

FOIA MARKER

This is not a textual record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

Collection/Record Group: Clinton Presidential Records
Subgroup/Office of Origin: Council on Environmental Quality
Series/Staff Member: Kathleen (Katie) McGinty
Subseries:

OA/ID Number: 2889
FolderID:

Folder Title:
Al's Keynote Address on Global Environment

Stack:	Row:	Section:	Shelf:	Position:
S	61	5	10	2

Katie's
files

Satellite vs. Surface: Two Points of View on Global Warming

By Boyce Renabarger
Washington Post Staff Writer

If there has been a planetwide warming trend over the last decade and a half—a claim repeated so often in recent years that many assume it is an established fact—it ought to have shown up by now in the 15 years of temperature readings taken by a network of Earth-orbiting satellites.

So said James Hansen, the Goddard Institute for Space Studies scientist who alarmed the world in the late 1980s with his assertion that Earth's atmosphere had been warming since the mid-1970s—caused by growing concentrations of carbon dioxide in the air, which trap heat that otherwise would radiate into space. Hansen bolstered his case with a chart showing that after 35 years of fairly steady temperatures, surface thermometer readings around the world were suddenly showing a warming trend.

Yet no sign of such warming has shown up in the satellite data.

"We've had total satellite coverage of the Earth since 1979, and we sure don't see it," said John Christy, of the University of Alabama at Huntsville.

For the last few years Christy and Roy Spencer of NASA's Marshall Space Flight Center, also in Huntsville, have been processing data collected by satellites operated by the National Oceanic and Atmospheric Administration (NOAA).

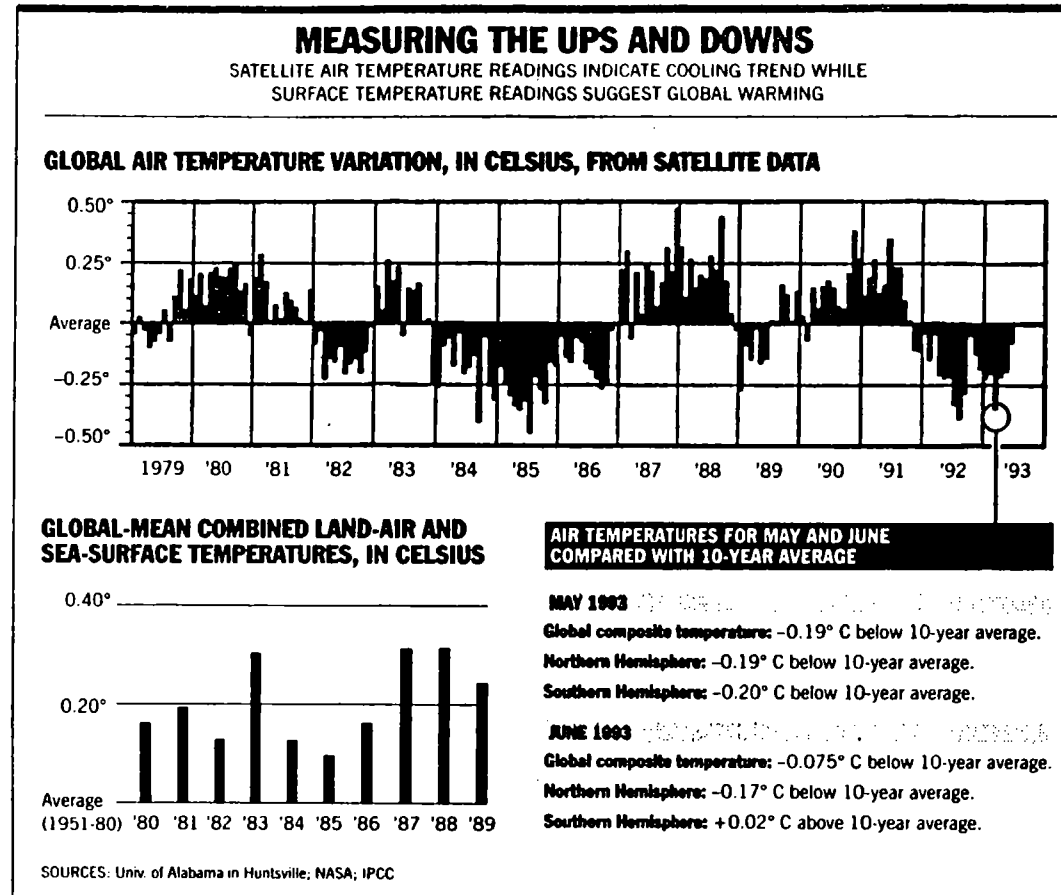
Causes for Discrepancies in Data

Each month Christy and Spencer update their analysis, issuing the planetary equivalent of a fever chart. Their latest report (upper chart) shows that in June, as in the 19 previous months, the average global temperature was cooler than the average for the previous decade. July, despite a local heat wave in the eastern United States, is shaping up to be cooler as well.

More significantly, instead of a global warming trend, the satellite data show no clear pattern. According to the space-based sensors, the temperature of the lower atmosphere has fluctuated irregularly—cooler than average for two or three years, then warmer for about the same time, then back, then forth.

Christy said the warmer intervals coincide with El Niño—the mysterious, periodic phenomenon in which the surface waters of the South Pacific become warmer than usual. Because heat from ocean surfaces supplies the energy that drives many weather phenomena, this warming sets off major weather shifts around the planet. El Niño appeared in 1983, recurred in 1987 through early 1988 and came back again for a prolonged stay in 1990 and 1991.

At the same time, however, Mount Pinatubo erupted in the Philippines in June 1991 and soon reversed El Niño's effect. It spewed tiny droplets of sulfuric acid into the upper atmosphere, where they eventually began to cover much of the globe. Because the drop-



lets reflected some sunlight back into space, they caused a global cooling. Most of the droplets have since rained out of the atmosphere.

Overall, Christy said, there has been no apparent warming trend.

Hansen's more widely reported data (lower chart) show similar fluctuations from year to year. But, he said, they indicate a clear warming trend that reached record high temperatures in the late 1980s before Pinatubo chilled the air.

Hansen said the readings show the lower atmosphere's average temperature rose by about a quarter of a degree Fahrenheit in that time. (Most of that warming in the Northern Hemisphere, the detailed records show, has happened at night and during the winter. Summertime high temperatures have not risen.)

Why the difference?

"Our data," Christy said, "come from satellite readings taken over the entire globe. Their data come from thermometers, mostly in industrial areas."

In other words, the temperature records were gathered in two very different ways.

The older method relies on conventional thermometers at weather stations around the world, most at airports and in cities in the industrialized world, plus scattered readings in Third World regions and aboard ships at sea. At some stations, readings have been taken regularly for more than a century. Because the readings are taken just a few feet off the ground, they are relevant to what most living things feel.

A major drawback is that many of the thermometers are in "heat islands"—places that have been artificially warmed by the growth of pavement and cities. Christy argues that this effect—as well as the fact that the limited number of stations provides uneven coverage of the globe—create the appearance of a warming trend. Hansen said the heat island effect is understood and that thermometer readings are routinely lowered a certain amount to correct for it.

The newer method uses a series of weather satellites that scan the entire surface of Earth several times a day and record the intensity of microwave radiation that comes naturally from oxygen molecules in the bottom-

most four miles of the atmosphere. The warmer the oxygen, the more intense the radiation. A major advantage of this method is that it monitors the whole planet evenly.

Disadvantages are that the readings go back only to 1979 and that instead of measuring the temperature near the ground, it reads an average for the bottom-most four miles of atmosphere. So it's less relevant to life on the ground, though perhaps more relevant to cloud formation, which cools the surface in the daytime and warms it at night. The cooler the air at cloud altitudes, the more likely it is that water vapor will condense, forming clouds.

Moreover, Hansen points out, the satellite microwave readings can be thrown off by water droplets and other particles in the air that interfere with the microwaves' path to the satellite detectors.

Nonetheless, "if there's a greenhouse warming," Hansen said, "it should be visible in their data. The fact that it isn't tells me there's something wrong with their data. There should be similar trends."

It is also possible that the discrepancies are revealing genuine differences in the atmosphere, Hansen said. There could be a warming near the ground and little or no change a few miles up.

Greenhouse Effect Still a Concern

"The fact that we see no warming doesn't mean there's nothing to worry about," Christy said. "From simple physics we know that increasing the amount of carbon dioxide in the atmosphere raises the possibility of a greenhouse effect. A concern is certainly warranted. But, I have to add, our data show little or no warming—indicating that this problem is a lot less than what the [computer-generated] climate models would make you think."

To one climate researcher the differences are not so troubling.

"If you look at them closely, they agree remarkably well," said Jerry Mahlman, head of NOAA's Geophysical Fluid Dynamics Laboratory in Princeton, N.J., a major climate research center. "There's no data set that's perfect. They've all got problems."

For one thing, Mahlman said, the satellite data cover a fairly brief interval: "It's extraordinarily hard just to look at one decade and get any sense of a trend."

Perhaps more perplexing than the air temperature discrepancy is one involving ocean temperatures. Two of the most complete sets of global water temperatures give opposite results. NOAA's Comprehensive Ocean Atmosphere Data Set says the oceans cooled during the 1980s. The United Kingdom Meteorological Office's Global Ocean Surface Temperature Atlas says the oceans warmed during the same decade.

Because scientific efforts to monitor real-world changes yield such ambiguous results, the clamor to "do something" about global warming remains largely an emotionally guided phenomenon.

