried away from it one overwhelming strong impression: that physics-and-society issues permeate a great deal of what the Council deals with. These issues are, for the most part, not specifically tied to the **Forum** (the agenda contained only two specific **Forum** matters, which I will mention later); but many are clearly related to the kinds of issues that recur in **Forum**-sponsored symposia and in the pages of this Newsletter.

Consider, for instance, the following set of entities, all of which exist within the APS, all of which had a place on the Council agenda, and all of which address physics-and-society issues: The Panel on Public Affairs (POPA) and its Subcommittee on International Scientific Affairs (SISA), the Committee on International Freedom of Scientists (CIFS), the recently formed Washington Office of Public Affairs, the Committee on Minorities, the Committee on Education, The International Physics Group (IPG), and a proposed new Panel on International Scientific Affairs (PISA).

Two POPA studies may be of special interest to **Forum** members. One, already underway, is the NRC Source Term Study. It will continue in July and August this year in Los Alamos. The other, on the science and technology of Directed Energy Weapons, is planned, although, as of January, it did not yet have a director. This latter study, of evidently great importance, has the backing of everybody who is anybody in the Washington science establishment--Science Advisor Keyworth, NSF Director Knapp, and National Academy President Press, as well as Department of Defense officials. It ought to happen!

An increasing APS concern with international scientific affairs is strongly supported by president Dresselhaus and former President Marshak. The Panel on International Scientific Affairs (PISA), if it is formed, is expected to be organizationally equivalent to POPA--that is, it would be an acting group appointed by, and directly responsible to, the Council. The International Physics Group (IPG), on the other hand, is organizationally closer to the **Forum**. It has a mass membership, distributes a newsletter, and is more or less "free wheeling." IPG is concerned with both assistance to developing countries and cooperation with developed countries (e.g., through the European Physical Society). Neal Lone was the spokesman for IPG.

Bob Pork, reporting to the Council on the Washington Office of Public Affairs, which he heads, focused on present threats to free scientific communication. There is a distinctly 1984 flavor to the various moves in Washington, either already completed or being considered, which make classification easier, circumscribe the Freedom of Information Act, and make the "export" of information harder. There was a clear sense in the Council that the APS should make its voice heard on this issue, preferably in consort with other science organizations.

Turning now to specific **Forum** matters before the Council: the **Forum** Award, to be presented in Washington, was approved. Proposed criteria for awarding Fellowship in the APS to members of the **Forum** for distinguished research or public service were referred to a special ad hoc Committee on Fellowships for review. (I served on this committee, which was chaired by Sidney Drell. It has now completed its deliberations. It accepted the principle that distinguished contributions to the solution of societal problems using physics, and unusually effective efforts in public education, should be recognized by Fellowship in the Society. It suggested minor changes in the criteria statement that it reviewed.)

One item of interest is an action not taken. The Council decided against requiring that newsletters (such as this one) carry a statement disclaiming Society approval of material therein.

In summary: Gradually, in recent years, the APS has been increasing the attention it gives to physics-and-society issues, to the point that such issues now occupy a substantial part of the Council's time. The **Forum** is only one of the many entities within APS concerned about the impact of physics on society and the use of physicist's talents to help solve societal problems. The **Forum** is already actively cooperating with some of the other groups, notably POPA and CIFS (as well as with the AAPT), and should seek cooperation with others, such as the Washington Office of Public Affairs.

CIVIL DEFENSE: A FORUM SYMPOSIUM AT THE MARCH 1984 APS MEETING IN DETROIT

INTRODUCTION: John Dowling, Physics Department, Mansfield University, Mansfield, PA 16933

Why is there so much opposition to civil defense when the purpose of civil defense is to save lives? This symposium attempts to address and clarify this question. But the question is complex. We are dealing with the public's perception of nuclear war formed over the years and with what can be realistically done to meet this threat. Further, what conditions of equity and acceptability to our society are required to implement a national civil defense program.

The explosion of the Soviet A-Bomb in 1949 and the deployment of Soviet intercontinental bombers set off an exuberant wave of civil defense in the early 1950s. This wave flowed and ebbed until a year or two after the Cuban Missile Crisis, when it just seemed to fade away. Those of my generation can remember the civil defense drills, proposed dog tags for school children and local fallout shelters in our neighborhoods. But government films on how to build your own fallout shelter were made suspect by such Hollywood films as "On the Beach" and "Dr. Strangelove." Today's generation sees those times captured in the feature film "The Atomic Cafe" and laughs derisively. Why such a dramatic change from acceptance by building your own backyard fallout shelter, to today's outright opposition by medical doctors refusing to participate in readying hospitals to accept casualties of a nuclear war?

