Wisconsin engineer. Vol. 74, No. 3 December 1969

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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OL. 74, NO. 3

35 CENTS DECEMBER 1969

wisconsin engineer

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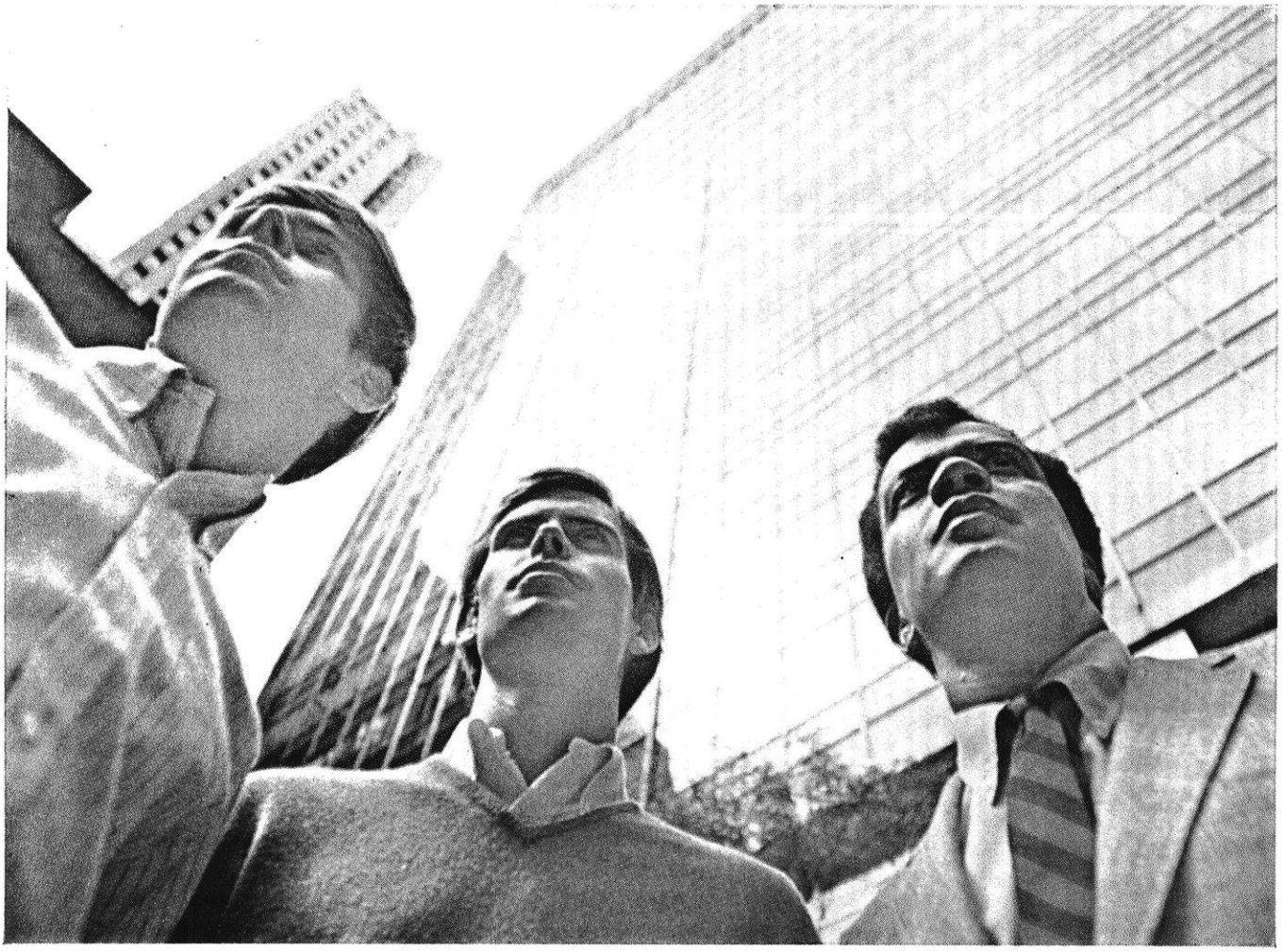

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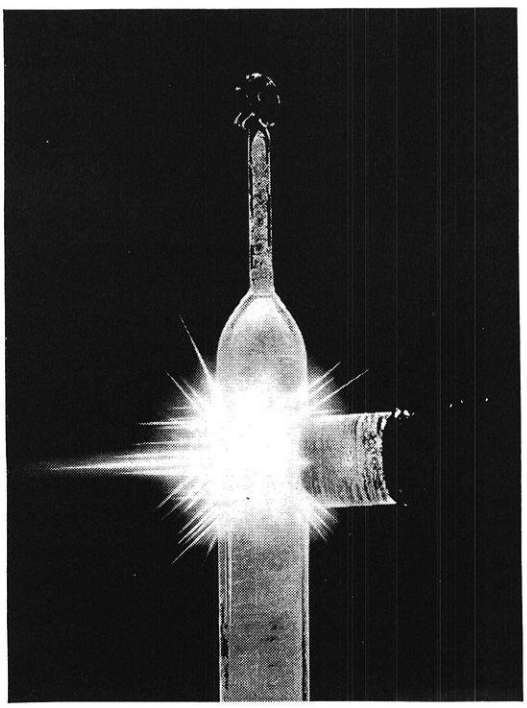
This intriguing state of affairs came about after physicists began firing photons into molecular crystals and observing the results. Which were: "excitons."

An exciton is a conceptual entity that has more "stateness" than "thingness" about it. When a photon strikes a molecule in an organic crystal with sufficient energy, it bumps an electron to a higher energy level, leaving a "hole" in the molecule. In the brief interval before it falls back into its hole, the electron releases the energy it received from the photon, which propagates another hole-electron pair in a neighboring molecule, and thus on through the crystal.

This phenomenon is called the "singlet" excited state: or the singlet exciton. Du Pont scientists have produced it with a 150-watt bulb. In the singlet, an electron is excited without any change in direction of its spin or magnetic moment. It dies quickly, and a blue light emerges from the crystal. But with an intense light source, such as the laser, an even more interesting excited state has been produced: the "triplet."

In the triplet, the spin of the excited electron is reversed, a magnetic field is produced, and the excited state lasts a million times as long—about a hundredth of a second. Du Pont researchers have also found that two triplets can combine, producing a singlet exciton with greatly increased energy and a life span of a hundred millionth of a second. Of promising interest is that this tendency of triplets to merge can be sensitively controlled by applying a magnetic field to the crystal.



Crystalline organic material in a sealed glass tube is illuminated by a filtered light source from the left, producing "excitons" in the material.

Perhaps the next step will be the engineering of devices that manipulate light signals directly, bypassing the present need to convert them first into electrical signals and then back into light. Perhaps too this line of research will lead to greater understanding of the mechanisms of light-energy transfer itself, such as those involved in photosynthesis by living plants. The possibilities are many.

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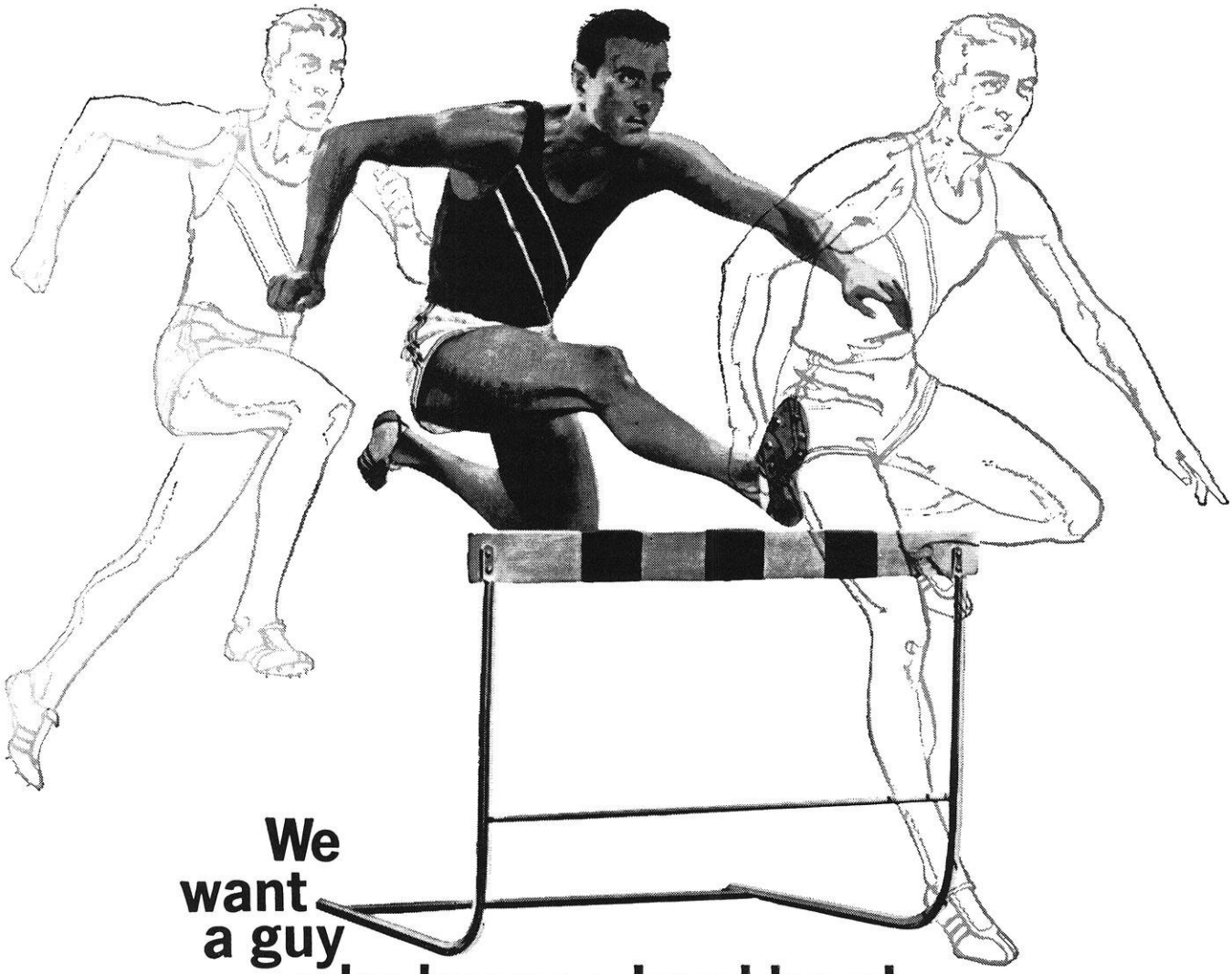
Chairman: Prof. Gordon Smith, School of Industrial Engineering, Oklahoma State University, Stillwater, Oklahoma 74074.
Publishers Representatives: Littell–Murray–Barnhall, Inc., 369 Lexington Avenue, New York, New York 10017.

Second Class Postage Paid at Madison, Wisconsin, under the Act of March 3, 1879. Acceptance for mailing at a special rate of postage provided for in Section 1103, Act. of Oct. 3, 1917, authorized Oct. 21, 1918.
Published monthly from October to May inclusive by the Wisconsin Engineering Journal Assn., 308 Mechanical Engineering Bldg., Madison, Wis. 53706. Office Phone (608) 262-3494.



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Editorial —

Happy Holidays

Happy Holidays. That's the password from Thanksgiving to mid-January. These are the Holidays, let us rejoice. A time of giving, a time of prayer, a time of thanks. And a time of retrospect.

Was it a good or bad year? Since these are the Holidays, we look only at the good — we must be happy — and decide, yes, it has been a good year. Grades weren't bad. Dad made that big killing in the market, Mom was elected president of the PTA, and Sis, God is she growing up fast. It feels good to be alive, to be living, and to be able to live. I am a middle class American and I am happy.

Yes, in retrospect, it was a good year. It was a good year because your chick wasn't pregnant after all, or because the abortion came off well. (A lotta bread, but Dad was good about it.) It was a good year because maybe you had some of the best acid ever. And it was a good year because your number was 311.