THE WASHINGTON POST
Monday, July 26, 1993

The Global Environment: A National Security Issue

Keynote Address by
U.S. SEN. AL GORE, D-Tennessee
National Academy of Sciences
Forum on Global Climate Change
Washington, D.C.
May 1, 1989

Many of us have come to this gathering because of a shared belief that humankind has suddenly entered into a brand new relationship with the planet Earth, and that human civilization is, in its current pattern, causing grave and perhaps soon irreparable damage to the ecological system which supports life as we know it.

My purpose is to sound an alarm loudly and clearly -- of imminent and grave danger -- and to describe a strategy for confronting this crisis, with changes in our collective behavior and thinking which, if made, can forestall and prevent the horrendous prospect of an ecological collapse.

First, why is such an alarm necessary? Do we need a crisis before we can act?

Sometimes in human affairs a pattern is well set before its implications are felt in our daily lives. This is true both in politics and in science. When shattered glass filled the streets of Berlin on Kristallnacht, few could conceive of the holocaust to follow. But from a distance, the pattern is now clear. When the first atom was split, few could conceive of nuclear bombs. But when Einstein wrote Roosevelt, the pattern was clear.

How much information is needed by the human mind to recognize a pattern? How much more is needed by the body politic to justify action in response?

It took a long time for the world to respond to Hitler. Because of Hitler, it took only a short time for Roosevelt to respond to Einstein.

In a classic experiment often cited, a frog dropped into a pot of boiling water quickly jumps out. But the same frog, put in the water before it is slowly heated, will remain in place until it is boiled.

The meaning of a pattern is conveyed by contrast as opposed to sameness. Sameness lulls the senses and conveys an absence of danger. Gradual change sometimes resembles sameness, obscuring danger from minds which reserve their alertness for sharp contrasts. Exponential change at first resembles sameness, then gradual change, then explosive contrast.

It is often hard to recognize the shape of an exponential curve before it reaches the explosive stage. It is difficult because the contrast essential to understanding very large patterns is sometimes visible only from a distance.

If an individual or a nation is accustomed to looking at the future one year at a time, and the past in terms of a single lifetime, then many large patterns are concealed. If a political body looks at policies in the context of a single nation, then the global impacts will remain invisible.

When you consider the relationship of the human species to the planet Earth, not much change is visible in a single year, in a single nation. Yet, if you look at the entire pattern of that relationship from the emergence of the species until today, May Day 1989, a distinctive contrast in very recent times clearly conveys the danger to which we must

respond. It took ten thousand human lifetimes for the population to reach two billion. Now, in the course of a single human lifetime -- mine and yours -- it is rocketing from two billion toward ten billion, and is already halfway there.

Startling graphs showing the loss of forest land, topsoil, stratospheric ozone, and species all follow the same pattern of sudden, unprecedented acceleration in the latter half of the 20th century. And yet, so far, the pattern of our politics remains remarkably unchanged.

The earth's forests are being destroyed at the rate of one football field's worth every second, one Tennessee's worth every year. An enormous hole is opening in the ozone layer, reducing the earth's ability to protect life from deadly ultraviolet radiation. Living species die at such an unprecedented rate that more than half may disappear within our lifetimes. Chemical wastes, in growing volumes, seep downward to poison groundwater and upward to destroy the atmosphere's delicate balance. Huge quantities of carbon dioxide, methane, and chlorofluorocarbons dumped in the atmosphere are trapping heat and raising global temperatures.

In 1987, carbon dioxide levels in the atmosphere began to surge with record annual increases. Global temperatures are also climbing: 1987 was the second hottest year on record; 1988 was the hottest. Scientists now predict our current course may raise world temperatures almost five degrees Celsius in the lifetimes of people in this room. The last time there was such a shift, it was five degrees colder: New York City was under one kilometer of ice. If five degrees colder over thousands of years produces an ice age, what could five degrees warmer produce in one lifetime?

Why are these dramatic changes taking place? Because the human population is surging, because the industrial, scientific, and technological revolutions magnify the environmental impact of these increases, and because we tolerate self-destructive behavior and environmental vandalism on a global scale.

"How much information is needed by the human mind to recognize a pattern? How much more is needed by the body politic to justify action in response?"

The problem in organizing our response is that the worst effects seem far off in the future, and they are so unprecedented they seem to defy common sense. While right now, in the present, millions of people are suffering in poverty and dying of starvation, warfare, and preventable diseases. How do we deal with these immediate problems and at the same time confront the problems of the future? One of the philosophers of the environmental movement, Ivan Illich, in a recent interview, explained the sudden environmental activism of Margaret Thatcher, Mikhail Gorbachev, and other world leaders previously uninterested in the global environment by saying "what has changed is that our common sense has begun searching for a language to speak about the shadow our future throws."

Science already has such a language. Have you ever seen the picture showing how time and space are

shaped by mass, with a black hole pictured as a deep well in a grid, with the space and time around the well sloping toward it? Human political awareness is shaped by history in precisely that way. Our political awareness of the world is shaped and bent by events. Large events like World War II exert a powerful gravitational pull on every idea we have about the world around us. The Holocaust shapes every idea we have about human nature.

And just as in Einstein's theory, future events can exert the same gravitational pull on our thinking as events in the past -- even though the events in the future have not yet occurred.

Time is relative in politics as in science. The political will which made possible the mass political protests against escalating the nuclear arms race came from awareness of a downslope toward a future we did not want to see. Many felt us being pulled toward a

nuclear war that would crush human history forever into a black hole. We are now changing our course away from that downslope, we hope, and taking a new direction -- even though 99.99% of all human beings on earth have never seen, heard, or personally felt nuclear destruction. The awareness of that potential future event came from political communication, with abstract symbols, like words.

Now, throughout the world, we are witnessing the emergence of a new political will to take a different course in order to avoid the slope toward global environmental destruction. We see the catastrophe coming, we hear Rachel Carson's *Silent Spring*. The slope seemed gradual at first but now it is steep. We feel strongly pulled toward ecological collapse by the policies we are now pursuing.

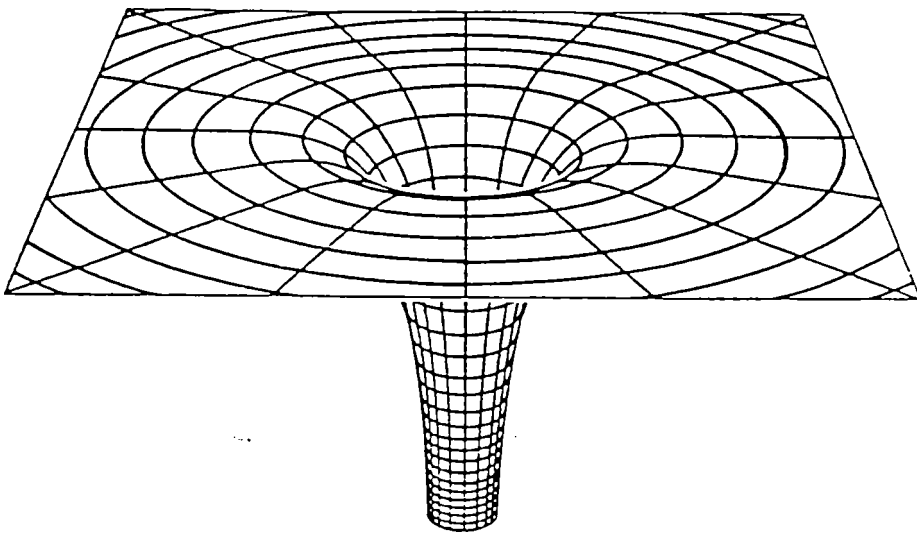
I personally became deeply involved in the effort to avoid a nuclear holocaust nine years ago because I felt the slope toward that horrendous possibility. And I tried to bring to the task the skills of my profession. I believe all this talk about the global environment as a national security issue makes a great deal of sense in political terms.

For the past 13 years, as a citizen and as a member of the United States Congress, I have had long-standing interests in both the environmental threat and in national security. As a practical matter, I have dealt with these subjects as separate intellectual accounts: involving distinct areas of public policy, each with its own completely different set of concerns and participants.

Yet, they grow more and more alike. National security comprises matters that directly and imminently menace the interests of the state, or the welfare of the people. As such, these issues command the attention of political leaders at the highest level, with a proportionate claim on the resources of government and the wealth of the nation. If society were an organism, national security would involve the instinct for survival.

To this point, the national security agenda has been dominated by issues of military security, embedded in the context of global struggle between the United States and the Soviet Union: a struggle which the protagonists have often waged through distant surrogates, but which has always harbored the risk of direct confrontation and nuclear war.

Given the changes in Soviet behavior which have begun under Gorbachev, there is growing optimism that



"Have you ever seen the picture showing how time and space are shaped by mass, with a black hole pictured as a deep well in a grid, with the space and time around the well sloping toward it? Human political awareness is shaped by history in precisely that way. Our political awareness of the world is shaped and bent by events."

Restoring Eco-librium

this long, dark period may be passing. There is also hope this will open the international agenda for other urgent matters and for the release of enormous resources, now committed to war, toward other objectives.

Many hope that the global environment will be the new Dominant Issue. They assert that a collective, international struggle for stability in the ecosystem will succeed the old pattern of national struggle for temporal power, and will justify the preemption of enormous resources, and reshape the public consciousness in support of another long, global struggle.

I am deeply in sympathy with this view, and yet as someone who has worked hard on both issues, I believe the analogy must be used very cautiously. The US-Soviet struggle has lasted almost half a century, consumed several trillions of dollars, cost us close to one hundred thousand American lives in Korea and Vietnam, and has profoundly shaped the psychological and social consciousness of our people. Much the same could be said of the Soviets, who, if anything, have endured far more than have we for the sake of their ideology.