There is a feeling of *deja vu* when one reads the civil defense literature of the 50s and 60s. The devastation of nuclear war, the civil defense problems of public acceptance and public apathy, and how to implement population protection and evacuation were all discussed then. But the problems have intensified. The relatively slow bombers could be countered by air defenses and the relatively small numbers of bombs could probably be protected against by a well-thought-out civil defense program. Today's ICBMs pose a different threat and the famous "cookie cutter" pictures of devastation of all major cities has caused public support to dwindle.

But while the government agency for civil defense underwent the requisite number of name changes it survived, maintained by an approximate annual budget of \$100 million since the 1950s. Today civil defense is back in vogue in government circles as evidenced by the attempts to beef up FEMA with a \$4 billion dollar plus budget to implement a comprehensive civil defense program over the next few years.

The **Forum** has formed a study group on civil defense and as part of this study we have set up this symposium. Here we wish to address and to clarify such important aspects of civil defense as what civil defense programs are pragmatic and cost-effective, what should the public know about protection from blast, heat, and radiation (both prompt and fallout), what public education is necessary to implement a national civil defense program, and can the differences between the two extremes of "It's the dirt that does it!" be reconciled with the gloomy prospects of a "nuclear winter."

This symposium presents a diverse spread of views on civil defense. It features a neutral report by Evans Harrell of Georgia Tech who explains the objectives and progress of the **Forum Study**. Next are two speakers who favor civil defense: Roger J. Sullivan of System Planning Corporation speaking on why "The U.S. Needs Civil Defense" and Carsten Haaland of Oak Ridge National Lab on

"Should We Protect Ourselves from Nuclear Weapons Effects." In conclusion Mike Casper of Carleton College speaks against civil defense in "Under the Mushroom Cloud."

THE FORUM STUDY OF CIVIL DEFENSE

E. M. Harrell, School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332-0160.

The **Forum** on Physics and Society is a division of the American Physical Society, open to any APS member with an active interest in public affairs connected with physics. Arms control is a growing concern of the **Forum**, and in the past it has sponsored a number of symposia as well as courses designed to help physicists teach about the subject.

The **Forum** study on civil defense is part of a new kind of **Forum** project on arms control, consisting of ad hoc study groups working on electromagnetic pulse (EMP), vulnerability of ICBMs, verification of treaty provisions (by spy satellites, etc.), and civil defense. The goal is to produce impartial reports for the community of physicists and the general public, to further education about arms control and aid intelligent discussion of policy. The intention of the **Forum** study groups is not advocacy, and they do not have preconceived conclusions. The professional interests of most of the members of the groups lie outside these subjects, and only open literature will be consulted.

As physicists we of the study group on civil defense are well equipped to understand traditional topics such as the nature and dispersal of fallout, the design of shelters to protect the public from blast and radiation, and monitoring of radiation. Although we do not have the manpower or funding for independent analyses, we are preparing summaries and evaluations of work by the Federal Emergency Management Authority (FEMA), the Rand Corporation, and other governmental and independent organizations. From the stand point of physics, some of these issues, such as radiative shielding, are fairly straightforward. We are also looking into the effectiveness and cost-effectiveness of actual and possible sheltering and relocation plans, and similar issues that are more properly engineering than physics. The study is considering a variety of civil defense plans both in the United States and abroad.

Since only two relatively small (though tragic) experiments have been run on the effects of nuclear attack on human populations, the uncertainties are enormous. Many of the hazards civil defense may have to contend with are less straightforward and well understood than the traditional topics, and some were unknown or considered in only peripheral ways until lately. For example, several studies, most recently "Nuclear Winter" by Turco et al., have shown that full-scale nuclear war might cause drastic long-term atmospheric and ecological changes. Widespread attention has been drawn to the disruptive effects of EMP, and of course the protection of the populace is affected by the types, placement, and quantities of weapons deployed. We would like to determine what civil defense plans have been made, or could be made, to cope with these problems. We may be able to make use of information from some of the other, more technical ad hoc groups.