And that's how Americans look at themselves during the Holidays. At least most of them. A majority of people in this country (the silent Americans?) just plainly don't face reality. Americans have the greatest quality known to human psychology. They are forgetful. To them, from us, just a reminder:

plastic culture
plastic food
plastic flowers
plastic people
Muzak
Hollywood
hero-worship
television
Beverly Hillbillies
Lawrence Welk
Billy Graham
Art Linkletter
mediocrity
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media
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fans
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pigs
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hate
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Supreme Court
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frigidity
no babies
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starving babies
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barbarians
My Lai
GI Joe
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Company Commander "Mad Dog" Medina
Colonel Frank Barker
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The Silent Majority
following orders
getting by
security
insurance
big money
big house
big car
Cadillac
cardiac
tension
daily routine
escape
alcohol
evasion
apathy
rejection
alienation
confrontation
escape
drugs
evasion
draft
winds of change
suburbia
no change
stagnation
traditions
regulations
rules
roles
status
superiority
inferiority
private property
property rights
human rights
ghettoes
rat bites
stilettos
street fights
priorities
moon rocks
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ABM
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Sanguine
pentagon
Military-Industrial Complex
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corporate-economic elites
bureaucracies
money
influence
power
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overconsumption
inflation
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Madison Avenue
Wall Street
dead ends
capitalism
Das Kapital
suppression
struggle
Groppi
the capitol
welfare
black people
Mississippi Delta
warfare
yellow people
Mekong Delta
napalm
defoliation
balance of nature
ecology
DDT
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food additives
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bleached flour
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W. Thomas Lamm
Jerry Gottsacker

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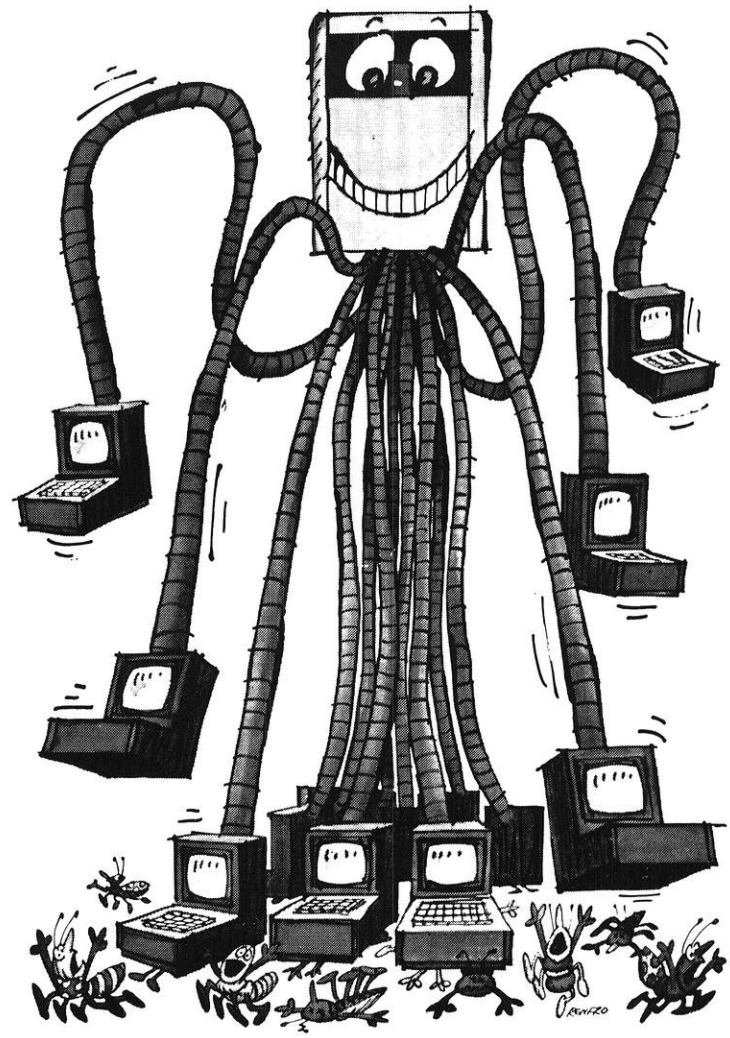

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WHAT WE MUST DO

A large-scale mobilization of scientists may be the only way to solve our crisis problems.

(Editor's Note: Dr. Platt is a research biophysicist and Associate Director of the Mental Health Research Institute at The University of Michigan, Ann Arbor, Michigan. The article first appeared nationally in the November 28, 1969 issue of **Science Magazine**.*).*

BY JOHN PLATT

There is only one crisis in the world. It is the crisis of transformation. The trouble is that it is now coming upon us as a storm of crisis problems from every direction. But if we look quantitatively at the course of our changes in this century, we can see immediately why the problems are building up so rapidly at this time. We will see that it has now become urgent for us to mobilize all our intelligence to solve these problems if we are to keep from killing our selves in the next few years.

The essence of the matter is that the human race is on a steeply rising "S-curve" of change. It is undergoing a great historical transition to new levels of technological power all over the world. We all know about these changes, but we do not often stop to realize how large they are in orders of magnitude, or how rapid and enormous compared to all previous changes in history. In the last century, we have increased our speeds of communication by a factor of 10 ; our speeds of travel by 10 ; our speeds of data handling by 10^6; our energy resources by 10^3; our power of wea-

pons by 10^6; our ability to control diseases by something like 10^2; and our rate of population growth to 10^3 times what it was a few thousand years ago.

Could anyone suppose that human relations around the world would not be affected to their very roots by such changes? Within just the last 25 years, the Western world has moved into an age of jet planes, missiles and satellites, nuclear power and nuclear terror. We have acquired computers and automation, a service and leisure economy, superhighways, superagriculture, supermedicine, mass higher education, universal TV, oral contraceptives, environmental pollution and urban crises. The rest of the world is also moving rapidly and may catch up with all these powers and problems within a very short time. It is hardly surprising that young people under 30, who have grown up familiar with these things from childhood, have developed very different expectations and concerns from the older generation that grew up in another world.

What many people do not realize is that many of these technological changes are now approaching certain natural limits. The "S-curve" is beginning to level off. We may never have faster communications or more TV or larger weapons or a higher level of danger than we have now. This means that if we could learn how to manage these new powers and problems in the next few years without killing ourselves by our obsolete structures and behavior, we might be able to create new and more effective social structures that would last for many generations. We might be able to move into that new world of abundance and diversity and well-being for all mankind which technology has now made possible.

The trouble is that we may not survive these next few years. The human race today is like a rocket on a launching pad. We have been building up to this moment of take-off for a long time, and if we can get safely through the take-off period, we may fly on a new and exciting course for a long time to come. But at this moment, as the powerful new engines are fired, their thrust and roar shakes and stresses every part of the ship and may cause the whole thing to blow up before we can steer it on its way. Our problem today is to harness and direct these tremendous new forces through this dangerous transition period to the new world instead of to destruction. But unless we can do this, the rapidly increasing strains and crises of the next decade may kill us all. They will make the last 20 years look like a peaceful interlude.

The Next Ten Years

Several types of crisis may reach explosion-point in the next 10 years: nuclear escalation, famine, participatory crises, race crises, and what have been called the crises of administrative legitimacy. It is worth singling out two or three of these to see how imminent and dangerous they are, so that we can fully realize how very little time we have for preventing or controlling them.

Take the problem of nuclear war, for example. A few years ago, Leo Szilard estimated the "half-life" of the human race with respect to nuclear escalation as being between 10 and 20 years. His reasoning then is still valid now. As long as we continue to have no adequate stabilizing peace-keeping structures for the world, we continue to live under the daily threat not only of local wars but of nuclear escalation with overkill and megatonnage enough to destroy all life on earth. Every year or two there is a confrontation between nuclear powers – Korea, Laos, Berlin, Suez, Quemoy, Cuba, Vietnam, and the rest. MacArthur wanted to use nuclear weapons in Korea; and in the Cuban missile crisis, John Kennedy is said to have estimated the probability of a nuclear exchange as about 25 percent.

The danger is not so much that of the unexpected, such as a radar error or even a new nuclear dictator, as it is that our present systems will work exactly as planned! – from border testing and strategic gambles and threat and counter-threat, all the way up to that "second-strike capability" that is already aimed, armed and triggered to wipe our hundreds of millions of people in a 3-hour duel!

What is the probability of this in the average incident? 10 percent? 5 percent? There is no average incident. But it is easy to see that five or ten more such confrontations in this game of "nuclear roulette" might indeed give us only a 50-50 chance of living until 1980 or 1990. This is a shorter life expectancy than people have ever had in the world before. All our medical increases in length of life are meaningless, as long as our nuclear lifetime is so short.

Many agricultural experts also think that within this next decade the great famines will begin, with deaths that may reach 100 million people in densely populated countries like India and China. Some contradict this, claiming that the remarkable new grains and new agricultural methods introduced in the last three years in Southeast Asia may now be able to keep the food supply ahead of population growth. But others think that the reeducation of farmers and consumers to use the new grains cannot proceed fast enough to make a difference.

But if famine does come, it is clear that it will be catastrophic. Besides the direct human suffering it will further increase our international instabilities, with food riots, troops called out, governments falling, and international interventions that will change the whole political map of the world. It could make Vietnam look like a popgun.

In addition, the next decade is likely to see continued crises of legitimacy of all our overloaded administrations, from universities and unions to cities and national governments. Everywhere there is protest and refusal to accept the solutions handed down by some central elite. Student revolutions circle the globe. Suburbs protest as well as ghettoes, Right as well as Left. There are many new sources of collision and protest, but it is clear that the general problem is in large part structural rather than political. Traditional methods of election and management no longer give administrations the skill and capacity they need to handle their complex new burdens and decisions. They become swollen, unresponsive, and repudiated. Every day now some distinguished administrator is pressured out of office by protesting constituents.

In spite of the violence of some of these confrontations, this may seem like a trivial problem compared to war or famine – until we realize the dangerous effects of these instabilities on the stability of the whole system. In a nuclear crisis or in any of our other crises today, administrators or negotiators may often work out some basis of agreement between conflicting groups, or nations, only to find themselves rejected by their people on one or both sides, who are then left with no mechanism except to escalate their battles further.

The Crisis of Crises

What finally makes all of our crises still more dangerous is that they are now coming on top of each other. Most administrations are able to endure or even enjoy an occasional crisis, with everyone working late together and getting a new sense of importance and unity. What they are not prepared to deal with is multiple crises, a crisis of crises all at one time. This is what happened in New York City in 1968 when the Ocean Hill-Brownsville teacher and race strike was combined with a police strike, on top of a garbage strike, on top of a longshoremen's strike, all within a few days of each other.

When something like this happens, the staffs get jumpy with smoke and coffee and alcohol, the mediators become exhausted, and the administrators find themselves running two crises behind. Every problem may escalate because those involved no longer have time to think straight. What would have happened in the Cuban missile crisis if the East Coast power blackout had occurred by accident that same day? Or if the "hot line" between Washington and Moscow had gone dead? There might have been hours of misinterpretation, and some fatally different decisions.

I think this multiplication of domestic and international crises today will shorten that short half-life. In the continued absence of better ways of heading off these multiple crises, our half-life may no longer be 10 or 20 years, but more like 5 to 10 years, or less. We may have even less than a 50-50 chance of living until 1980.

This statement may seem uncertain and excessively dramatic. But is there any scientist who would make a much more optimistic estimate after considering all the different sources of danger and how they are increasing? The shortness of the time is due to the exponential and multiplying character of our problems and not to what particular numbers or guesses we put in. Anyone who feels more hopeful about getting past the nightmares of the 1970's has only to look beyond them to the monsters of pollution and population rising up in the 1980's and 1990's. Whether we have 10 years or more like 20 or 30, unless we systematically find new large-scale solutions, we are in the gravest danger of destroying our society, our world, and ourselves in any of a number of different ways well before the end of this century. Many futurologists who have predicted what the world will be like in the year 2000 have neglected to tell us that.

But the real reason for trying to make rational estimates of these deadlines is not because of their shock value but because they give us at least a rough idea of how much time we may have for finding and mounting some large-scale solutions. The time is short but, as we shall see, it is not too short to give us a chance that something can be done, if we begin immediately.

From this point, there is no place to go but up. Human predictions are always conditional. The future always depends on what we do and can be made worse or better by stupid or intelligent action. To change our earlier analogy, today we are like men coming out of a coal mine who suddenly begin to hear the rock rumbling, but who have also begun to see a little square of light at the end of the tunnel. Against this background, I am an optimist – in that I want to insist that there is a square of light and that it is worth trying to get to. I think what we must do is to start running as fast as possible toward that light, working to increase the probability of our survival through the next decade by some measurable amount.

For the light at the end of the tunnel is very bright indeed. If we can only devise new mechanisms to help us survive this round of terrible crises, we have a chance of moving into a new world of incredible potentialities for all mankind. But if we cannot get through this next decade, we may never reach it.