Nothing is automatic or foreordained about the course of US-Soviet relations, no matter how many editorial writers now claim the "Cold War is Over." Nothing relieves us of our present responsibilities for defense or of the need to conduct painstaking negotiations to limit arms and reduce the risk of war. The old agenda is with us still, exacting its price in wealth, creativity and the attention of statesmen.

And yet, the environmentalists are right.

Certainly, there is strong evidence the new enemy is at least as real as the old. For the general public, the shocking images of last year's drought, or of beaches covered with medical garbage, inspired a sense of peril once sparked only by Soviet behavior. But for environmental specialists, the steady flow of data from scientific investigation of the environment -- often ambiguous, but always menacing -- is eerily equivalent to intelligence collection against the more familiar Soviet threat. The U2 spy plane, for example, now is used to monitor not missile silos but ozone depletion.

Already, we are seeing governments struggling to resolve issues whose domains go far beyond anything in our experience. Debate over the disposition of radioactive wastes, for example, involves choices that must remain valid across geological time. The species now disappearing at an unprecedented rate will never return. The global climate pattern could shift to a new equilibrium and never regain its former pattern.

In the not distant future, there will be a new "sacred agenda" in international affairs: policies that enable the rescue of the global environment. This task will one day join, and then perhaps even supplant, preventing the world's incineration through nuclear war, as the principal test of statecraft.

However, in thinking about environmentalism as a national security concern, it is important to differentiate between what would -- in military jargon -- be called the level of threat. Certain environmental problems may be important but are essentially local; others cross borders, and in effect represent theaters of operations; and still others are global and strategic in nature.

On this scale, even phenomena as important as the slow suffocation of Mexico City, the deaths of northern forests in America and Europe, or even the desertification of large areas of Africa, will likely not be regarded as full scale national security issues.

However, the greenhouse effect and stratospheric ozone depletion fit the profile of national security issues of global significance. These phenomena certainly will in time produce effects big enough to threaten international order, even at the level of war and peace. In the case of global warming,

the fact that some of the worst effects will not fully manifest themselves until the middle of the next century is offset by the fact that actions we take now will determine the extent of the damage later.

When nations perceive that they are threatened at the strategic level, they may be induced to think of drastic responses, involving sharp discontinuities from everyday approaches to policy. In military terms, this is the point when the United States begins to think of invoking nuclear weapons. The global environment may well involve responses that are, in comparative terms, just as radical. Not just business as usual, not just incremental variations but massive departures from the norm.

Nuclear war is an apocalyptic subject, and so is global environmental destruction. We are dealing here with increasingly credible forecasts of climatic dislocations, vast changes in growing cycles, inundations of coastal areas and the loss to the sea of vast territories -- some of them very heavily developed and populated. We also are dealing not only with a threat to human health, but unpredictable and potentially vast changes to all life at the surface of the earth and the seas, as the result of prolonged exposure to increased ultra-violet radiation.

What's more, despite some progress made toward limiting some sources of the problem, such as CFCs, we have to face the stark fact that we have barely scratched the surface. Even if all other elements of the problem are solved, a major threat is still posed by emissions of carbon dioxide, the exhaling breath of the industrial culture upon which our civilization rests. The implications of the latest and best studies on this matter are staggering. We must be honest about them. Essentially, they tell us that with our current pattern of tech-

"In the not distant future, there will be a new 'sacred agenda' in international affairs: policies that enable the rescue of the global environment. This task will one day join, and then perhaps even supplant, preventing the world's incineration through nuclear war as the principal test of statecraft."

"Nuclear war is an apocalyptic subject, and so is global environmental destruction. We are dealing here with increasingly credible forecasts of climatic dislocations, vast changes in growing cycles, innundations of coastal areas and the loss to the sea of vast territories -- some of them very heavily developed and populated."

nology and production, we face a Hobson's Choice between economic growth in the near term, and massive environmental disorder as the subsequent penalty.

This central fact cuts across the face of all environmental strategies as we generally think of them. It suggests that the notion of environmentally sustainable development at present may be an oxymoron, rather than a realistic objective. It declares war, in effect, on routine life in the advanced industrial societies. And -- central to the outcome of the entire struggle to restore global environmental balance -- it declares war on the Third World.

The Third World does not have a choice about whether or not it will develop economically. If it does not develop economically, poverty, hunger and disease will consume entire populations. And long before that, whole societies will experience revolutionary political disorder. Rapid economic growth is a life-or-death imperative throughout the Third World. The peoples and governments of the Third World will not be denied that hope, no matter the longer-term costs for the global environment.

And why should they accept what we, manifestly, will not accept for ourselves? Who is so bold as to say that any nation in the developed world is prepared to abandon industrial and economic growth? Who will proclaim that any nation in the developed world will accept even serious compromises in levels of comfort, for the sake of global environmental balance? And who will apportion these sacrifices; who will then bear them?

Development, of course, is part of

the problem as well as the solution. We know that, just as we know that nuclear deterrence depends on the weapons we are trying to render obsolete.

The effort to solve the nuclear arms race has been complicated not only by simplistic stereotypes of the enemy and the threat he poses. It also has been complicated by simplistic demands for immediate unilateral disarmament, without any basis for a widely shared confidence that the original threat is no longer real.

My own belief is that perceptions must evolve simultaneously in both superpowers as technology evolves simultaneously in both countries, as conscious efforts are made to improve information about the other, about the nature of the threat, and the confidence we can summon that the threat is in fact changing and receding.

In similar fashion, the effort to solve the global environmental crisis will be complicated not only by blind assertions that more and more environmental manipulation and more and more resource extraction are essential for economic growth. It will also be complicated by the emergence of simplistic demands that development, or technology itself, must be stopped for the problem to be solved. This is a crisis of confidence which must be addressed.

This speech, if you'll permit me a personal moment, is the first time I've spoken in public on any subject in six weeks. My wife and I have been in Johns Hopkins Hospital, at the bedside of our son, who was hit by an automobile. I've been living in the world of medical science, pursuing the

goal of restoring our son to health. Ten years ago, a child with his injuries would have had several surgical interventions which doctors now realize are unwise, given the greater likelihood of the body healing itself where some injuries are concerned.

Yet, two days after the accident, when doctors were unable to stabilize internal bleeding, my wife and I naively hoped that same natural healing process would take care of that problem and make any surgery unnecessary. If the doctor had relied not on science but on us, we would have unwisely urged against an operation. But doctors have acquired sufficient knowledge to realize that the body should be allowed to heal itself when it can do so. At the same time, they know there are some instances where intervention is essential to save life.

Similarly, we must acquire sufficient knowledge of the earth's system to judge when it can heal itself, and when it is necessary for us to intervene. For example, when 40,000 children die of disease and starvation every 24 hours, we obviously must intervene. But it is past time to recognize that many of society's interventions in the environment have been and are unwise. Much ecological destruction is subsidized by governments. We need more knowledge, more experience, and the kind of sensitive judgments that modern doctors have learned to make.

The cross-cut between the imperatives of growth and the imperatives of environmental management, represents a supreme test for modern industrial civilization. The test is whether we can devise very dynamic new strategies which will accommodate economic growth within a stabilized environmental framework.

That is an extreme demand to place upon technology. There is no real assurance that such a balance can in fact be struck. Nevertheless the effort must be made. And because of the urgency, scope and even the improbability of complete success in such an endeavor, I am strongly tempted to use a military term for a metaphor. To deal with the global environment, we will need the environmental equivalent of the Strategic Defense Initiative, a Strategic Environment Initiative.

I have been an opponent of the military SDI. But even opponents of SDI recognize this effort has been

A Strategic Environment Initiative

remarkably successful in drawing together previously disconnected government programs, in stimulating the development of new technologies, and in forcing upon us a wave of intense new analysis of subjects previously thought to have been exhausted.

We need the same kind of focus and intensity, and similar levels of funding, to deal comprehensively with global warming, stratospheric ozone depletion, species loss, deforestation, ocean pollution, acid rain, air and water, and groundwater pollution, and all of the problems degrading the world's environment. In every major sector of economic activity -- energy, agriculture, manufacturing, and transportation, for example -- a Strategic Environment Initiative must identify and then spread sets of increasingly effective new technologies: some that are already well in hand; some that need further work, though well understood in principle; and some that are revolutionary ideas whose very existence is now a matter of speculation.

Let me briefly illustrate:

Energy is the lifeblood of development. Unfortunately, today's most economical technologies for converting energy resources into usable forms of power (as in burning coal to make electricity) release a plethora of pollutants. An Energy SEI should focus on producing the energy of development without compromising the environment. Chief on the near-term list of alternatives are energy efficiency and conservation; on the mid-term list, solar power, possibly new-generation nuclear power, biomass (with no extraneous pollutants and a closed carbon cycle), as well as enhanced efficiency; and long-term, nuclear fusion, as well as enhanced versions of solar, biomass, and nuclear energy, and energy efficiency.

In agriculture, we have witnessed vast growth in Third World food production through the Green Revolution, but often that growth relied on heavily subsidized fertilizers, pesticides, irrigation, and overall mechanization, sometimes giving the advantage to rich farmers over poor ones. We need a second green revolution, to address the needs of the Third World's poor: a focus on increasing productivity from small farms on marginal land, with low-input agricultural methods.

These technologies, whose components are not only technological, but financial and political, may be the key to satisfying the land hunger of the disadvantaged and the desperate who are slashing daily into the rainforest of Amazonia -- leaving behind the depleted soil of their first homesteads. It may also be the key in the battle to arrest the desertification of sub-Saharan Africa, where human need and climate stress are now operating in a deadly partnership.