There are many important and interesting social and political questions connected with civil defense. Does the existence of civil defense plans affect the balance of power? Could it thereby affect the chances that a nuclear war will start? Should or could the United States emulate the ambitious Soviet civil defense system? Assuming enough survivors for a functioning post-attack

society, what would it be like, and how would pre-attack civil defense affect it? In keeping with the limitations of our own expertise and our mission as a non-advocacy group, we do not anticipate making pronouncements about these questions. They are an important part of education about arms control, however, so we plan to survey them and the arguments on all sides. In fact there is quite a diversity of opinion among the study group members.

The study group has been operating in an informal, unfunded way for over a year. During this time we have collected volunteers, selected issues on which to concentrate, compiled large, partially annotated bibliographies, and have prepared some internal, preliminary reports on a few subjects, like the history and current status of civil defense plans in the United States and Soviet Union. If we get support from the Physical Society we hope to meet soon with FEMA officials and other professionals in civil defense, and by the fall we expect to put together comprehensive reports and educational materials for physicists, possibly including such things as computer programs for studying the effects of blast, radiation, etc. Since ours is the least technical topic of the **Forum** study, and the one of most immediate concern to the general citizenry, we also hope to produce a nontechnical report for public consumption.

THE U.S. NEEDS CIVIL DEFENSE: Roger Sullivan, System Planning Corp., 1560 Wilson Blvd., Arlington, Virginia 22209.

A large-scale Soviet nuclear attack against the United States is, unfortunately, entirely possible. If it occurred, it would probably arise from an escalating crisis, rather than "out of the blue". The weapons would probably be directed against our military and industrial targets, but probably not against our extensive rural areas. Radioactive fallout would probably blow over most parts of our country.

Under such a scenario, a person who evacuates from a probable target area to a probable non-target area, and establishes fallout protection, greatly improves his/her chances for survival. This fact forms the basis for Crisis Relocation Planning.

Since World War II over 200 evacuations from natural disasters have taken place in the United States, and they have been very successful. Many careful studies have been done on the numerous aspects of a nationwide evacuation, e.g. traffic control; they show that it probably could be accomplished successfully. Field tests have shown that untrained people can build fallout shelters fairly quickly. Polls show that the majority of Americans want civil defense protection. And historical events indicate that, if a serious nuclear crisis ever occurs, millions of Americans will spontaneously evacuate their homes and besiege the government for information on where to go and what to do. We may well have an evacuation whether we want it or not, and if for no other reason, we should prepare for it.

Furthermore, I believe that the chances of postwar survival and recovery would be good.

In my opinion, civil defense planning will not increase the chance of nuclear war. I have discussed this with many people, and I have concluded that the factors causing a nuclear war would be so numerous and complex that the presence or absence of a U.S. crisis relocation plan would have negligible effect on the chance of war. (In a crisis the President should not call for U.S. evacuation in the absence of a Soviet evacuation; but he certainly should do so if the Soviets begin to evacuate.) Civil defense is like an automobile seat belt: it

doesn't change the chance of an accident, but it improves your odds of survival if the unwanted accident nevertheless occurs.

Our overall nuclear policy should include at least two essential items: (1) we should try very hard to achieve sensible disarmament agreements with the Soviets, leading to substantial nuclear arms reductions on both sides, and (2) we should establish good civil defense to provide some protection in case the unwanted nuclear war nevertheless occurs.

SHOULD WE PROTECT OURSELVES FROM NUCLEAR WEAPON EFFECTS? By Carsten M. Haaland, Engineering Physics and Mathematics Division, P.O. Box X, Oak Ridge National Laboratory, Oak Ridge, TN 37830.

Simple shelters constructed by hand labor using Soviet designs will provide complete protection to the occupants from almost all airbursts of nuclear weapons. Of several Soviet designs adapted for American use, one was constructed of simple tree-poles, buried in the ground under five feet of earth cover, and subjected to blast from chemical explosives. The structure survived an overpressure of 90 psi, more than twice the overpressure on the ground directly below the Hiroshima weapon. If the people of Hiroshima had been in shelters like this one at the time of the detonation, there would have been no injuries or fatalities produced by the effects of the weapon.