Task Forces for Social Research and Development

What can we do? I think that nothing less than the application of the full intelligence of our society is likely to be adequate. These problems will require the humane and constructive efforts of everyone involved. But I think they will also require something very similar to the mobilization of scientists for solving crisis problems in wartime. I believe we are going to need large numbers of scientists forming something like research teams or task forces for social research and development. We will need full-time interdisciplinary teams combining men of different specialties, natural scientists, social scientists, doctors, engineers, teachers, lawyers, and many other trained and inventive minds. Such groups could begin to put together our stores of knowledge and powerful new ideas into improved technical methods, organizational designs or "social inventions" that have a chance of being adopted soon enough and widely enough to be effective. Even a great mobilization of scientists may not be enough. There is no guarantee that these problems can be solved, or solved in time, no matter what we do. But for problems of this scale and urgency, this kind of focusing of our brains and knowledge may be the only chance we have.

Scientists, of course, are not the only ones who can make contributions. Millions of citizens, business and labor leaders, city and government officials, and workers in existing agencies, are already doing all they can to solve these problems. No scientific innovation will be effective without extensive advice and help from all these groups.

But it is the new science and technology that have made our problems so immense and intractable. Technology did not create human con-

flicts and inequities, but it has made them unendurable. And where science and technology have expanded the problems in this way, *it* may be only more scientific understanding and better technology that can carry us past them. The cure for the pollution of the rivers by polluting detergents is non-polluting detergents. The cure for bad management designs is better management designs.

Also, in many of these areas, there are few people outside the research community who have the basic knowledge necessary for radically new solutions. In our great biological problems, it is the new ideas from cell biology and ecology that may be crucial. In our social-organizational problems, it may be the new theories of organization and management and behavior theory and game theory that offer the only hope. Scientific research and development groups of some kind may be the only effective mechanism by which many of these new ideas can be converted into practical invention and action.

The time-scale on which such task forces would have to operate is very different from what is usual in science. In the past, most scientists have tended to work on something like a 30-year time-scale, hoping that their careful studies would fit into some great intellectual synthesis that might be years away. Of course when they become politically concerned, they begin to work on something more like a 3-month time-scale, collecting signatures or trying to persuade the government to start or stop some program.

But 30 years is too long, and 3 months is too short, to cope with the major crises that might destroy us in the next 10 years. Our urgent problems now are more like wartime problems, where we need to work as rapidly as is consistent with large-scale effectiveness. We need to think rather in terms of a 3-year time-scale – or more broadly, a 1-to-5 year time scale. In World War II, the ten thousand scientists who were mobilized for war research knew they did not have 30 years, or even 10 years, to come up with answers. But they did have time for the new research design and construction that brought sonar and radar and atomic energy to operational effectiveness within 1 to 4 years. Today we need the same large-scale mobilization for innovation and action and the same sense of constructive urgency.

Priorities: A Crisis Intensity Chart

In any such enterprise, it is most important to be clear about which problems are the real priority problems. To get this straight, it is valuable to try to separate the different problem areas according to some measures of their magnitude and urgency. A possible classification of this kind is shown in Tables 1 and 2. In these Tables, I have tried to rank a number of present or potential problems or crises, vertically, according to an estimate of their order of intensity or "seriousness"; and horizontally, by a rough estimate of their time to reach climactic importance. Table 1 is such a classification for the United States for the next 1-5 years, the next 5-20 years, and the next 20-50 years. Table 2 is a similar classification for world problems and crises.

The successive rows indicate something like order-of-magnitude differences in crisis intensity, as estimated by a rough product of the size of population that might be hurt or affected, times some estimated average effect in the disruption of their lives. Thus the top row corresponds to total or near-total annihilation, the second row to great destruction or change affecting everybody, the third row to a lower tension affecting a smaller part of the population or a smaller part of everyone's life, and so on.

Informed men might easily disagree about one row up or down in intensity, or one column left or right in the time-scales, but these order-of-magnitude differences are already so great that it would be surprising to find much larger disagreements. Clearly an important initial step in any serious problem study would be to refine such estimates.

In both Tables, the one crisis that must be ranked at the top in total danger and imminence is, of course, the danger of large-scale or total annihilation by nuclear escalation or by radiological-chemical-biological warfare (RCBW). This kind of crisis will continue through both the 1-5 year time period and the 5-20 year period as Crisis Number 1, unless and until we get a safer peace-keeping arrangement. But in the 20-50 year column, following the reasoning already given, I think we must simply put a big "X" at this level, on the grounds that the peace-keeping stabilization problem will either be solved by that time or we will probably be dead.

At the second level, the 1-5 year period may not be a period of great destruction (except nuclear) in either the U. S. or the world. But the problems at this level are building up and within the 5-20 year period, many scientists fear the destruction of our whole biological and ecological balance in the U. S. by mismanagement or pollution. Others fear political catastrophe within this period, as a result of participatory confrontations or backlash or even dictatorship, if our divisive social and structural problems are not solved before that time.

On a world scale in this period, famine and ecological catastrophe head the list of destructive problems. We will come back later to the items in the 20-50 year column.

The third level of crisis problems in the U. S. includes the problems that are already upon us: administrative management of communities and cities, slums, participatory democracy, and race conflict. In the 5-20 year period, the problems of pollution and poverty or major failures of law and justice could escalate to this level of tension if they are not solved. The last column is left blank because secondary events and second-order effects will interfere seriously with any attempt to make longer-range predictions at these lower levels.

The items in the lower part of the Tables are not intended to be exhaustive. Some are common headline problems which are included simply to show how they might rank quantitatively in this kind of comparison. Anyone concerned with any of them will find it a useful exercise to estimate for himself their order of seriousness, in terms of the number of people they actually affect and the average distress they cause. Transportation problems and neighborhood ugliness, for example, are listed as Grade 4 problems in the U. S. because they depress the lives of tens of millions for one or two hours every day. Violent crime may affect a corresponding number every year or two. These evils are not negligible, and they are worth the efforts of enormous numbers of people to cure them and to keep them cured – but they will not destroy our society either.

(Continued on Page 28)

William Randolph Hearst, founder of the Hearst Press, is famed for having used sensational journalism to expose the evils of his day.

His spirit is here reborn to decry

The Evils of Apple Pie

W. THOMAS LAMM

In 1965, Dr. S.C. Gilfillan of Santa Monica, California offered a new explanation for the decline of the Roman Empire based not on historical or philosophical speculation, but on the sciences of toxicology, vital statistics, and archaeology, plus such concrete evidence as old Roman recipes, old bones, and lead lined pots for brewing.

His explanation goes as follows: 1) Roman culture declined and lost progressiveness, except in technology. 2) Rome's cultural progress, except in technology, depended upon the upper class. 3) The Roman upper class beginning about the second or first century B.C., died out with extreme rapidity, each generation being perhaps a fourth of the previous one, largely from rearing few children. 4) Wine, grape syrup, and preserved fruit, delicacies of the Roman upper-class diet, were prepared and served in lead-lined pots. 5) In women, lead poisoning produces sterility, miscarriage, stillbirth, heavy child mortality; it brings permanent mental impairment in children. 6) The Roman free poor and the slaves had much less lead in their diet. They must have maintained their number without much decline, because the Roman population as a whole did. Technical invention was confined to the artisan class, so invention continued.

In short, Roman culture lost its source of progress because its elite, endowed by heredity and/or upbringing with the powers to make or

mate with money, was exterminated by various factors, above all by lead in the diet of the upper class women.

History may well be repeating itself, the people of the American Empire are today feeding on a poison diet. It is too sophisticated for lead-poisoning, it prefers food processing agents, preservatives, sweeteners, dyes, flavorings, and pesticides to pervert nearly all food consumed today. Compound this situation with the existence of an incredible imbalance in the nation's diet, resulting from gross overconsumption of fats and carbohydrates (the proportion of fat in the diet has risen from 25% in 1900 to more than 40% today, and the per capita consumption of refined sugar, the principle source of carbohydrates, is ten times what it was a hundred years ago.)

Today, as in Roman times, the elites (political and economic) still support the progress of culture. The middle class (then the artisan class) still create the technology, but today the elites control it, and it is their decision to what ends it is to serve. This presents a sad state of affairs because the economic elite consistently serves first its own interests, and the political elite consistently collaborates with it instead of acting as a source of responsibility towards the people.

The political elite also neglects the people in preference to pursuing a morally and intellectually bankrupt foreign policy and presenting the masses with technological bread-and-circuses in the form of spectacular space endeavors. These ventures, aside from being regrettable in themselves, pose a direct threat to the nation's health. The president of the American Heart Association recently declared that "It is incredible that we should be more interested in the conquest of space than the conquest of disease. I shudder to anticipate what will happen to health research and services if we decide to land on Mars." He also said that "extraordinary cuts in the national health budget" have resulted from a combination of spending for the Vietnam war and the space program and from what he termed rising inflation.

Technology put America on the moon and has revolutionized the art of war. Technology has in fact created a new world, and with it a new set of social and environmental ills. It is creating tremendous new problems while slowly solving the old ones.

The technology of food production is no exception. America has developed the means to produce and transport vast quantities of food to feed our predominately urban population, but in the process has changed the character of many foods beyond recognition, and made their nutritional value of little or no significance. A nutritional therapist by the name of L. Stambovsly states that "only a third of the average person's caloric intake consists of foods capable of providing a measure of essential vitamin and mineral substances." He comments further that in the one-third of the day's caloric intake just referred to, more than half of the vital nutritional value will have been destroyed or lost by heat, in washing, in storage, cooking, or by the factory and field manipulations to which modern foods are subject. If America isn't poisoned first, the **lack** of essential nutrients in the diet may make it the first nation to starve on a full stomach. The adulteration and contamination of food is dangerous enough; the gross imbalance of types of food consumed compounds the problem.

But those who feed us say that we've never had it so good. They point to all the big, strong bodies walking around today. Big bodies don't necessarily mean healthy bodies, our health is in fact declining. Life expectancy for the American male has dropped from 11th place in 1949 to 37th in 1966. Dr. Franklin Bicknell, a noted British physician, writes that "Americans consume more chemicals in their food than any other nation. At the same time American forecasts are the gloomiest in the world about the continued rise of cancer, high blood pressure, heart disease, congenital abnormalities, etc. – in fact all the degenerative diseases. The United States leads the civilized world in chemicalized food and in degenerative diseases."

The movement towards chemicalized food has gone too far too fast. The research on the safety of chemical additives has been done after, rather than before, their adoption by industry. Scores of long-accepted additives and contaminants have been found to be poisonous and a few even to be sources of cancer. The American people have become human guinea pigs, upon whom some experiments succeed, and many others fail. The question of the singular and collective effects of all the additives and contaminants in the food supply has **not** been answered. It is a most vital question that must be answered.

But clear perception is needed to answer questions, and America's perception is clouded with myth. The nation's myths are manifested in symbols like The Flag, Motherhood, and Apple Pie, which are supposed to provide security, ideals of virtue and life, and nourishment. Do they?

Consider the Flag. Myopic minds, enmeshed in the machinations of their psychic phobias, spend over half the national budget for security, all the time leaving the people to feel very insecure with nuclear terror politics and the horrors of Vietnam. As for Motherhood, the world is getting too much of a good thing.

Motherhood is the fuse of the fast-descending population bomb. It is hard to relate ideals of virtue and life to the fact that this year alone at least three and one-half million people will starve to death, mostly children.

At this point in the story one might expect to find a whole list of horrendous crimes concealed within the All-American Favorite: Apple Pie. A crime requires a judge. Before reaching a verdict the judge must first examine the evidence. Examine first the main defendant: the apple.

Snow White's poison fruit would run into stiff competition here. The apple of today contains several or possibly all of the following pesticides: chlordane, demeton, DDT, dinitro-orthocresol, benzene hexachloride, lead arsenate, lindane, malathion, methoxychlor, nicotine, and parathion. And this is no fairy tale. The harsh reality of these poisons' toxic effects on the human system is becoming clearer all the time. What are some of their properties and powers?

Housewives make a careful practice of washing their fruits before preparing them for the table. It does little good. DDT and other new poisons in use today won't wash off. They not only stay on the skin of the fruit but penetrate into the fruit itself.

Once DDT gets into the system, it accumulates in body fat. DDT does not pass quickly through an organism as one might expect. Each time it is ingested more is added to the existing amount. The amount of DDT stored in body fat is measured in parts per million (ppm), with one ppm equalling about one teaspoonful of DDT in ten tons of food. Food and Drug Administration tests show that rats fed five ppm of DDT suffer liver injury. A May 1969 National Cancer Institute report declared that DDT added to the diet of mice quadrupled the frequency of tumors of the liver, lungs, and lymphoid organs.

The Public Health Service estimate of ppm of DDT in human body fat is about 5 ppm. Other, more objective, investigators believe it to be closer to 9 ppm and rising steadily. What are the implications of DDT in the human system? Various researchers claim that DDT and solutions that carry it in sprays contribute to causes of leukemia, aplastic anemia, hepatitus, Hodgkin's disease, and jaundice. Others hold that it destroys vitamins and inhibits the body's delicate enzyme systems and is connected with the phenomenal rise in liver ailments in recent years. Studies by the University of Miami School of Medicine found that human cancer victims had more than twice as much DDT in their fat than did victims of accidental death.