Fortunately, the next wave of agricultural improvements is almost upon us -- from biotechnology. In my view, we should carefully push forward work on new crop strains with genetic encoding that allows "natural" resistance to pests, disease, and droughts; not to mention improved yield. Of course, biotechnology will not completely solve the problems that arise from inadequate distribution of food supplies -- they are most often due to a failure of politics, not crops.

In addition, new industrial processes, new materials, and increased use of recycled materials, will all become important to "sustainable" development.

Needed in the U.S. probably more than anywhere, is a Transportation SEI focusing in the near term on improving the mileage standards of our vehicles, and encouraging and enabling Americans to drive less. In the mid-term, come questions of alternative fuels, such as biomass-based liquid fuels or electricity. And in the mid- and long-terms come the inescapable need for re-examining the entire structure of our transportation sector, and its inherent demand on the personal vehicle for efficient transport.

Funds to promote these research objectives could be drawn from very modest US energy taxes, eventually perhaps even a CO₂ tax, although that is not yet politically viable. The U.S. government should organize itself to finance the export of energy-efficient systems, and of renewable energy sources. That means preferential lending arrangements through the Export - Import Bank, and Overseas Private Investment Corporation.

Encouragement for the Third World should also come in the form of attractive international credit arrangements for energy efficient and en-

vironmentally sustainable processes. Funds for this lending stream would be generated by institutions such as the World Bank, which, in the course of debt swapping, might dedicate new funds to the purchase of environmentally sounder technologies.

Finally, the United States, other developers of new technology, and international lending institutions, should establish centers of training at locations around the world, to create a core of environmentally educated planners and technicians, in order to "make the ground fertile" for sowing environmentally attractive technologies and practices; an effort not unlike that which produced agricultural research centers throughout the world during the Green Revolution.

With this SEI, we must transform science and technology to make it more efficient, consume less of the earth's natural resources, and emphasize waste minimization, recycling, and the use of renewable resources in harmony with the natural world. We must start by quickly obtaining massive quantities of information about the global processes now underway -- through, for example, the Mission to Planet Earth program of NASA.

And we also must target first the most readily identifiable and correctable sources of environmental damage. Today, for example, I have introduced a new comprehensive legislative package to effectively halt chlorofluorocarbon, carbon tetrachloride, methyl chloroform, and halon emissions, and to promote development of technologies to replace those that now rely on CFCs. Earlier this year, I introduced the World Environment Policy Act of 1989, a far-ranging bill to address virtually every aspect of the global environmental crisis, including CFCs and CO₂.

In order to accomplish our goal we also must transform global politics, shifting from short-term concerns to long-term concerns, from conflict to cooperation.

The evidence of the last six months leads me to believe we have the capacity for this change. Just as the equilibrium of an environmental system can suddenly change from one state to another, the equilibrium of one political system can suddenly change from one state to another. We politi-

"... the solutions we seek will be found in a new faith in the future of life on earth after our own, a faith in the future which justifies sacrifices in the present, a new moral courage to choose higher values in the conduct of human affairs, and a new reverence for absolute principles that can serve as guiding stars by which to map the future course of our species and our place within creation."

cians are frequently adept at symbolic action, a pretense of change without the substance of change. And for that reason, my optimism is tempered by awareness of the power in the forces of greed and fear. But I do believe we have the capacity for what is needed -- because the challenge can now be accurately described in terms of national security.

Some may believe that the idea of the environment as a national security issue is just rhetoric. Most of us in this room, however, accept it as a statement of fact. But, we also know that just as the world has been living with the possibility of man-made disaster in the form of nuclear war, so it now lives with the growing threat of man-made disaster in the form of catastrophic environmental failure.

In many ways, it is the same basic dilemma. In each case, our survival was threatened at a basic, primal level -- the fear of death from attack by an enemy, the fear of death from running out of food. To each threat, we responded with more and more efficiency. The increasing sophistication of our technology has enabled us to confront each threat to our survival with a more powerful response. And in each case, the effort to secure our survival has instead threatened our survival.

Moreover, even if we are successful this time in meeting the needs of our survival and preserving the world environment, it probably won't be the last time we'll face this basic problem. Genetic engineering may pose the same dilemma all over again. In the effort to protect ourselves against disease, we're creating a new and more power-

ful technology that ultimately will confront us with the same historic challenge to human nature and the same hubristic relationship of our species to the limits nature has designed for us as part of the world ecological system.

As a result, it is hard to escape the conclusion that we must also transform ourselves -- or at least the way we think about ourselves, our children, and our future. This last transformation is the most essential, and yet the most difficult. If there is one cause for the prevailing pessimism about our ability to meet this unprecedented challenge, it is the belief by many that we are incapable of the change in thinking required.

And yet, there are precedents which give cause for realistic hope. Human sacrifice and slavery were both once commonplace in human societies, yet both are now obsolete. Our thinking was transformed. These changes, like most changes in global climate patterns, took place over a long period of time. But now, just as climate changes are telescoped into short periods of time, we must create in a single generation changes in human thinking of a magnitude comparable to the change that brought about the abolition of slavery. Yet once again, we must remind ourselves that the pattern of change required is visible only from a distance.

In this case, we cannot rely on science to give us a new point of view for it is partly responsible for the problem. In ways not yet fully understood, the scientific revolution itself changed the way we saw ourselves in relation to the world. We detached

ourselves from nature to examine the physical world. In a kind of Heisenberg Principle writ large, we altered -- without realizing it -- the nature of what we began to examine. The new pattern of thinking we must now create is one in which we once again see ourselves as a part of the ecological system in which we live. What we now lack is a sense of the proper location of our species in the ecosystem. We have lost our eco-librium.

How then can we gain sufficient distance from ourselves to see a pattern which contains ourselves in a larger context? My own religious faith teaches me that we are given dominion over the earth, but that we also are required to be good stewards of the earth. If we witness the destruction of half the living species God put on this earth during our lifetimes as a result of our actions, we will have failed in the responsibility of stewardship. Are those actions, because of their result, "evil"? The answer depends not upon the everyday nature of the actions, but upon our knowledge of their consequences. In an examination of Hitler's lieutenants, Hannah Arendt coined the memorable phrase "the banality of evil." The individual actions which collectively produce the world's environmental crisis are indeed banal when they are looked at one by one: the cutting of a tree, the air conditioning of a car.

"Evil," and "good" are terms not used frequently by politicians. But in my own view, this problem cannot be solved without reference to spiritual values found in every faith. For many scientists on the edge of new discoveries in cosmology and quantum physics, the reconciliation of science and religion sometimes now seems near at hand. It is a reconciliation not unlike the one we seek between man and nature.

But even without defining the problem in religious terms, it is possible to conclude that the solutions we seek will be found in a new faith in the future of life on earth after our own, a faith in the future which justifies sacrifices in the present, a new moral courage to choose higher values in the conduct of human affairs, and a new reverence for absolute principles that can serve as guiding stars by which to map the future course of our species and our place within creation. ■

The Global Environment: A National Security Issue

Keynote Address by
U.S. SEN. AL GORE, D-Tennessee
National Academy of Sciences
Forum on Global Climate Change
Washington, D.C.
May 1, 1989

Many of us have come to this gathering because of a shared belief that humankind has suddenly entered into a brand new relationship with the planet Earth, and that human civilization is, in its current pattern, causing grave and perhaps soon irreparable damage to the ecological system which supports life as we know it.

My purpose is to sound an alarm loudly and clearly -- of imminent and grave danger -- and to describe a strategy for confronting this crisis, with changes in our collective behavior and thinking which, if made, can forestall and prevent the horrendous prospect of an ecological collapse.

First, why is such an alarm necessary? Do we need a crisis before we can act?

Sometimes in human affairs a pattern is well set before its implications are felt in our daily lives. This is true both in politics and in science. When shattered glass filled the streets of Berlin on Kristallnacht, few could conceive of the holocaust to follow. But from a distance, the pattern is now clear. When the first atom was split, few could conceive of nuclear bombs. But when Einstein wrote Roosevelt, the pattern was clear.

How much information is needed by the human mind to recognize a pattern? How much more is needed by the body politic to justify action in response?

It took a long time for the world to respond to Hitler. Because of Hitler, it took only a short time for Roosevelt to respond to Einstein.

In a classic experiment often cited, a frog dropped into a pot of boiling water quickly jumps out. But the same frog, put in the water before it is slowly heated, will remain in place until it is boiled.

The meaning of a pattern is conveyed by contrast as opposed to sameness. Sameness lulls the senses and conveys an absence of danger. Gradual change sometimes resembles sameness, obscuring danger from minds which reserve their alertness for sharp contrasts. Exponential change at first resembles sameness, then gradual change, then explosive contrast.

It is often hard to recognize the shape of an exponential curve before it reaches the explosive stage. It is difficult because the contrast essential to understanding very large patterns is sometimes visible only from a distance.

If an individual or a nation is accustomed to looking at the future one year at a time, and the past in terms of a single lifetime, then many large patterns are concealed. If a political body looks at policies in the context of a single nation, then the global impacts will remain invisible.

When you consider the relationship of the human species to the planet Earth, not much change is visible in a single year, in a single nation. Yet, if you look at the entire pattern of that relationship from the emergence of the species until today, May Day 1989, a distinctive contrast in very recent times clearly conveys the danger to which we must

respond. It took ten thousand human lifetimes for the population to reach two billion. Now, in the course of a single human lifetime -- mine and yours -- it is rocketing from two billion toward ten billion, and is already halfway there.

Startling graphs showing the loss of forest land, topsoil, stratospheric ozone, and species all follow the same pattern of sudden, unprecedented acceleration in the latter half of the 20th century. And yet, so far, the pattern of our politics remains remarkably unchanged.