When a nuclear weapon is groundburst, there are no simple structures that can withstand the effects at close range. However, a buried shelter such as described above can reduce the area of lethality by a factor of as much as 60. The most vulnerable situation for humans is that of completely unprotected persons who take no evasive action and who are in direct line-of-sight to the fireball. In this case, the area of lethality on a clear day from the thermal radiation from a one-megaton ground burst is almost 80 square miles. If people were well protected by being inside shelters that would withstand an overpressure of 100 psi, this area of lethality would shrink from 80 square miles to 1.3 square miles, a reduction by a factor of 60.

Official records show that in the Hamburg, Germany firestorm of 1943, over 85 percent of the 280,000 people in the firestorm area survived, and nearly all who sought refuge in bunkers, covered trenches, and other non-basement shelters survived. Many of those 15 percent who died sought refuge in shelters in the basements of many-storied, heavy-timbered German structures, where they were first asphyxiated and then cremated.

The lessons from the Hamburg evidence are these: 1) people can survive and have survived the worst firestorms; and 2), shelters should not be located where they may be covered by burning structures or rubble unless they have the capability to be sealed off and can provide an adequate supply of air for the occupants for several hours.

A special shelter, or the small-pole shelter described earlier, buried under seven feet of earth, and with a properly designed entrance, will provide so much shielding from even the worst fallout conditions that the radiation received by the occupants from the fallout is less than they would receive from normal background radiation at the surface of the earth.

Shelters can provide effective defense against all nuclear weapons effects. At the cost of roughly \$1,000 per space, concrete blast shelters could be provided for half of the population of the United States at a total cost of about 120 billion dollars, spread out over about ten years. The most urgent task of any civil defense program for this country is to educate people on defense against nuclear weapons. Some additional money would be required to make a total civil defense system, including fallout shelters for the rest of the population, education of the public, warning systems, stocks of food, water, medical supplies, and radiological instruments, protection of communications, and training of special cadres such as shelter managers and radiological monitors.

Even if 70 to 85 percent of the US industrial capability were destroyed by a large attack, the remaining manufacturing capability in the U.S. would be approximately equivalent to that which this country had at the beginning of World War II. Without any civil defense, essentially where we stand now, about 60 to 80 percent of our population would perish, but about 40 to 80 million persons would survive without trying. With a civil defense program, at least 80 to 90 percent of the population would survive, resulting in at least 100 million more survivors than if there were no civil defense. More important, such a civil defense might possibly deter the would-be attacker, so there would not be any attack at all.

According to President Reagan's speech of March 23rd, 1983, it may be possible to build an active defense that would prevent most nuclear weapons from reaching the United States, a defense that may deter such an attack in the first place. It would be necessary to back up such a system with a strong civil defense.

It is estimated that the Soviets have recently been spending 30 to 40 times more per year on civil defense than the United States, spending possibly as much as six billion dollars on civil defense in 1982. Their civil defense program includes extensive instruction and training programs for everyone; and evacuation plans to move much of the population of major cities into outlying

fallout shelters where food is stored; blast shelters for over half of the working population, perhaps as many as 45 million spaces; and numerous "mirror factories," that is, duplicated factories, some hidden under residential structures in villages. Some 150,000 people are engaged full time as civil defense cadre in a national program that extends from the national level under the Defense Ministry down to cities, rural areas, and industries. An additional 16 million cadre are available under mobilization. These forces are separate from the National Air Defense Troops numbering about a half million. There are at least 75 hardened command posts within 120 kilometers of Moscow. Key Soviet leaders have two relocation sites: one to be used on the eve of war, the second to be used about seven hours after the war begins.

It has been estimated that if the Soviets implemented their civil defense evacuation plan, an operation that would take seven to ten days (not overnight, as implied in the movie, "The Day After"), an all-out counter-attack by the entire U.S. strategic arsenal of nuclear weapons would result in less than ten million Soviet fatalities.

An examination of Soviet radio broadcasts and publications reveals that they have two messages with opposite meanings concerning civil defense. For external consumption the message is that civil defense is useless. For internal consumption, the message is that civil defense is effective and necessary. A typical Soviet message for internal consumption is completely opposite in meaning to those presented for external consumption:

"It is appropriate to say that we still meet people who have an incorrect idea about defense possibilities. The significant increase in the devastating force of nuclear weapons compared with conventional means of attack makes some people feel that death is inevitable for all who are in the strike area. However, there is not and can never be a weapon from which there is no defense. With knowledge and the skillful use of contemporary procedures, each person can not only preserve his own life but also can actively work of his enterprise or institution. The only person who suffers is the one who neglects his civil defense studies."