Chlordane is a chemical relative of DDT, and four times as toxic. The FDA found that pigeons could not survive in a room treated with chlordane, even after it was thoroughly scrubbed with alkali and aired for several weeks.

Benzene hexachloride (BHC), another relative of DDT, has been found by government researchers to be in the brain tissues of laboratory animals and producing abnormal cancerlike cell growth elsewhere. Testimony given to the FDA pointed out that BHC destroys an important vitamin, inositol, which has perhaps a more beneficial effect in preventing hardening of the arteries than other substance. BHC is so stable that it retains up to half its original strength in the soil after three years. Both BHC and chlordane have been found to be active in soil twelve years after application. These poisons will, quite literally, live on in the minds and hearts of Americans everywhere.

DDT's other chemical relatives found on the apple include: dieldrin (considered twenty times more poisonous than DDT), methoxychlor (with possible cancer producing properties similiar to DDT), and lindane.

The apple's accomplices include: butter or margarine, bleached flour, salt, and white refined sugar. What manner of food are they?

Butter contains the following additives and contaminants: nordihydroguaiaretic acid (antioxident), oxidation products from interaction with hydrogen peroxide (bleach), magnesium oxide (neutralizer), AB and OB Yellow (coal-tar dyes), diacetyl (artificial aromatic agent), and in three out of four cases, DDT and related compounds. The coal-tar dyes deserve comment because of the great controversy surrounding them.

Much speculation has arisen concerning the alleged carcinogenic properties of Yellow AB and Yellow OB. A carcinogen is any substance that causes cancer in man. Yellow AB and Yellow OB are made from a potent carcinogen called beta-naphthylamine, which has caused bladder cancer in animals and man. It is feared that when dyes containing beta-naphthylamine are ingested and broken down in the body, the carcinogenic capacity is restored to the chemical. Besides the fact that these dyes are potential causes of cancer, they add nothing to the nutritive value of the butter. It seems that an undue risk is being taken for the sake of a little color.

These same two dyes are used widely in the preparation of margarine. In addition, margarine contains mono- and diglycerides, isoproplyl citrate, and, as in butter, DDT and related pesticides.

Bleached flour is laced with a host of chemicals. In the milling process it is treated with oxidizing agents such as: persulfate, bromate, iodate and nitrogen trichloride. Bleaching agents

include: oxides of nitrogen, chlorine, benzoyl peroxide, and mineral salts. Cyanide may be present as a result of its employment in fumigation of flour in storage. Water used in the production of flour may be chemically purified by means of alum, soda ash, copper sulfate, and chlorine.

The additives of table salt are: calcium hydroxide (stabilizer), potassium iodide (nutrient supplement), and calcium silicate (anticaking agent).

One-half to three-fourths of a cup of sugar is an ingredient in the average apple pie. This makes it an accomplice to one of the great scourges of American health: The Sweet-tooth. Aided by a deceptive propaganda campaign based on the virtues of sugar, its use has risen phenomenally.

The myth extolling sugar as a "quick-energy food" is pure fraud. "Concentrated sugar," writes Consumer Bulletin, "not only impairs the appetite for necessary foods, but displaces some of the vitamin and mineral rich foods in the diet." It also states that "sugar, though attractive in flavor, and a cheap source of calories, brings about a basic inbalance in the diet, which makes it impossible to provide for most people to get the foods that are needed for good health and for strong and healthy teeth." Refined sugar supplies no vitamins, minerals, or proteins and requires greater expenditure of body energy to utilize it than the energy it produces. The ill effects of the over-use of refined sugar are staggering. For example, concerning dental hygiene, it is estimated that there is a backlog of over half a billion cavities in America today. The nation's teeth never were in that condition. (In World War I, Army dentists made practically no dentures. During World War II, in one month alone, Army dentists made 102,000.)

Nothing is being done to educate the people of the dangers of refined sugar, and no governmental pressure is being exerted to help curb its consumption. The Sugar Research Foundation urges manufacturers to increase considerably the use of sugar "to gain maximum consumer acceptance." Manufacturers may be expected to do just this, their concern is not with providing the minimum amount that is best for health, but rather with the amount that will produce the best sales appeal and thusly, the highest profits. Government agencies don't issue warnings concerning sugar because influential commercial interests are involved. Instead another poison is forced on the people.

That poison is sodium fluoride, whose toxic side effects are vague, especially for persons with metabolic ailments. Thusly, a person with such a sickness may be forced to suffer further for the Common Good, pointing to a growing situation in which a person is put in a hazardous position unless he conforms biologically to the rest of society. It was bad enough when he had only to conform culturally, politically, and intellectually.

Sugar gives a sweet taste, but in the long run leaves an incredibly bitter aftertaste. Sugar is the part of Apple Pie which is representative of the total case of nutritional perversion. Behind this dismal thought lies the afterthought: change is essential. Instead of closing the door on any and all contaminations of food, governmental agencies have opted to sustain a shameless policy which permits known poisons plus substances of questionable safety to enter the food supply. This situation must not prevail. The government should allow no adulterants of any kind where there is the slightest question of absolute safety for human consumption.

But change comes slowly in a topheavy bureaucracy, especially one in which money means power. Concerned citizens who protest government food policy are labeled as "food faddists" and "cultists." Their feeble cries fall on deaf ears, ears tuned only to the prattle of the food industry.

This situation was brought into painful clarity during the recent White House Conference of Food, Nutrition and Health. By the urgings of the Grocery Manufacturers Association, a conference panel on food safety junked several recommendations for new curbs on additives. James S. Turner, an associate of consumer advocate Ralph Nader, termed this action "a great disservice to the country." The discarded recommendations would bar any new additives from the market unless it had a "significantly less hazard" than the one it was to replace. A revised recommendation changed it to "no greater hazard" and then made the clause optional. Besides an admission that hazards do exist, the indication is that they will continue to exist. And the strength of the American people may cease to exist.

Man will one day trip over his ego and never get up again. He thinks he can flaunt the natural forces governing his physical self and his environment. He cannot. Alexis Carrol sums it up well:

> "We have not been capable of distinguishing the prohibited from the lawful. We have infringed natural laws. We have thus committed the supreme sin, the sin that is always punished. The dogmas of scientific religion and industrial morals have fallen under the onslaught of biological reality. Life always gives an identical answer when asked to trespass on forbidden ground. It weakens. And civilizations collapse."

[***]


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E DAY

by ROY JOHNSON

Following our great mentor's example of choosing to represent a "silent majority" (which a 1968 poll statistic might contradict), I would like to speak on behalf of another "silent majority," all those Americans under the age of 30. We are statistically significant, representing well over half of the United States population. Our common bond is the fact that we are all part of the same generation, the generation that will "inherit the earth."

Wisconsin Senator Nelson foresees us as "the real losers," for the planet we will "inherit" is what he calls "an ugly world in the near future, with dangerously and deadly polluted air and water; overcrowded development; festering mounds of debris; and an insufficient amount of open space to get away from it all." With all this impending upon us, why would our majority choose to be silent?

Many of us are not aware of the fact that such a debacle is in the forecast. Due to an abbreviated exposure to a small portion of the media, a portion that may deal only with "newsworthy" sensationalism, the creeping environmental miscalculations always seem to slip past. Left off the front pages and buried among the ads, eliminated from the five minute encapsulated "bubble gum music" news blurb, or conflicting with national television advertisers "interests," the ever ascending environmental ills are removed in favor of more "pressing problems." Only when it is too late does the national conscience awaken and mourn. (Tch, tch, tch, tch. Too bad about Lake Erie. I can remember when . . . .)

A large number of us realize that there are serious problems facing humanity, but due to life's heirarchy of priorities or a lack of similarly motivated individuals (in some cases just plain motivation), we have left the solutions to "someone more qualified, someone who can do something." Others, living in a stifled silence, have undergone the excruciating frustration of talking to a wall, which, in some extreme cases, has a piquing quality of smiling.

However there is hope for us "losers." A nationwide environmental teach-in is being scheduled for next April 22. The target of this teach-in is every campus in America with every college student participating. The purpose of the teach-in is to have a massive impact on the nation's environmental conscience with a subsequent arousal of public opinion concerning the many environmental ills. Senator Nelson conceived the idea. He is over 30 (can be trusted), labled us "losers" and now is trying to do something about it. (He is serving as a national co-chairman of the teach-in.)

There are a number of "wall talkers" coupled with some similarly motivated individuals who have rearranged priorities and are now trying to make the most of the coming "E" day on this campus. They're trying to find more grasshoppers to join the ant colony. They're working with members of the "other" generation, trying to initiate a city wide referendum; trying to help "our people" with a bad case of "media burn." They've got a lot of good ideas, but they need a body count.

Interested? Stop for information and/or volunteer your help in Room 1118 of the Space and Science Building (1225 W. Dayton St.) or call Roy Tull at 251-2348 or 241-1493.

We developed TV transmission. But a lot of engineers still don't get the picture.

Like, we'll ask a graduating engineer: "What opportunities do you think an engineer has if he works for the telephone company?"

And, zap—we get a blackout!

Well, we think the company responsible for engineering innovations such as the transistor, radio astronomy, high fidelity and stereo recording, magnetic tape, synthetic crystals, negative feedback, sound motion pictures, microwave relay, electronic switching, the solar battery and telstar deserves a consideration that's strong and clear.

When the Bell System recruiting team comes to your campus, be sure to talk to them. Or ask your Placement Director for the name of the Bell System recruiter at the local Bell Telephone Company, an equal opportunity employer.

We'll turn you on.

AT&T

Wisconsin Memorial UNION-SOUTH

MARJENE JONDROW

Behind the graffiti-ed fence across from the Engineering complex at South Randall and West Johnson streets, the $3.5 million, 102,000 square foot, Wisconsin Memorial Union-South is rising.

Not merely an extension of the Wisconsin Union down by the lake, the new Union will have an identity of its own, with programs planned for the University community by students who live on that end of the campus.

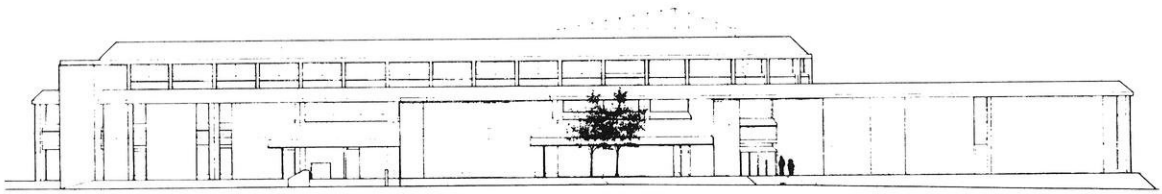
This doesn't mean, however, that it will be an "Engineering-Agriculture" Union. New buildings housing earth science, zoology, psychology, chemistry, and computer science departments are just a few blocks away. Within a few years, education, pharmacy and even a handful of Letters and Science departments may be neighbors.

The brown, brick-faced building was designed by Architects Weiler, Strang, McMullen, and Associates, Inc. to provide a multitude of different services, and recreational and educational facilities for persons of diverse interests and tastes.

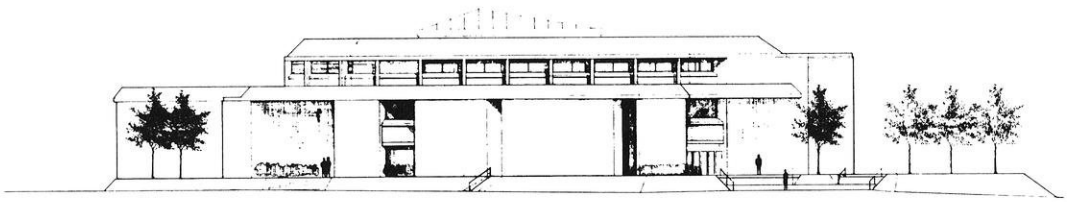
In the basement, bowlers, individuals or in leagues, will be able to roll the balls on eight lanes. There'll be 10 tables for billiards and 5 for table tennis buffs. And in a viewing room will be two color TV sets.