The earth's forests are being destroyed at the rate of one football field's worth every second, one Tennessee's worth every year. An enormous hole is opening in the ozone layer, reducing the earth's ability to protect life from deadly ultraviolet radiation. Living species die at such an unprecedented rate that more than half may disappear within our lifetimes. Chemical wastes, in growing volumes, seep downward to poison groundwater and upward to destroy the atmosphere's delicate balance. Huge quantities of carbon dioxide, methane, and chlorofluorocarbons dumped in the atmosphere are trapping heat and raising global temperatures.

In 1987, carbon dioxide levels in the atmosphere began to surge with record annual increases. Global temperatures are also climbing: 1987 was the second hottest year on record; 1988 was the hottest. Scientists now predict our current course may raise world temperatures almost five degrees Celsius in the lifetimes of people in this room. The last time there was such a shift, it was five degrees colder: New York City was under one kilometer of ice. If five degrees colder over thousands of years produces an ice age, what could five degrees warmer produce in one lifetime?

Why are these dramatic changes taking place? Because the human population is surging, because the industrial, scientific, and technological revolutions magnify the environmental impact of these increases, and because we tolerate self-destructive behavior and environmental vandalism on a global scale.

"How much information is needed by the human mind to recognize a pattern? How much more is needed by the body politic to justify action in response?"

The problem in organizing our response is that the worst effects seem far off in the future, and they are so unprecedented they seem to defy common sense. While right now, in the present, millions of people are suffering in poverty and dying of starvation, warfare, and preventable diseases. How do we deal with these immediate problems and at the same time confront the problems of the future? One of the philosophers of the environmental movement, Ivan Illich, in a recent interview, explained the sudden environmental activism of Margaret Thatcher, Mikhail Gorbachev, and other world leaders previously uninterested in the global environment by saying "what has changed is that our common sense has begun searching for a language to speak about the shadow our future throws."

Science already has such a language. Have you ever seen the picture showing how time and space are

shaped by mass, with a black hole pictured as a deep well in a grid, with the space and time around the well sloping toward it? Human political awareness is shaped by history in precisely that way. Our political awareness of the world is shaped and bent by events. Large events like World War II exert a powerful gravitational pull on every idea we have about the world around us. The Holocaust shapes every idea we have about human nature.

And just as in Einstein's theory, future events can exert the same gravitational pull on our thinking as events in the past -- even though the events in the future have not yet occurred.

Time is relative in politics as in science. The political will which made possible the mass political protests against escalating the nuclear arms race came from awareness of a downslope toward a future we did not want to see. Many felt us being pulled toward a

nuclear war that would crush human history forever into a black hole. We are now changing our course away from that downslope, we hope, and taking a new direction -- even though 99.99% of all human beings on earth have never seen, heard, or personally felt nuclear destruction. The awareness of that potential future event came from political communication, with abstract symbols, like words.

Now, throughout the world, we are witnessing the emergence of a new political will to take a different course in order to avoid the slope toward global environmental destruction. We see the catastrophe coming, we hear Rachel Carson's Silent Spring. The slope seemed gradual at first but now it is steep. We feel strongly pulled toward ecological collapse by the policies we are now pursuing.

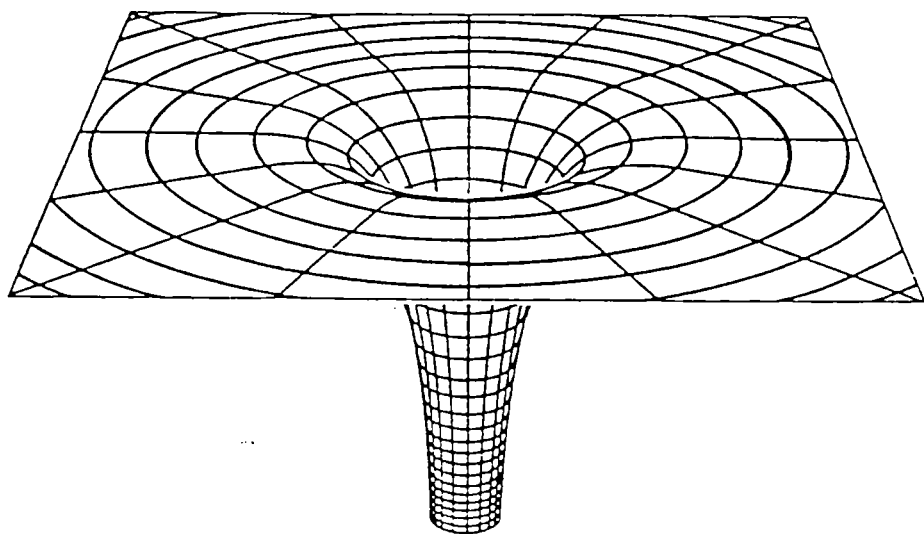
I personally became deeply involved in the effort to avoid a nuclear holocaust nine years ago because I felt the slope toward that horrendous possibility. And I tried to bring to the task the skills of my profession. I believe all this talk about the global environment as a national security issue makes a great deal of sense in political terms.

For the past 13 years, as a citizen and as a member of the United States Congress, I have had long-standing interests in both the environmental threat and in national security. As a practical matter, I have dealt with these subjects as separate intellectual accounts: involving distinct areas of public policy, each with its own completely different set of concerns and participants.

Yet, they grow more and more alike. National security comprises matters that directly and imminently menace the interests of the state, or the welfare of the people. As such, these issues command the attention of political leaders at the highest level, with a proportionate claim on the resources of government and the wealth of the nation. If society were an organism, national security would involve the instinct for survival.

To this point, the national security agenda has been dominated by issues of military security, embedded in the context of global struggle between the United States and the Soviet Union: a struggle which the protagonists have often waged through distant surrogates, but which has always harbored the risk of direct confrontation and nuclear war.

Given the changes in Soviet behavior which have begun under Gorbachev, there is growing optimism that



"Have you ever seen the picture showing how time and space are shaped by mass, with a black hole pictured as a deep well in a grid, with the space and time around the well sloping toward it? Human political awareness is shaped by history in precisely that way. Our political awareness of the world is shaped and bent by events."

Restoring Eco-librium

this long, dark period may be passing. There is also hope this will open the international agenda for other urgent matters and for the release of enormous resources, now committed to war, toward other objectives.

Many hope that the global environment will be the new Dominant Issue. They assert that a collective, international struggle for stability in the ecosystem will succeed the old pattern of national struggle for temporal power, and will justify the preemption of enormous resources, and reshape the public consciousness in support of another long, global struggle.

I am deeply in sympathy with this view, and yet as someone who has worked hard on both issues, I believe the analogy must be used very cautiously. The US-Soviet struggle has lasted almost half a century, consumed several trillions of dollars, cost us close to one hundred thousand American lives in Korea and Vietnam, and has profoundly shaped the psychological and social consciousness of our people. Much the same could be said of the Soviets, who, if anything, have endured far more than have we for the sake of their ideology.

Nothing is automatic or foreordained about the course of US-Soviet relations, no matter how many editorial writers now claim the "Cold War is Over." Nothing relieves us of our present responsibilities for defense or of the need to conduct painstaking negotiations to limit arms and reduce the risk of war. The old agenda is with us still, exacting its price in wealth, creativity and the attention of statesmen.

And yet, the environmentalists are right.

Certainly, there is strong evidence the new enemy is at least as real as the old. For the general public, the shocking images of last year's drought, or of beaches covered with medical garbage, inspired a sense of peril once sparked only by Soviet behavior. But for environmental specialists, the steady flow of data from scientific investigation of the environment -- often ambiguous, but always menacing -- is eerily equivalent to intelligence collection against the more familiar Soviet threat. The U2 spy plane, for example, now is used to monitor not missile silos but ozone depletion.

Already, we are seeing governments struggling to resolve issues whose domains go far beyond anything in our experience. Debate over the disposition of radioactive wastes, for example, involves choices that must remain valid across geological time. The species now disappearing at an unprecedented rate will never return. The global climate pattern could shift to a new equilibrium and never regain its former pattern.

In the not distant future, there will be a new "sacred agenda" in international affairs: policies that enable the rescue of the global environment. This task will one day join, and then perhaps even supplant, preventing the world's incineration through nuclear war, as the principal test of statecraft.

However, in thinking about environmentalism as a national security concern, it is important to differentiate between what would -- in military jargon -- be called the level of threat. Certain environmental problems may be important but are essentially local; others cross borders, and in effect represent theaters of operations; and still others are global and strategic in nature.

On this scale, even phenomena as important as the slow suffocation of Mexico City, the deaths of northern forests in America and Europe, or even the desertification of large areas of Africa, will likely not be regarded as full scale national security issues.

However, the greenhouse effect and stratospheric ozone depletion fit the profile of national security issues of global significance. These phenomena certainly will in time produce effects big enough to threaten international order, even at the level of war and peace. In the case of global warming,

the fact that some of the worst effects will not fully manifest themselves until the middle of the next century is offset by the fact that actions we take now will determine the extent of the damage later.

When nations perceive that they are threatened at the strategic level, they may be induced to think of drastic responses, involving sharp discontinuities from everyday approaches to policy. In military terms, this is the point when the United States begins to think of invoking nuclear weapons. The global environment may well involve responses that are, in comparative terms, just as radical. Not just business as usual, not just incremental variations but massive departures from the norm.

Nuclear war is an apocalyptic subject, and so is global environmental destruction. We are dealing here with increasingly credible forecasts of climatic dislocations, vast changes in growing cycles, inundations of coastal areas and the loss to the sea of vast territories -- some of them very heavily developed and populated. We also are dealing not only with a threat to human health, but unpredictable and potentially vast changes to all life at the surface of the earth and the seas, as the result of prolonged exposure to increased ultra-violet radiation.