On the first floor, to create a warmer feeling on a cold day, will be a fireplace in the main lounge. Across the central area, past the light well which runs the four floors of the building and the main desk where magazines and newspapers will be

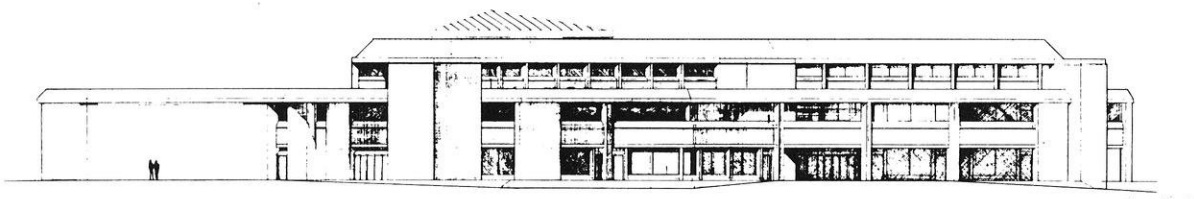
(Continued on Page 24)



Above is the Architect's drawing of the Johnson Street elevation.



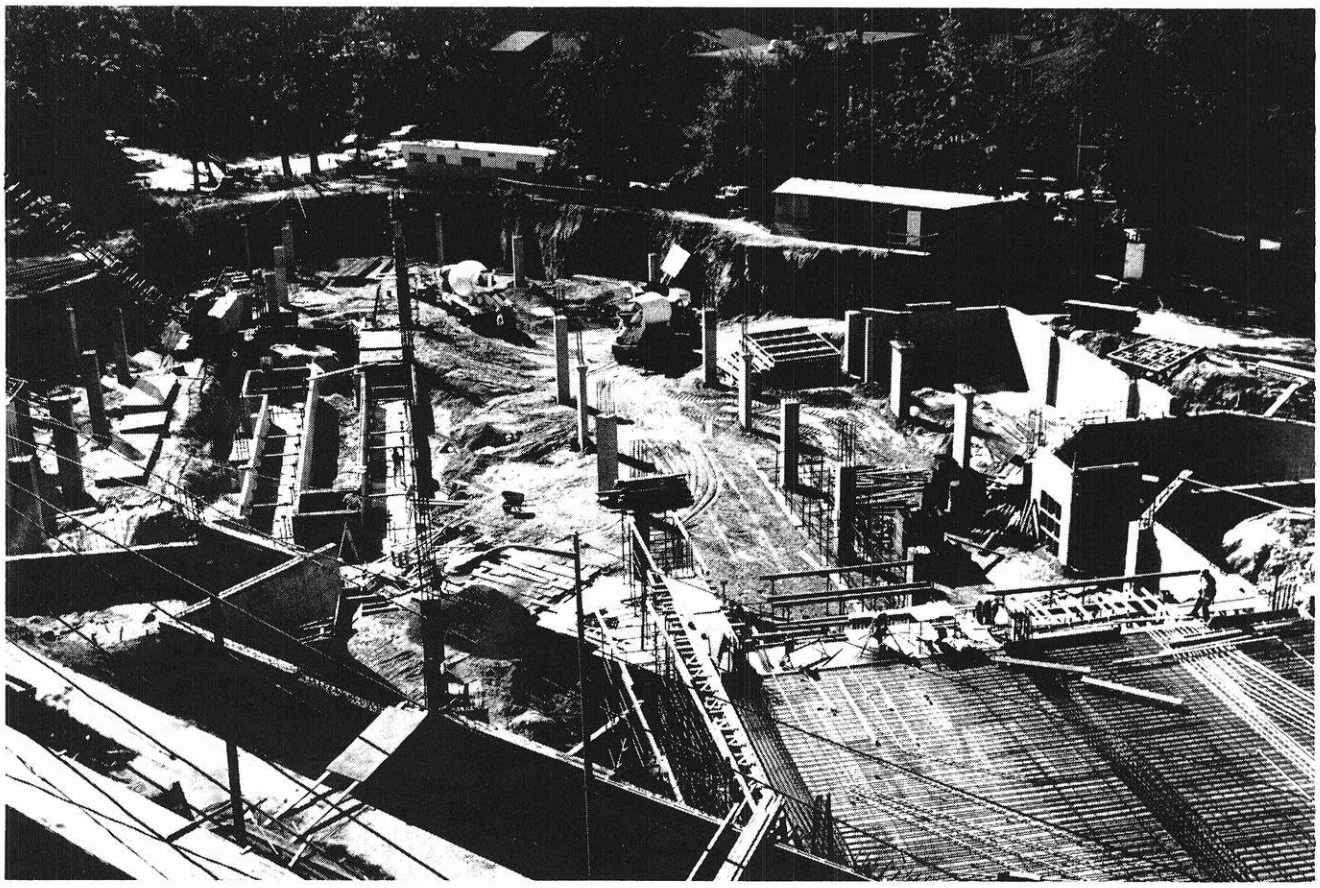
Above: Randall Avenue elevation



Above: West Dayton elevation

Above is an aerial view of the completed Union-South (Architect's model) from the corner of Randall and Dayton. The tree in the upper-left hand corner was hit by lightning.

Below is a photo taken of the site in July, 1960



"Union-South Will Be a

(Continued from Page 22)

available, is the assembly hall. There, 325 persons can meet for lectures, films, and parties – banquets can also be served.

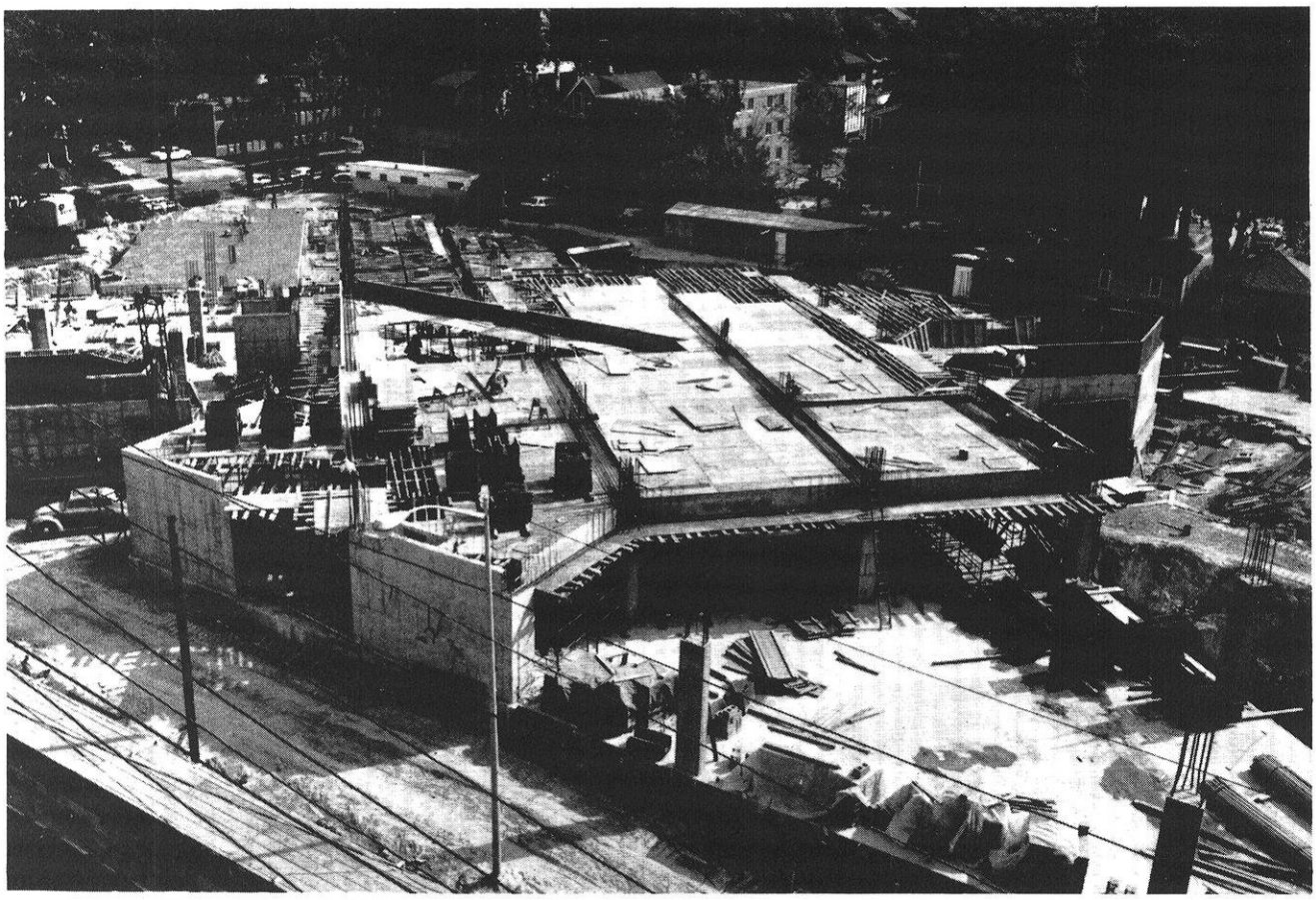
On the second floor, will be perhaps the most unusual new feature in a building full of them: the Kay-way wheel in the cafeteria serving area. Sixteen persons at a time can serve themselves from this large horizontal revolving wheel, 23 feet in diameter. About 240 degrees of it is on the cafeteria side of the wall, toward the diner, and the rest is in the adjacent kitchen where it is refilled as it moves. It is divided in six sections, alternating between hot foods with their heating units and cold salads and desserts on refrigerated areas. While the diner stands with his tray, the wheel turns, each section passing him in thirty seconds. So in a minute – or perhaps an extra half, allowing for second thoughts – the guest will be ready to eat.

In the music lounge, a listener will be able to dial his selections, choosing from the 100 sides available at any time in the record console, and settle himself in a comfortable chair to listen.

Among other areas with special uses will be a meeting room with a fully equipped kitchen where groups can prepare their own meals or refreshments, an arts and crafts workshop with hand tools and a darkroom, and 14 guest rooms for visitors to the campus. In fact, when school would not be in session, Union-South could provide complete facilities for a small conference of professionals.

Providing space where such dialogues-in-depth would be possible is one of the personal priorities

Construction progress as of September, 1969 is seen below.



Unifying Force on Campus"

of Merrill Sischo, assistant director of the Memorial Union who has been chosen to be Wisconsin Union-South's resident manager. He hopes that Union-South will be a unifying force on campus, providing the opportunities for persons in the various disciplines to get together, to penetrate the different assumptions, vocabularies, and techniques that separate, with a chance for better understanding.

But all this is still at least a year away. Meanwhile, students on the Wisconsin Union Special Services Committee who are interested in the Union-South are getting the word out to students and faculty on that end of the campus: the Union will be there for them. They are contacting organizations, visiting in apartments, dorms and cooperatives, finding out what programs the students there would like to have. They also are looking for a nucleus of creative, responsible, and interested students who can do the actual planning as the time draws near to open.

Faculty members also have had a part. Together with students, they make up the building committee, who determined what the new Union should contain.

Any who have suggestions about the Wisconsin Memorial Union-South are invited to get in touch with Howard Tolkan, chairman of the Union's Special Services committee, or with "Corky" Sischo, and pass along their ideas. Making the Union-South responsive to the needs and desires of faculty and students on that side of the campus is top priority.

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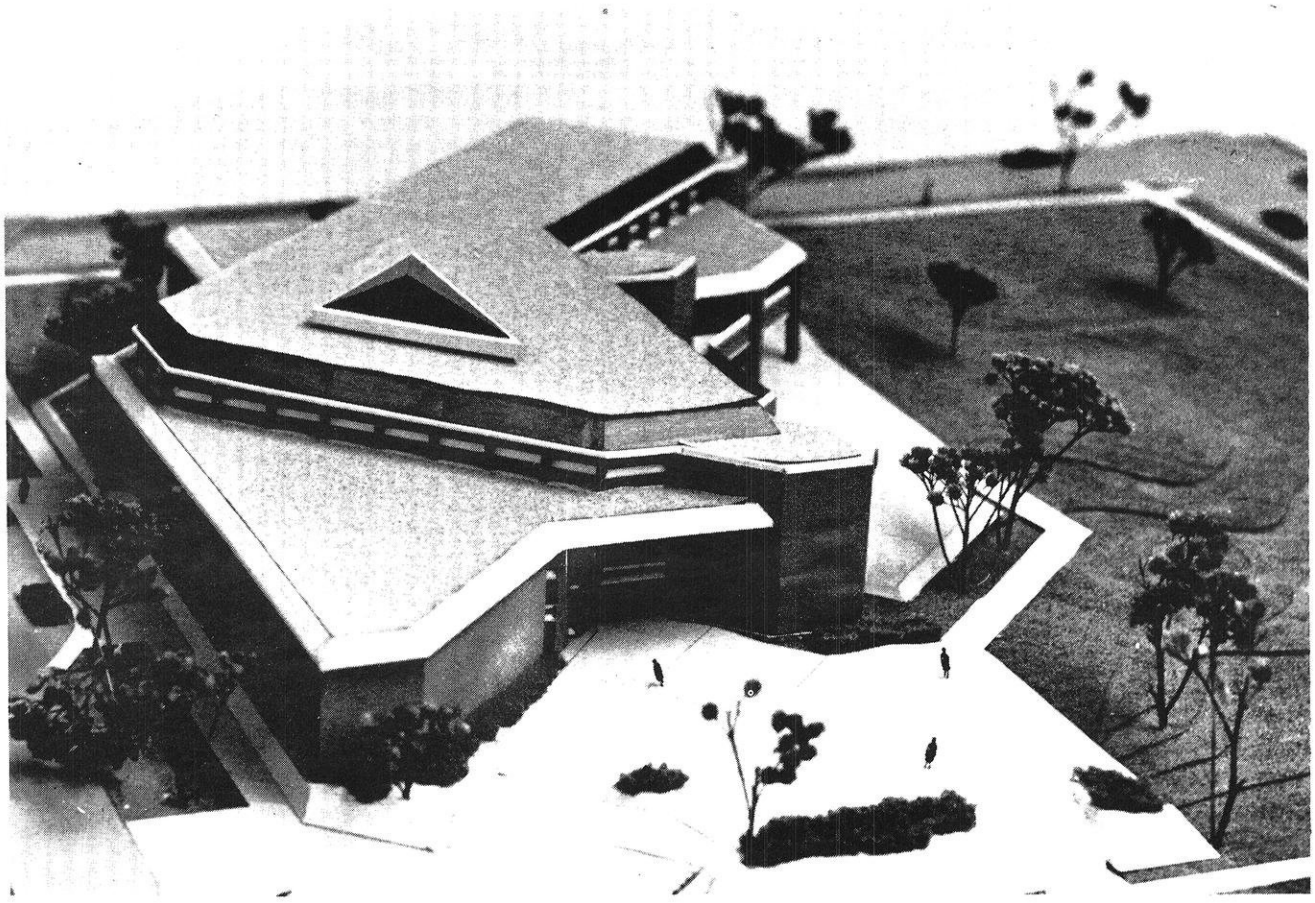
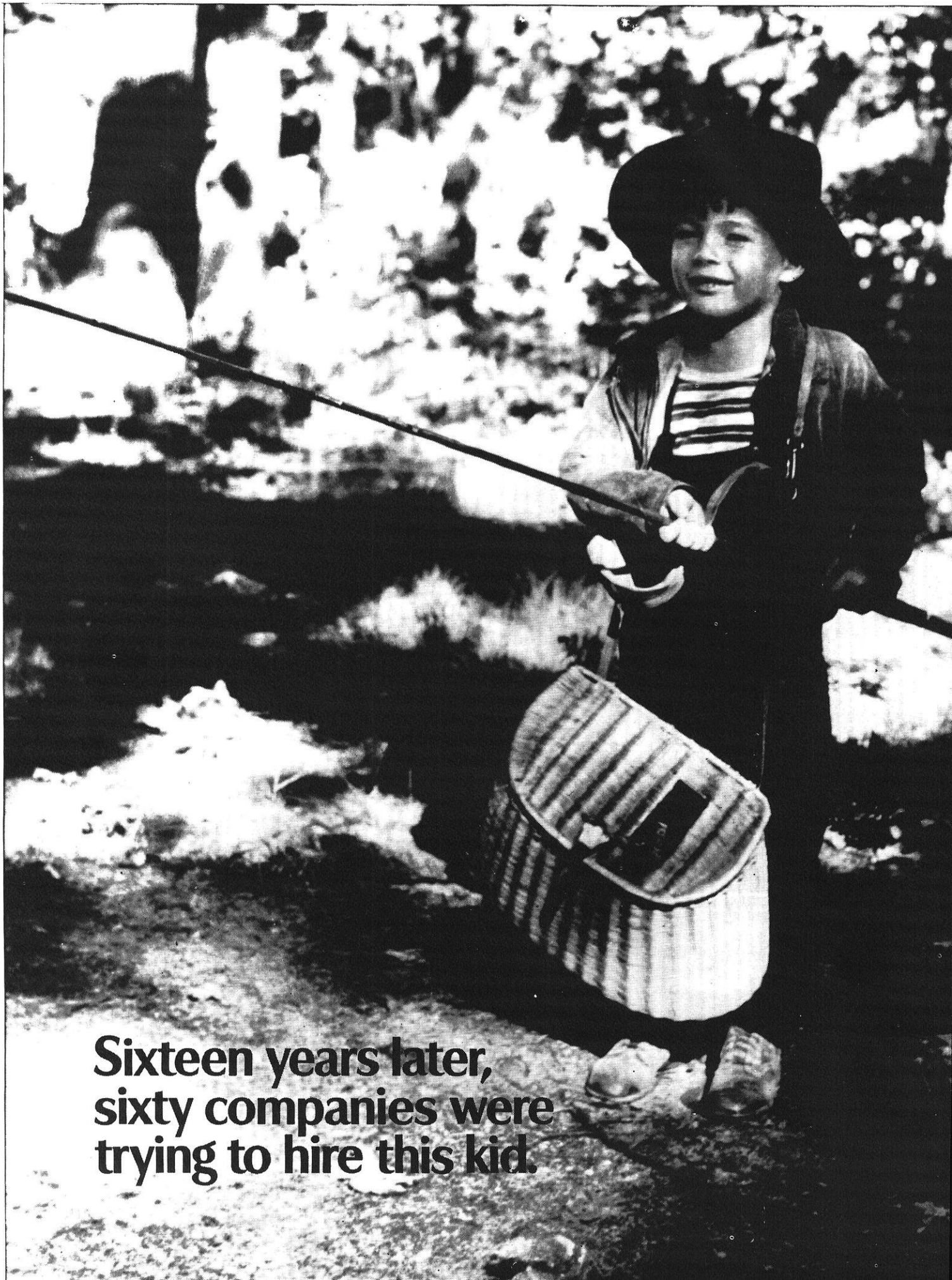
Below is an aerial perspective of Union-South as viewed from the corner of Johnson Street and Randall Avenue.




Sixteen years later,
sixty companies were
trying to hire this kid.

While still in kindergarten, science was already moving to make Dennis Twining a hot property.

"By the eleventh grade they launched Sputnik I. The science race was on and I was in it. I started cramming.

"After high school, I had a chance to go to the University of Michigan and work as a research assistant.

"Our project was in a cemetery in case of explosions. Great for dates.

"When I got my metallurgy degree there were sixty companies with jobs for six of us. I checked out the top ten and picked International Nickel. Why?

"Because they gave me the best chance to stay at the front edge of technology and also learn the other half of the equation—business.

"It worked.

"I spent the first year in research. Then moved on to marketing—Chicago, Hartford, and now New York. Fantastic city.

"I'm responsible for development in mainstream markets—motor freight, containerization, construction equipment.

"Here I am on Wall Street, past halfway to my MBA at NYU with a thousand opportunities in front of me.

"Yes, Sputnik took me quite a way."

Nickel helps other metals resist heat, cold, impact, pressure, abrasion, corrosion...to advance engineering in vital fields—power, desalination, electronics, transportation, aerospace.

We're doing everything we can to produce more nickel. Searching around the world—Indonesia, Australia, Guatemala, Canada. We've found ways to extract nickel from ores thought too poor to mine a few years ago.

We count our blessings and respect our surroundings. From nickel ores, we recover platinum, palladium, twelve other commercially useful elements. Make iron pellets for steel. Convert smoke in our stacks to chemicals for other industries. On sand left from processing ore, we grow meadows of hay.

We are 33,000 people hard at work in 18 countries—miners, researchers, market builders. We bring opportunity to underdeveloped lands, new technologies, new payrolls, new tax income. Nickel in the ground is useless. We put it to work.

INTERNATIONAL NICKEL

The International Nickel Company, Inc., New York, N.Y.
The International Nickel Company of Canada, Limited, Toronto, Ontario
International Nickel Limited, London, England

(Continued from Page 13)

The Grade 5 crises are those where the hue and cry has been raised and where responsive changes of some kind are already under way. Cancer goes here, along with problems like auto safety and an adequate water supply. This is not to say that we have solved the problem of cancer, but rather that good people are working on it and are making as much progress as we could expect from anyone. (At this level of social intensity, it should be kept in mind that there are also positive opportunities for research, such as the automation of clinical biochemistry or the invention of new channels of personal communication, which might affect the 20-year future as greatly as the new drugs and solid-state devices of 20 years ago have begun to affect the present.)

Where the Scientists Are

Below Grade 5, three less quantitative categories are listed, where the scientists begin to outnumber the problems. Grade 6 consists of problems that many people believe to be important but that are adequately researched at the present time. Military R and D belongs in this category. Our huge military establishment creates many social problems, both of national priority and international stability, but even in its own terms, research, which engrosses hundreds of thousands of scientists and engineers, is being taken care of generously. Likewise fusion power is being studied at the hundred-million-dollar level, though even if we had it tomorrow, it would scarcely change our rates of application of nuclear energy in generating more electirc power for the world.

Grade 7 contains the exaggerated problems which are being talked about or worked on out of all proportion to their true importance, such as heart transplants, which can never affect more than a few thousands of people out of the billions in the world. It is sad to note that the symposia on "social implications of science" at many national scientific meetings are often on the problems of Grade 7.

In the last category, Grade 8, are two subjects which I am sorry to say I must call "overstudied," at least with respect to the real crisis problems today. The Man in Space flights to the moon and back are the most beautiful technical achievements of man, but they are not urgent except for national display, and they absorb tens of thou-

TABLE 1 – CLASSIFICATION OF PROBLEMS AND CRISES BY ESTIMATED TIME AND INTENSITY (UNITED STATES)

Grade	Estimated Crisis Intensity (number affected times degree of effect)		Estimated time to crisis (if no major effort at anticipatory solution)		
			1 to 5 years	5 to 20 years	20 to 50 years
1.		**Total Annihilation**	**Nuclear or RCBW Escalation**	**Nuclear or RCBW Escalation**	**(SOLVED OR DEAD)**
2.	10^8	**Great Destruction or Change (Physical, Biological, or Political)**	(Too Soon)	Participatory Democracy Eco-balance	Political Theory and Economic Structure Population Planning Patterns of Living Education Communications Integrative Philosophy
3.	10^7	**Widespread Almost Unbearable Tension**	Administrative Management Slums Participatory Democracy Race Conflict	Pollution Poverty Law and Justice	?
4.	10^6	**Large-Scale Distress**	Transportation Neighborhood Ugliness Crime	Communications-Gaps	?
5.	10^5	**Tension Producing Responsive Change**	Cancer and Heart Smoking and Drugs Artificial Organs Accidents Sonic Boom Water Supply Marine Resources Privacy on Computers	Educational Inadequacy	?
6.		**Other Problems – Important, but Adequately Researched**	Military R and D New Educational Methods Mental Illness Fusion Power	Military R and D	
7.		**Exaggerated Dangers and Hopes**	Mind Control Heart Transplants Definition of Death	Sperm Banks Freezing Bodies Unemployment from Automation	Eugenics
8.		**Non-Crisis Problems Being "Overstudied"**	Man in Space **Most Basic Science**		

sands of our most ingenious technical brains.

And in the "overstudied" list I have begun to think we must now put most of our basic science. This is a hard conclusion, because every part of science may be important in the long run and because it is all still small compared, say, to advertising or the tobacco industry. But basic scientific thinking is a scarce resource. In a national emergency, we would suddenly find that a host of our scientific problems could be postponed for several years in favor of more urgent research. Should not our total human emergency make the same claim? Long-range science is useless unless we survive to use it. Tens of thousands of our best-trained minds may now be needed for something more important than "science as usual."

The arrows at level 2 in the Tables are intended to indicate that problems may escalate to a higher level of crisis in the next time period if they are not solved. The arrows toward Level 2 in the last columns of both Tables show the escalation of all our problems upward to some general reconstruction in the 20-50 year time period, if we survive. Problably no human institution will continue unchanged for another 50 years, because they will all be changed by the crises if they are not changed in advance to prevent them. There will surely be widespread rearrangements in all our ways of life everywhere, from our patterns of society to our whole philosophy of man. Will they be more humane, or less? Will the world come to resemble a diverse and open humanist democracy? Or Orwell's **1984**? Or a post-nuclear desert with its scientists' hanged? It is our acts of commitment and leadership in the next few months and years that will decide.