What's more, despite some progress made toward limiting some sources of the problem, such as CFCs, we have to face the stark fact that we have barely scratched the surface. Even if all other elements of the problem are solved, a major threat is still posed by emissions of carbon dioxide, the exhaling breath of the industrial culture upon which our civilization rests. The implications of the latest and best studies on this matter are staggering. We must be honest about them. Essentially, they tell us that with our current pattern of tech-

"In the not distant future, there will be a new 'sacred agenda' in international affairs: policies that enable the rescue of the global environment. This task will one day join, and then perhaps even supplant, preventing the world's incineration through nuclear war as the principal test of statecraft."

"Nuclear war is an apocalyptic subject, and so is global environmental destruction. We are dealing here with increasingly credible forecasts of climatic dislocations, vast changes in growing cycles, innundations of coastal areas and the loss to the sea of vast territories -- some of them very heavily developed and populated."

nology and production, we face a Hobson's Choice between economic growth in the near term, and massive environmental disorder as the subsequent penalty.

This central fact cuts across the face of all environmental strategies as we generally think of them. It suggests that the notion of environmentally sustainable development at present may be an oxymoron, rather than a realistic objective. It declares war, in effect, on routine life in the advanced industrial societies. And -- central to the outcome of the entire struggle to restore global environmental balance -- it declares war on the Third World.

The Third World does not have a choice about whether or not it will develop economically. If it does not develop economically, poverty, hunger and disease will consume entire populations. And long before that, whole societies will experience revolutionary political disorder. Rapid economic growth is a life-or-death imperative throughout the Third World. The peoples and governments of the Third World will not be denied that hope, no matter the longer-term costs for the global environment.

And why should they accept what we, manifestly, will not accept for ourselves? Who is so bold as to say that any nation in the developed world is prepared to abandon industrial and economic growth? Who will proclaim that any nation in the developed world will accept even serious compromises in levels of comfort, for the sake of global environmental balance? And who will apportion these sacrifices; who will then bear them?

Development, of course, is part of

the problem as well as the solution. We know that, just as we know that nuclear deterrence depends on the weapons we are trying to render obsolete.

The effort to solve the nuclear arms race has been complicated not only by simplistic stereotypes of the enemy and the threat he poses. It also has been complicated by simplistic demands for immediate unilateral disarmament, without any basis for a widely shared confidence that the original threat is no longer real.

My own belief is that perceptions must evolve simultaneously in both superpowers as technology evolves simultaneously in both countries, as conscious efforts are made to improve information about the other, about the nature of the threat, and the confidence we can summon that the threat is in fact changing and receding.

In similar fashion, the effort to solve the global environmental crisis will be complicated not only by blind assertions that more and more environmental manipulation and more and more resource extraction are essential for economic growth. It will also be complicated by the emergence of simplistic demands that development, or technology itself, must be stopped for the problem to be solved. This is a crisis of confidence which must be addressed.

This speech, if you'll permit me a personal moment, is the first time I've spoken in public on any subject in six weeks. My wife and I have been in Johns Hopkins Hospital, at the bedside of our son, who was hit by an automobile. I've been living in the world of medical science, pursuing the

goal of restoring our son to health. Ten years ago, a child with his injuries would have had several surgical interventions which doctors now realize are unwise, given the greater likelihood of the body healing itself where some injuries are concerned.

Yet, two days after the accident, when doctors were unable to stabilize internal bleeding, my wife and I naively hoped that same natural healing process would take care of that problem and make any surgery unnecessary. If the doctor had relied not on science but on us, we would have unwisely urged against an operation. But doctors have acquired sufficient knowledge to realize that the body should be allowed to heal itself when it can do so. At the same time, they know there are some instances where intervention is essential to save life.

Similarly, we must acquire sufficient knowledge of the earth's system to judge when it can heal itself, and when it is necessary for us to intervene. For example, when 40,000 children die of disease and starvation every 24 hours, we obviously must intervene. But it is past time to recognize that many of society's interventions in the environment have been and are unwise. Much ecological destruction is subsidized by governments. We need more knowledge, more experience, and the kind of sensitive judgments that modern doctors have learned to make.

The cross-cut between the imperatives of growth and the imperatives of environmental management, represents a supreme test for modern industrial civilization. The test is whether we can devise very dynamic new strategies which will accommodate economic growth within a stabilized environmental framework.

That is an extreme demand to place upon technology. There is no real assurance that such a balance can in fact be struck. Nevertheless the effort must be made. And because of the urgency, scope and even the improbability of complete success in such an endeavor, I am strongly tempted to use a military term for a metaphor. To deal with the global environment, we will need the environmental equivalent of the Strategic Defense Initiative, a Strategic Environment Initiative.

I have been an opponent of the military SDI. But even opponents of SDI recognize this effort has been

A Strategic Environment Initiative

remarkably successful in drawing together previously disconnected government programs, in stimulating the development of new technologies, and in forcing upon us a wave of intense new analysis of subjects previously thought to have been exhausted.

We need the same kind of focus and intensity, and similar levels of funding, to deal comprehensively with global warming, stratospheric ozone depletion, species loss, deforestation, ocean pollution, acid rain, air and water, and groundwater pollution, and all of the problems degrading the world's environment. In every major sector of economic activity -- energy, agriculture, manufacturing, and transportation, for example -- a Strategic Environment Initiative must identify and then spread sets of increasingly effective new technologies: some that are already well in hand; some that need further work, though well understood in principle; and some that are revolutionary ideas whose very existence is now a matter of speculation.

Let me briefly illustrate:

Energy is the lifeblood of development. Unfortunately, today's most economical technologies for converting energy resources into usable forms of power (as in burning coal to make electricity) release a plethora of pollutants. An Energy SEI should focus on producing the energy of development without compromising the environment. Chief on the near-term list of alternatives are energy efficiency and conservation; on the mid-term list, solar power, possibly new-generation nuclear power, biomass (with no extraneous pollutants and a closed carbon cycle), as well as enhanced efficiency; and long-term, nuclear fusion, as well as enhanced versions of solar, biomass, and nuclear energy, and energy efficiency.

In agriculture, we have witnessed vast growth in Third World food production through the Green Revolution, but often that growth relied on heavily subsidized fertilizers, pesticides, irrigation, and overall mechanization, sometimes giving the advantage to rich farmers over poor ones. We need a second green revolution, to address the needs of the Third World's poor: a focus on increasing productivity from small farms on marginal land, with low-input agricultural methods.

These technologies, whose components are not only technological, but financial and political, may be the key to satisfying the land hunger of the disadvantaged and the desperate who are slashing daily into the rainforest of Amazonia -- leaving behind the depleted soil of their first homesteads. It may also be the key in the battle to arrest the desertification of sub-Saharan Africa, where human need and climate stress are now operating in a deadly partnership.

Fortunately, the next wave of agricultural improvements is almost upon us -- from biotechnology. In my view, we should carefully push forward work on new crop strains with genetic encoding that allows "natural" resistance to pests, disease, and droughts; not to mention improved yield. Of course, biotechnology will not completely solve the problems that arise from inadequate distribution of food supplies -- they are most often due to a failure of politics, not crops.

In addition, new industrial processes, new materials, and increased use of recycled materials, will all become important to "sustainable" development.

Needed in the U.S. probably more than anywhere, is a Transportation SEI focusing in the near term on improving the mileage standards of our vehicles, and encouraging and enabling Americans to drive less. In the mid-term, come questions of alternative fuels, such as biomass-based liquid fuels or electricity. And in the mid- and long-terms come the inescapable need for re-examining the entire structure of our transportation sector, and its inherent demand on the personal vehicle for efficient transport.

Funds to promote these research objectives could be drawn from very modest US energy taxes, eventually perhaps even a CO₂ tax, although that is not yet politically viable. The U.S. government should organize itself to finance the export of energy-efficient systems, and of renewable energy sources. That means preferential lending arrangements through the Export - Import Bank, and Overseas Private Investment Corporation.

Encouragement for the Third World should also come in the form of attractive international credit arrangements for energy efficient and en-

vironmentally sustainable processes. Funds for this lending stream would be generated by institutions such as the World Bank, which, in the course of debt swapping, might dedicate new funds to the purchase of environmentally sounder technologies.

Finally, the United States, other developers of new technology, and international lending institutions, should establish centers of training at locations around the world, to create a core of environmentally educated planners and technicians, in order to "make the ground fertile" for sowing environmentally attractive technologies and practices; an effort not unlike that which produced agricultural research centers throughout the world during the Green Revolution.

With this SEI, we must transform science and technology to make it more efficient, consume less of the earth's natural resources, and emphasize waste minimization, recycling, and the use of renewable resources in harmony with the natural world. We must start by quickly obtaining massive quantities of information about the global processes now underway -- through, for example, the Mission to Planet Earth program of NASA.

And we also must target first the most readily identifiable and correctable sources of environmental damage. Today, for example, I have introduced a new comprehensive legislative package to effectively halt chlorofluorocarbon, carbon tetrachloride, methyl chloroform, and halon emissions, and to promote development of technologies to replace those that now rely on CFCs. Earlier this year, I introduced the World Environment Policy Act of 1989, a far-ranging bill to address virtually every aspect of the global environmental crisis, including CFCs and CO₂.

In order to accomplish our goal we also must transform global politics, shifting from short-term concerns to long-term concerns, from conflict to cooperation.