Mobilizing Scientists

It is a unique experience for us to have peace-time problems, or technical problems which are not industrial problems, on such a scale. We do not know quite where to start, and there is

TABLE 2 – CLASSIFICATION OF PROBLEMS AND CRISES BY ESTIMATED TIME AND INTENSITY (WORLD)

Grade	Estimated Crisis Intensity (number affected times degree of effect)		Estimated time to crisis (if no major effort at anticipatory solution)		
			1 to 5 years	5 to 20 years	20 to 50 years
1.	10^{10}	**Total Annihilation**	**Nuclear or RCBW Escalation**	**Nuclear or RCBW Escalation**	**(SOLVED OR DEAD)**
2.	10^{9}	**Great Destruction or Change (Physical, Biological, or Political)**	(Too Soon)	Famines Eco-balance Development Failures Local Wars Rich-Poor Gap	Economic Structure and Political Theory Population and Eco-balance Patterns of Living Universal Education Communications-Integration Management of World Integrative Philosophy
3.	10^{8}	**Widespread Almost Unbearable Tension**	Administrative Management Need for Participation Group and Race Conflict Poverty-Rising Expectations Environmental Degradation	Poverty Pollution Race Wars Political Rigidity Strong Dictatorships	?
4.	10^{7}	**Large-Scale Distress**	Transportation Diseases Loss of Old Cultures	Housing Education Independence of Big Powers Communications Gap	?
5.	10^{6}	**Tension Producing Responsive Change**	Regional Organization Water Supplies	?	?
6.		**Other Problems – Important, but Adequately Researched**	Technical Development Design Intelligent Monetary Design		
7.		**Exaggerated Dangers and Hopes**			Eugenics Melting of Ice Caps
8.		**Non-Crisis Problems Being "Overstudied"**	Man in Space **Most Basic Science**		

no mechanism yet for generating ideas systematically or paying teams to turn them into successful solutions.

But the comparison with wartime research and development may not be inappropriate. Perhaps the anti-submarine warfare work or the atomic energy project in the 1950's provide the closest parallels to what we must do in terms of the novelty, scale, and urgency of the problems, the initiative needed, and the kind of large success that had to be achieved. In the anti-submarine campaign, Blackett assembled a few scientists and other ingenious minds in his "back room" and within a few months they had worked out the "operations analysis" that made an order-of-magnitude difference in the success of the campaign. In the atomic energy work, scientists started off with extra-curricular research, formed a central committee to channel their secret communications, and then studied the possible solutions for some time before they went to the government for large-scale support for the great development laboratories and production plants.

Fortunately, work on our crisis problems today would not require secrecy. Our great problems today are all beginning to be world problems and scientists from many countries would have important insights to contribute.

Probably the first step in crisis studies now should be the organization of intense technical discussion and education groups in every laboratory. Promising lines of interest could then lead to the setting up of part-time or full-time studies and teams and coordinating committees. Administrators and boards of directors might find active crisis research important to their own organizations in many cases. Several foundations and federal agencies already have in-house research and make outside grants in many of these crisis areas, and they would be important initial sources of support. But the step that will probably be required in a short time is the creation of whole new centers, perhaps comparable to Los Alamos or the RAND Corporation, where interdisciplinary groups can be assembled to work full-time on solutions to these crisis problems. Many different kinds of centers will eventually be necessary, including research centers, development centers, training centers and even production centers for new socio-technical inventions. The problems of our time – the $100-billion food problem or the $100-billion arms control problem – are no smaller than World War II in scale and importance, and it would be absurd to think that a few academic research teams or a few agency laboratories could do the job.

Social Inventions

The thing that discourages many scientists – even social scientists – from thinking in these research-and-development terms is their failure to realize that there are such things as social inventions and that they can have large-scale effects in a surprisingly short time. A recent study with Karl Deutsch has examined some 40 of the great achievements in social science in this century, to see where they were made and by whom and how long they took to become effective. They include developments such as the following:

- Keynesian economics
- Opinion polls and statistical sampling
- Input-output economics
- Operations analysis
- Information theory and feedback theory
- Theory of games and economic behavior
- Operant conditioning and programmed learning
- Planned programming and budgeting (PPB)
- Non-zero-sum game theory

Many of these have made remarkable differences within just a few years in our ability to handle social problems or management problems. The opinion poll became a national necessity within a single election period. The theory of games, published in 1946, had become an important component of American strategic thinking by RAND and the Defense Department by 1953, in spite of the limitation of the theory at that time to zero-sum games, with their dangerous bluffing and "brinksmanship." Today, within less than a decade, the PPB management technique is sweeping through every large organization.

This list is particularly interesting because it shows how much can be done outside official government agencies by inventive men putting their brains together. Most of the achievements were the work of teams of two or more men, almost all of them located in intellectual centers such as Princeton or the two Cambridges.

The list might be extended by adding commercial social inventions with rapid and widespread effects, like credit cards. And socio-technical inventions, like computers and automation or like oral contraceptives, which were in widespread use within 8 years after they were developed. In addition, there are political innovations like the New Deal, which made great changes in our economic life within 4 years, and the Pay-As-You-Go Income Tax, which transformed federal taxing power within 2 years.

On the international scene, the Peace Corps, the "hot line," the Test-Ban Treaty, the Antarctic Treaty, and the Non-Proliferation Treaty, were all implemented within 2 to 10 years after their initial proposal. These are only small contributions, a tiny patchwork part of the basic international stabilization system that is needed, but they show that the time to adopt new structural designs may be surprisingly short. Our cliches about "social lag" are very misleading. Over half of the major social innovations since 1940 were adopted or had widespread social effects within less than 12 years – a time as short as, or shorter than, the average time for adoption of technological innovations.

Areas for Task Forces

Is it possible to make more of these social inventions systematically to deal with our present crisis problems? I think it is. It may be worth listing a few specific areas where new task might start.

(1) Peace-keeping mechanisms and feedback stabilization. Our various nuclear treaties are a beginning. But how about a technical group that sits down and thinks about the whole range of possible and impossible stabilization and peace-keeping mechanisms? Stabilization feedback-design might be a

complex modern counterpart of the "checks and balances" used in designing the constitutional structure of the United States 200 years ago. With our new knowledge today about feedbacks, group behavior, and game theory, it ought to be possible to design more complex and even more successful structures.

Some peace-keeping mechanisms that might be hard to adopt today could still be worked out and tested and publicized, awaiting a more favorable moment. Sometimes the very existence of new possibilities can change the atmosphere. Sometimes in a crisis, men may finally be willing to try out new ways and may find some previously prepared plan of enormous help.

(2) Biotechnology. Humanity must feed and care for the children who are already in the world, even while we try to level off the further population explosion that makes this so difficult. Some novel proposals, such as food from coal, or genetic copying of champion animals, or still simpler contraceptive methods, could possibly have large-scale effects on human welfare within 10 to 15 years. New chemical and statistical and management methods for measuring and maintaining the ecological balance could be of very great importance.

(3) Game Theory. As we have seen, zero-sum game theory has not been too academic to be used for national strategy and policy analysis. Unfortunately, in zero-sum games, what I win, you lose, and what you win, I lose. This may be the way poker works, but it is not the way the world works. We are collectively in a non-zero-sum game in which we will all lose together in nuclear holocaust or race conflict or economic nationalism, or all win together in survival and prosperity. Some of the many variations of non-zero-sum game theory, applied to group conflict and cooperation, might show us profitable new approaches to replace our sterile and dangerous confrontation strategies.

(4) Psychological and social theories. Many teams are needed to explore in detail and in practice how the powerful new ideas of behavior theory and the new ideas of responsive living might be used to improve family life or community and management structures. New ideas of information handling and management theory need to be turned into practical recipes for reducing the daily frustrations of small businesses, schools, hospitals, churches, and town meetings. New economic inventions are needed such as Urban Development Corporations. A deep systems-analysis is urgently needed to see if there is not some practical way to separate full employment disputes, and multiplies all our domestic conflicts and our sense of despair.

(5) Social indicators. We need new social indicators, like the cost-of-living index, for measuring a thousand social goods and evils. Good indicators can have great "multiplier effects" in helping to maximize our welfare and minimize our ills. Engineers and physical scientists working with social scientists might come up with ingenious new methods of measuring many of these important but elusive parameters.

(6) Channels of effectiveness. Detailed case studies of the reasons for success or failure of various social inventions could also have a large multiplier effect. Handbooks showing what channels or methods are now most effective for different small-scale and large-scale social problems would be of great value.

The list could go on and on. In fact, each study group will have its own pet projects. Why not? Society is at least as complex as, say, an automobile with its several thousand parts. It will probably require as many research-and-development teams as the auto industry in order to explore all the inventions it needs to solve its problems. But it is clear that there are many areas of great potential crying out for brilliant minds and brilliant teams to get to work on them.

Future Satisfactions and Present Solutions

This is an enormous program. But there is nothing impossible about mounting and financing it, if we as concerned men go into it with commitment and leadership. Yes, there will be a need for money and power to overcome organizational difficulties and vested interests. But it is worth remembering that the only real source of power in the world is the gap between what is and what might be. Why else do men work and save and plan? If there is some future increase in human satisfaction that we can point to and realistically anticipate, men will be willing to pay something for it and invest in it in the hope of that return. In economics, they pay with money; in politics, with their votes and time and sometimes with their jail sentences and their lives.

Social change, peaceful or turbulent, is powered by "what might be." This means that for peaceful change, to get over some impossible barrier of unresponsiveness or complexity or group conflict, what is needed is an inventive man or group – a "social entrepreneur" – who can connect up the pieces and show how to turn the advantage of "what might be" into some present advantage for every participating party. To get toll roads, when highways were hopeless, a legislative-corporation mechanism was invented that turned the future need into present profits for contstruction workers and bondholders and continuing profitability for the state and all the drivers.

This principle of board-payoff anticipatory design has guided many successful social plans. Regular task forces using systems analysis to find payoffs over the barriers might give us such successful solutions much more often. The new world that could lie ahead, with its blocks and malfunctions removed, would be fantastically wealthy. It seems almost certain that there must be many systematic ways for intelligence to convert that large payoff into the profitable solution of our present problems.

The only possible conclusion is a call to action. Who will commit himself to this kind of search for more ingenious and fundamental solutions? Who will begin to assemble the research teams and the funds? Who will begin to create those full-time interdisciplinary centers that will be necessary for testing detailed designs and turning them into effective applications?

The task is clear. The task is huge. The time is horribly short. In the past, we have had science for intellectual pleasure, and science for the control of nature. We have had science for war. But today, the whole human experiment may hang on how fast we press the development of science for survival. [***]

Report on the Disposal of Chemical Munitions

The following report is a summary of the principal conclusions and recommendations of a study group appointed by the president of the National Academy of Sciences at the request of the Director of Defense Research and Engineering. The study group, evaluating military plans for the disposal of "surplus" chemical munitions at sea, recommended substantial modification in order to avoid even the least risk of disaster.

The group's recommendations, after due consideration by the Department of Defense, were accepted in favor of the original plans, which involved large scale rail transport of highly toxic "nerve gas" through large urban areas.

Our thanks to **News Report** *of the National Academy of Sciences for their permission to publish the group's summary as found in their August-September issue.*

We are very much aware that continuing inaction will not reduce the hazards of eventual disposal of the chemicals and munitions intended for disposal in the 1969 Operation CHASE, and in some instances will increase them.

Presumably, the Army plan to transport the chemical munitions, via rail, from Denver, Colorado to Earle, New Jersey for disposal in the Atlantic Ocean.

Furthermore we are aware that many activities of the Federal Government unavoidably involve some hazards to the personnel involved and also to private "bystanders". In this respect, government activities resemble those of private manufacturing and transportation organizations. We believe, however, that the government should set an example to private organizations and individuals of minimizing risks to humans and damage to the environment, even though this may complicate and make more costly its own operations. Therefore we recommend that Operation CHASE as originally conceived be modified as follows. Five types of materials are included in the plan:

I. AF M34 bomblet clusters containing GB, a "nerve gas"

II. Bulk containers of Mustard

Refers to mustard gas of World War I fame.

III. M55 rockets containing GB in concrete "coffins"

IV. Contaminated and water-filled bulk containers

V. Drums containing cans of CS agent in concrete

A tear/nausea gas similar to CN, the common tear gas.

We recommend that disposal of these materials should be as follows:

I. A total of 21,108 M34 clusters, each containing 76 bomblets, each of which is loaded with 2.6 lb. of GB (volatile liquid "nerve gas"), 0.55 lb. of tetryl burster charge, and fuse, are stored now at Rocky Mountain Arsenal (RMA), the site of their manufacture some sixteen years ago.

That's enough GB to kill 22,232,936,880 human beings at maximum efficiency.