The evidence of the last six months leads me to believe we have the capacity for this change. Just as the equilibrium of an environmental system can suddenly change from one state to another, the equilibrium of one political system can suddenly change from one state to another. We politi-

"... the solutions we seek will be found in a new faith in the future of life on earth after our own, a faith in the future which justifies sacrifices in the present, a new moral courage to choose higher values in the conduct of human affairs, and a new reverence for absolute principles that can serve as guiding stars by which to map the future course of our species and our place within creation."

cians are frequently adept at symbolic action, a pretense of change without the substance of change. And for that reason, my optimism is tempered by awareness of the power in the forces of greed and fear. But I do believe we have the capacity for what is needed -- because the challenge can now be accurately described in terms of national security.

Some may believe that the idea of the environment as a national security issue is just rhetoric. Most of us in this room, however, accept it as a statement of fact. But, we also know that just as the world has been living with the possibility of man-made disaster in the form of nuclear war, so it now lives with the growing threat of man-made disaster in the form of catastrophic environmental failure.

In many ways, it is the same basic dilemma. In each case, our survival was threatened at a basic, primal level -- the fear of death from attack by an enemy, the fear of death from running out of food. To each threat, we responded with more and more efficiency. The increasing sophistication of our technology has enabled us to confront each threat to our survival with a more powerful response. And in each case, the effort to secure our survival has instead threatened our survival.

Moreover, even if we are successful this time in meeting the needs of our survival and preserving the world environment, it probably won't be the last time we'll face this basic problem. Genetic engineering may pose the same dilemma all over again. In the effort to protect ourselves against disease, we're creating a new and more power-

ful technology that ultimately will confront us with the same historic challenge to human nature and the same hubristic relationship of our species to the limits nature has designed for us as part of the world ecological system.

As a result, it is hard to escape the conclusion that we must also transform ourselves -- or at least the way we think about ourselves, our children, and our future. This last transformation is the most essential, and yet the most difficult. If there is one cause for the prevailing pessimism about our ability to meet this unprecedented challenge, it is the belief by many that we are incapable of the change in thinking required.

And yet, there are precedents which give cause for realistic hope. Human sacrifice and slavery were both once commonplace in human societies, yet both are now obsolete. Our thinking was transformed. These changes, like most changes in global climate patterns, took place over a long period of time. But now, just as climate changes are telescoped into short periods of time, we must create in a single generation changes in human thinking of a magnitude comparable to the change that brought about the abolition of slavery. Yet once again, we must remind ourselves that the pattern of change required is visible only from a distance.

In this case, we cannot rely on science to give us a new point of view for it is partly responsible for the problem. In ways not yet fully understood, the scientific revolution itself changed the way we saw ourselves in relation to the world. We detached

ourselves from nature to examine the physical world. In a kind of Heisenberg Principle writ large, we altered -- without realizing it -- the nature of what we began to examine. The new pattern of thinking we must now create is one in which we once again see ourselves as a part of the ecological system in which we live. What we now lack is a sense of the proper location of our species in the ecosystem. We have lost our eco-librium.

How then can we gain sufficient distance from ourselves to see a pattern which contains ourselves in a larger context? My own religious faith teaches me that we are given dominion over the earth, but that we also are required to be good stewards of the earth. If we witness the destruction of half the living species God put on this earth during our lifetimes as a result of our actions, we will have failed in the responsibility of stewardship. Are those actions, because of their result, "evil"? The answer depends not upon the everyday nature of the actions, but upon our knowledge of their consequences. In an examination of Hitler's lieutenants, Hannah Arendt coined the memorable phrase "the banality of evil." The individual actions which collectively produce the world's environmental crisis are indeed banal when they are looked at one by one: the cutting of a tree, the air conditioning of a car.

"Evil," and "good" are terms not used frequently by politicians. But in my own view, this problem cannot be solved without reference to spiritual values found in every faith. For many scientists on the edge of new discoveries in cosmology and quantum physics, the reconciliation of science and religion sometimes now seems near at hand. It is a reconciliation not unlike the one we seek between man and nature.

But even without defining the problem in religious terms, it is possible to conclude that the solutions we seek will be found in a new faith in the future of life on earth after our own, a faith in the future which justifies sacrifices in the present, a new moral courage to choose higher values in the conduct of human affairs, and a new reverence for absolute principles that can serve as guiding stars by which to map the future course of our species and our place within creation. ■

The Global Environment: A National Security Issue

Keynote Address by
U.S. SEN. AL GORE, D-Tennessee
National Academy of Sciences
Forum on Global Climate Change
Washington, D.C.
May 1, 1989

Many of us have come to this gathering because of a shared belief that humankind has suddenly entered into a brand new relationship with the planet Earth, and that human civilization is, in its current pattern, causing grave and perhaps soon irreparable damage to the ecological system which supports life as we know it.

My purpose is to sound an alarm loudly and clearly -- of imminent and grave danger -- and to describe a strategy for confronting this crisis, with changes in our collective behavior and thinking which, if made, can forestall and prevent the horrendous prospect of an ecological collapse.

First, why is such an alarm necessary? Do we need a crisis before we can act?

Sometimes in human affairs a pattern is well set before its implications are felt in our daily lives. This is true both in politics and in science. When shattered glass filled the streets of Berlin on Kristallnacht, few could conceive of the holocaust to follow. But from a distance, the pattern is now clear. When the first atom was split, few could conceive of nuclear bombs. But when Einstein wrote Roosevelt, the pattern was clear.

How much information is needed by the human mind to recognize a pattern? How much more is needed by the body politic to justify action in response?

It took a long time for the world to respond to Hitler. Because of Hitler, it took only a short time for Roosevelt to respond to Einstein.

In a classic experiment often cited, a frog dropped into a pot of boiling water quickly jumps out. But the same frog, put in the water before it is slowly heated, will remain in place until it is boiled.

The meaning of a pattern is conveyed by contrast as opposed to sameness. Sameness lulls the senses and conveys an absence of danger. Gradual change sometimes resembles sameness, obscuring danger from minds which reserve their alertness for sharp contrasts. Exponential change at first resembles sameness, then gradual change, then explosive contrast.

It is often hard to recognize the shape of an exponential curve before it reaches the explosive stage. It is difficult because the contrast essential to understanding very large patterns is sometimes visible only from a distance.

If an individual or a nation is accustomed to looking at the future one year at a time, and the past in terms of a single lifetime, then many large patterns are concealed. If a political body looks at policies in the context of a single nation, then the global impacts will remain invisible.

When you consider the relationship of the human species to the planet Earth, not much change is visible in a single year, in a single nation. Yet, if you look at the entire pattern of that relationship from the emergence of the species until today, May Day 1989, a distinctive contrast in very recent times clearly conveys the danger to which we must

respond. It took ten thousand human lifetimes for the population to reach two billion. Now, in the course of a single human lifetime -- mine and yours -- it is rocketing from two billion toward ten billion, and is already halfway there.

Startling graphs showing the loss of forest land, topsoil, stratospheric ozone, and species all follow the same pattern of sudden, unprecedented acceleration in the latter half of the 20th century. And yet, so far, the pattern of our politics remains remarkably unchanged.

The earth's forests are being destroyed at the rate of one football field's worth every second, one Tennessee's worth every year. An enormous hole is opening in the ozone layer, reducing the earth's ability to protect life from deadly ultraviolet radiation. Living species die at such an unprecedented rate that more than half may disappear within our lifetimes. Chemical wastes, in growing volumes, seep downward to poison groundwater and upward to destroy the atmosphere's delicate balance. Huge quantities of carbon dioxide, methane, and chlorofluorocarbons dumped in the atmosphere are trapping heat and raising global temperatures.

In 1987, carbon dioxide levels in the atmosphere began to surge with record annual increases. Global temperatures are also climbing: 1987 was the second hottest year on record; 1988 was the hottest. Scientists now predict our current course may raise world temperatures almost five degrees Celsius in the lifetimes of people in this room. The last time there was such a shift, it was five degrees colder: New York City was under one kilometer of ice. If five degrees colder over thousands of years produces an ice age, what could five degrees warmer produce in one lifetime?

Why are these dramatic changes taking place? Because the human population is surging, because the industrial, scientific, and technological revolutions magnify the environmental impact of these increases, and because we tolerate self-destructive behavior and environmental vandalism on a global scale.

"How much information is needed by the human mind to recognize a pattern? How much more is needed by the body politic to justify action in response?"

The problem in organizing our response is that the worst effects seem far off in the future, and they are so unprecedented they seem to defy common sense. While right now, in the present, millions of people are suffering in poverty and dying of starvation, warfare, and preventable diseases. How do we deal with these immediate problems and at the same time confront the problems of the future? One of the philosophers of the environmental movement, Ivan Illich, in a recent interview, explained the sudden environmental activism of Margaret Thatcher, Mikhail Gorbachev, and other world leaders previously uninterested in the global environment by saying "what has changed is that our common sense has begun searching for a language to speak about the shadow our future throws."

Science already has such a language. Have you ever seen the picture showing how time and space are

shaped by mass, with a black hole pictured as a deep well in a grid, with the space and time around the well sloping toward it? Human political awareness is shaped by history in precisely that way. Our political awareness of the world is shaped and bent by events. Large events like World War II exert a powerful gravitational pull on every idea we have about the world around us. The Holocaust shapes every idea we have about human nature.

And just as in Einstein's theory, future events can exert the same gravitational pull on our thinking as events in the past -- even though the events in the future have not yet occurred.

Time is relative in politics as in science. The political will which made possible the mass political protests against escalating the nuclear arms race came from awareness of a downslope toward a future we did not want to see. Many felt us being pulled toward a

nuclear war that would crush human history forever into a black hole. We are now changing our course away from that downslope, we hope, and taking a new direction -- even though 99.99% of all human beings on earth have never seen, heard, or personally felt nuclear destruction. The awareness of that potential future event came from political communication, with abstract symbols, like words.