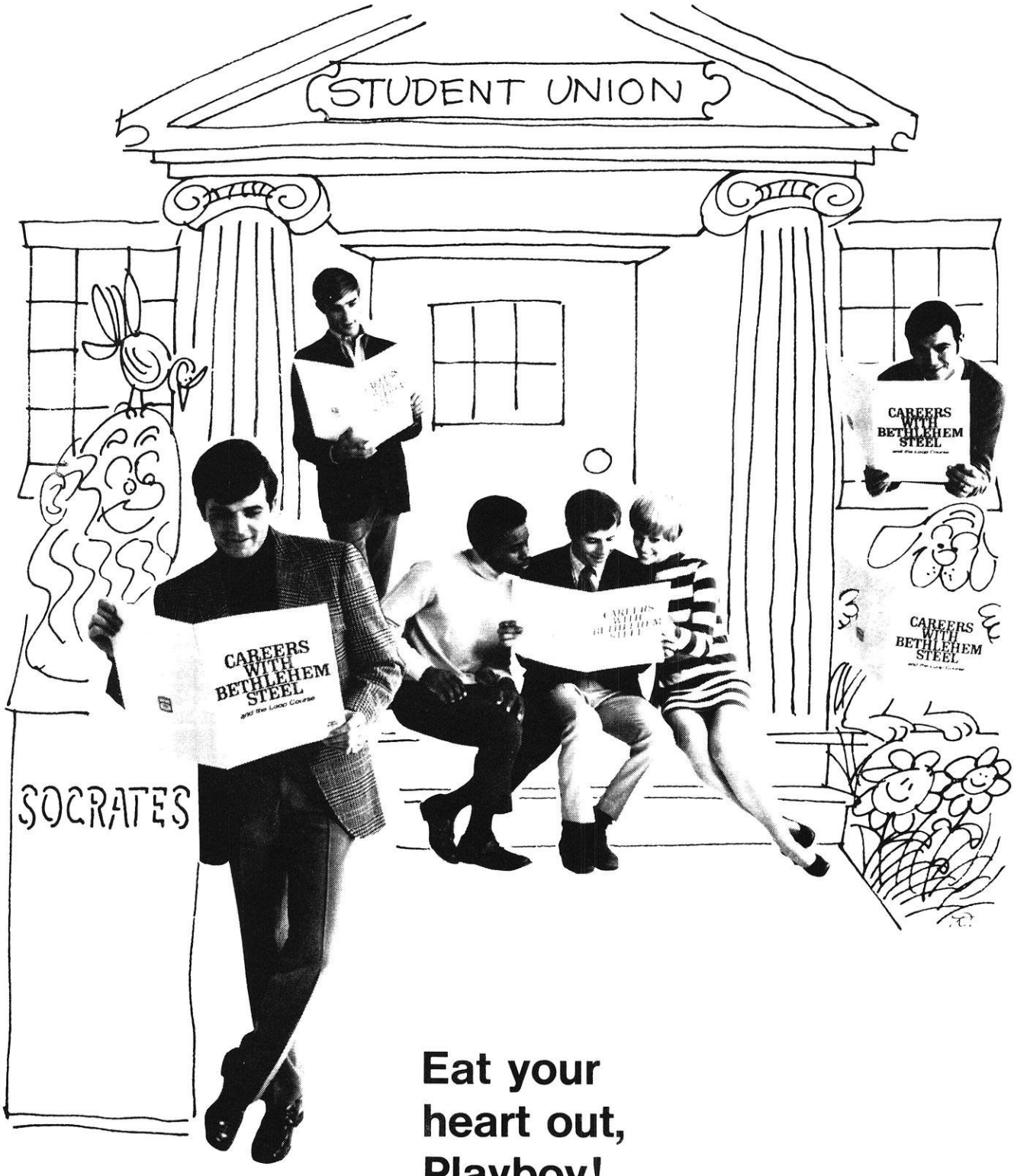
Recommendations: We recommend, therefore, that the M34 clusters be disassembled and the withdrawn GB be destroyed chemically either by acid or alkaline hydrolysis. This procedure would result in waste materials without "nerve gas" properties and not more hazardous than large volumes of industrial waste that are routinely discharged elsewhere.

In many cases, industrial waste is quite hazardous. Talk to the man who refuses to drink from a polluted stream.

On balance, weighing various hazards, we recommended that this disassembly be undertaken at RMA because (1) the hazards arising from transportation by rail will be eliminated; (2) RMA has an experienced staff that has already disassembled M34 clusters; (3) RMA has facilities that can be fairly rapidly expanded for the recommended operation. We consider the addition of waste waters from hydrolysis to the sealed pond on the grounds of RMA not to be an issue since it would only be a small increment of similar waste now in the pond. If this recommendation is adopted, however, we urge the Army to proceed as rapidly as possible with the implementation of the plan, which may take from 18 to 30 months. In the meantime, immediate measures should be taken to protect the stores of M34 clusters from lightning and excessive direct sunlight, and also to distribute them so as to minimize the effects of the unlikely event of an aircraft crashing on the stores.

If, for any reason, the disposal of M34 clusters cannot be carried out at RMA, we recommend that they be moved by rail to the Tooele Army Depot and there disposed of by disassembly and chemical destruction of GB, as above. Tooele is recommend-

(Continued on Page 34)



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(Continued from Page 32)

ed because (1) it offers a shorter haul by rail from RMA through a less-populated area (with the major exception of the passage through a part of Denver); (2) it is located in a sparsely populated region and has a large land area; (3) the Army has transported to Tooele other munitions containing "nerve gas" so that, when the time comes for their disposal, the disposal facilities that will have to be constructed at Tooele for M34 clusters would make further railroad transportation unnecessary.

As noted earlier, the probability of a catastrophic railroad accident involving M34 clusters is very low,

Railroad derailments have increased 86 percent in the last six years.

but not zero. To reduce it further we recommend that, in addition to safety measures already planned by the Army, positive steps be taken to close grade crossings in inhabited areas during the passage from RMA to Tooele of trains loaded with explosive munitions containing "nerve gases."

II. A total of 5,311 one-ton steel containers (like those used commercially for chlorine) filled with Mustard liquid were to be disposed of in Operation CHASE, and are stored at the Rocky Mountain, Anniston, and Edgewood Army establishments. Another 7,332 such containers that were to be disposed of later are at Pine Bluff and Tooele.

Recommendation: We recommend that the Mustard scheduled for disposal in CHASE (and about 6,600 tons more in the 7,332 containers still to be disposed of, as mentioned previously be burned in government establishments where storage is safe and *local* air pollution from the resulting SO_2 and HCl is not a serious problem. This procedure was successfully followed at RMA in an incinerator having a heat dissipation capacity of about $17(10^6)$ Btu/hr. The products of combustion were dispersed into the air from a 200-ft. chimney. Should maximum ground-level concentrations of pollutants prove to be excessive, a simple liquid scrubber should be added to the existing facilities and the effluent sent to the sealed lake. If for compelling reasons the disposal is at a site other than RMA, similar facilities are suggested, with thought being given, during design, to long-term use to incinerate other materials.

III. A total of 418 "coffins" containing M55 rockets are now at the Anniston (Alabama and Blue Grass (Kentucky) Army establishments.) The rockets are distributed evenly in solid blocks of concrete cast into heavy steel boxes with welded lids. Each such "coffin" weighs about 6.4 tons and contains 30 rockets. Each rocket contains 10.8 lb. of GB liquid "nerve gas" and about 2.6 lb. of Composition B burster charge, as well as rocket propellant and fuze.

At maximum efficiency, that's enough to kill 15,601,766,400 human beings.

In previous CHASE operations during 1967 and 1968, 1,706 such "coffins" have been sunk in one location east of NAD Earle at a depth of 7,200 feet.

Recommendations: We recommend that the Army convene a group of technically qualified individuals,

A group of technically qualified individuals called by the Army devised Project CHASE. There are plenty of jokes, quips, and anecdotes describing the longstanding incompetence and ineptness of the Services, especially the Army. One could not safely assume – with any confidence – that the Army will break its tradition.

including demolition experts (which we are not), to consider whether a practically feasible way could be devised to dispose of the "coffins" on an Army establishment. This method should be safe to neighboring populations and positive in the sense that toxic and explosive contents of the "coffin" would be destroyed within a predictable time. As a group, however, we are unable to formulate a definite proposal that satisfies these conditions.

If the proposed study does not produce such a method (and assuming that what is now being recommended is consistent with the international obligations of the United States of America, a matter which we as a group cannot assess), we recommend that the 418 "coffins" be transported by rail

That was the Army's original plan.

(choosing routes minimizing proximity of population) to NAD Earle and through Operation CHASE, sunk in the same disposal area (centered at 39° 38'N, 71° O'W) where the other 1,706 "coffins" have already been dumped. The choice of this location is based on the reasoning that the concrete blocks will remain on the bottom for a very long time after the loss of toxic ingredients, and it is preferable that all of them be in one location when, in some more or less distant future, technological operations at the depths involved (7,000 ft.) will be common and the records of CHASE operations may have been lost. To accelerate the conversion of the additional "coffins" into inert blocks of concrete, we recommend brazing to each of the outer steel boxes several pieces of copper to form electrochemical couples for accelerated corrosion.

If it is decided not use NAD Earle for Operation CHASE, we recommend reconsideration of the use of the Naval Weapons Station-Charleston, Charleston, South Carolina, since, if these recommenda-

tions are carried out, only one CHASE ship would be required, and the local personnel and facilities at Charleston may be found to be adequate for its safe loading and towing to sea. The use of Charleston would entail a less serious rail-transportation problem and the ship could be sunk in the dump area (29° 29'N, 76° O'W) already designated on charts as used for "explosives, chemicals, and munitions," which is in a very deep ocean (about 15,000 ft.) where disposal might be less undesirable.

IV. At Edgewood Arsenal (Maryland) are stored 2,325 one-ton steel containers that, at one time, contained some unknown contaminant, and have since been emptied and filled with water.

Recommendation: We recommend that, to ensure only insignificant content of toxic materials, these containers be drained

And where does the drained water end up?

and refilled with water at the Edgewood Arsenal, a procedure, we are told, that presents no serious problems. Thereupon, if they still cannot be disposed of through commercial channels, we recommend disposing of them through Operation CHASE.

V. Also located at Edgewood Arsenal are 86 drums of 55-gallon capacity filled with cast concrete in each of which has been embedded cannisters containing 80 lb. of a mixture of a solid riot-control agent CS and some pyrotechnic composition.

Recommendation: Unless a procedure similar to the demolition procedure first recommended in Section III is developed, we recommend including in the same Operation CHASE procedure recommended as second choice in Section III the small additional tonnage here involved.

While the following comments are outside the terms of reference of the Committee, we wish to suggest to the Department of Defense that it adopt basically the same approach to chemical warfare agents and munitions that the Atomic Energy Commission has adopted toward radioactive waste products from nuclear reactors. It should be assumed that all such agents and munitions will require eventual disposal and that dumping at sea should be avoided. Therefore, a systematic study of optimal methods of disposal on appropriate military installations, involving no hazards to the general population and no pollution of the environment, should be undertaken. Appropriately large disposal facilities should be regarded as a required counterpart to existing stocks and planned manufacturing operations. As the first step in this direction, we suggest the construction of facilities for gradual demilitarization and detoxification of remaining M55 rockets.

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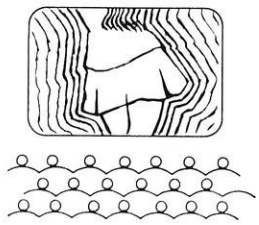

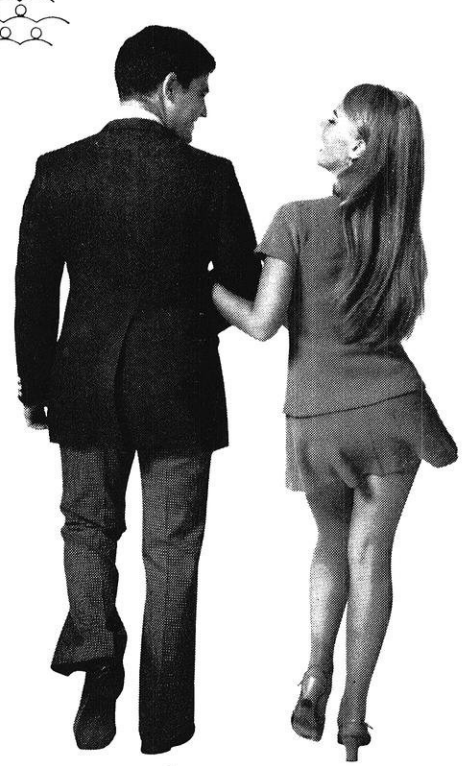

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