Now, throughout the world, we are witnessing the emergence of a new political will to take a different course in order to avoid the slope toward global environmental destruction. We see the catastrophe coming, we hear Rachel Carson's Silent Spring. The slope seemed gradual at first but now it is steep. We feel strongly pulled toward ecological collapse by the policies we are now pursuing.

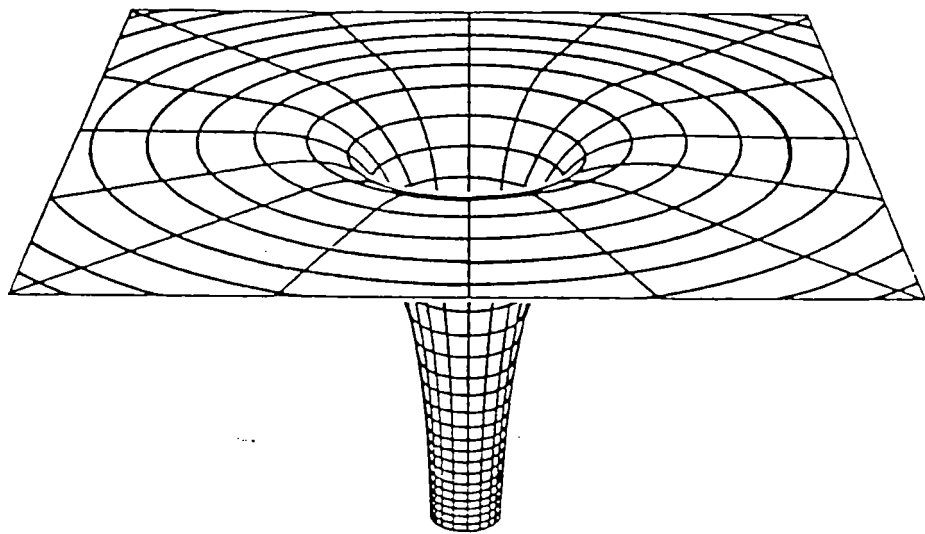
I personally became deeply involved in the effort to avoid a nuclear holocaust nine years ago because I felt the slope toward that horrendous possibility. And I tried to bring to the task the skills of my profession. I believe all this talk about the global environment as a national security issue makes a great deal of sense in political terms.

For the past 13 years, as a citizen and as a member of the United States Congress, I have had long-standing interests in both the environmental threat and in national security. As a practical matter, I have dealt with these subjects as separate intellectual accounts: involving distinct areas of public policy, each with its own completely different set of concerns and participants.

Yet, they grow more and more alike. National security comprises matters that directly and imminently menace the interests of the state, or the welfare of the people. As such, these issues command the attention of political leaders at the highest level, with a proportionate claim on the resources of government and the wealth of the nation. If society were an organism, national security would involve the instinct for survival.

To this point, the national security agenda has been dominated by issues of military security, embedded in the context of global struggle between the United States and the Soviet Union: a struggle which the protagonists have often waged through distant surrogates, but which has always harbored the risk of direct confrontation and nuclear war.

Given the changes in Soviet behavior which have begun under Gorbachev, there is growing optimism that



"Have you ever seen the picture showing how time and space are shaped by mass, with a black hole pictured as a deep well in a grid, with the space and time around the well sloping toward it? Human political awareness is shaped by history in precisely that way. Our political awareness of the world is shaped and bent by events."

Restoring Eco-librium

this long, dark period may be passing. There is also hope this will open the international agenda for other urgent matters and for the release of enormous resources, now committed to war, toward other objectives.

Many hope that the global environment will be the new Dominant Issue. They assert that a collective, international struggle for stability in the ecosystem will succeed the old pattern of national struggle for temporal power, and will justify the preemption of enormous resources, and reshape the public consciousness in support of another long, global struggle.

I am deeply in sympathy with this view, and yet as someone who has worked hard on both issues, I believe the analogy must be used very cautiously. The US-Soviet struggle has lasted almost half a century, consumed several trillions of dollars, cost us close to one hundred thousand American lives in Korea and Vietnam, and has profoundly shaped the psychological and social consciousness of our people. Much the same could be said of the Soviets, who, if anything, have endured far more than have we for the sake of their ideology.

Nothing is automatic or foreordained about the course of US-Soviet relations, no matter how many editorial writers now claim the "Cold War is Over." Nothing relieves us of our present responsibilities for defense or of the need to conduct painstaking negotiations to limit arms and reduce the risk of war. The old agenda is with us still, exacting its price in wealth, creativity and the attention of statesmen.

And yet, the environmentalists are right.

Certainly, there is strong evidence the new enemy is at least as real as the old. For the general public, the shocking images of last year's drought, or of beaches covered with medical garbage, inspired a sense of peril once sparked only by Soviet behavior. But for environmental specialists, the steady flow of data from scientific investigation of the environment -- often ambiguous, but always menacing -- is eerily equivalent to intelligence collection against the more familiar Soviet threat. The U2 spy plane, for example, now is used to monitor not missile silos but ozone depletion.

Already, we are seeing governments struggling to resolve issues whose domains go far beyond anything in our experience. Debate over the disposition of radioactive wastes, for example, involves choices that must remain valid across geological time. The species now disappearing at an unprecedented rate will never return. The global climate pattern could shift to a new equilibrium and never regain its former pattern.

In the not distant future, there will be a new "sacred agenda" in international affairs: policies that enable the rescue of the global environment. This task will one day join, and then perhaps even supplant, preventing the world's incineration through nuclear war, as the principal test of statecraft.

However, in thinking about environmentalism as a national security concern, it is important to differentiate between what would -- in military jargon -- be called the level of threat. Certain environmental problems may be important but are essentially local; others cross borders, and in effect represent theaters of operations; and still others are global and strategic in nature.

On this scale, even phenomena as important as the slow suffocation of Mexico City, the deaths of northern forests in America and Europe, or even the desertification of large areas of Africa, will likely not be regarded as full scale national security issues.

However, the greenhouse effect and stratospheric ozone depletion fit the profile of national security issues of global significance. These phenomena certainly will in time produce effects big enough to threaten international order, even at the level of war and peace. In the case of global warming,

the fact that some of the worst effects will not fully manifest themselves until the middle of the next century is offset by the fact that actions we take now will determine the extent of the damage later.

When nations perceive that they are threatened at the strategic level, they may be induced to think of drastic responses, involving sharp discontinuities from everyday approaches to policy. In military terms, this is the point when the United States begins to think of invoking nuclear weapons. The global environment may well involve responses that are, in comparative terms, just as radical. Not just business as usual, not just incremental variations but massive departures from the norm.

Nuclear war is an apocalyptic subject, and so is global environmental destruction. We are dealing here with increasingly credible forecasts of climatic dislocations, vast changes in growing cycles, inundations of coastal areas and the loss to the sea of vast territories -- some of them very heavily developed and populated. We also are dealing not only with a threat to human health, but unpredictable and potentially vast changes to all life at the surface of the earth and the seas, as the result of prolonged exposure to increased ultra-violet radiation.

What's more, despite some progress made toward limiting some sources of the problem, such as CFCs, we have to face the stark fact that we have barely scratched the surface. Even if all other elements of the problem are solved, a major threat is still posed by emissions of carbon dioxide, the exhaling breath of the industrial culture upon which our civilization rests. The implications of the latest and best studies on this matter are staggering. We must be honest about them. Essentially, they tell us that with our current pattern of tech-

"In the not distant future, there will be a new 'sacred agenda' in international affairs: policies that enable the rescue of the global environment. This task will one day join, and then perhaps even supplant, preventing the world's incineration through nuclear war as the principal test of statecraft."

"Nuclear war is an apocalyptic subject, and so is global environmental destruction. We are dealing here with increasingly credible forecasts of climatic dislocations, vast changes in growing cycles, innundations of coastal areas and the loss to the sea of vast territories -- some of them very heavily developed and populated."

nology and production, we face a Hobson's Choice between economic growth in the near term, and massive environmental disorder as the subsequent penalty.

This central fact cuts across the face of all environmental strategies as we generally think of them. It suggests that the notion of environmentally sustainable development at present may be an oxymoron, rather than a realistic objective. It declares war, in effect, on routine life in the advanced industrial societies. And -- central to the outcome of the entire struggle to restore global environmental balance -- it declares war on the Third World.

The Third World does not have a choice about whether or not it will develop economically. If it does not develop economically, poverty, hunger and disease will consume entire populations. And long before that, whole societies will experience revolutionary political disorder. Rapid economic growth is a life-or-death imperative throughout the Third World. The peoples and governments of the Third World will not be denied that hope, no matter the longer-term costs for the global environment.

And why should they accept what we, manifestly, will not accept for ourselves? Who is so bold as to say that any nation in the developed world is prepared to abandon industrial and economic growth? Who will proclaim that any nation in the developed world will accept even serious compromises in levels of comfort, for the sake of global environmental balance? And who will apportion these sacrifices; who will then bear them?

Development, of course, is part of

the problem as well as the solution. We know that, just as we know that nuclear deterrence depends on the weapons we are trying to render obsolete.

The effort to solve the nuclear arms race has been complicated not only by simplistic stereotypes of the enemy and the threat he poses. It also has been complicated by simplistic demands for immediate unilateral disarmament, without any basis for a widely shared confidence that the original threat is no longer real.

My own belief is that perceptions must evolve simultaneously in both superpowers as technology evolves simultaneously in both countries, as conscious efforts are made to improve information about the other, about the nature of the threat, and the confidence we can summon that the threat is in fact changing and receding.

In similar fashion, the effort to solve the global environmental crisis will be complicated not only by blind assertions that more and more environmental manipulation and more and more resource extraction are essential for economic growth. It will also be complicated by the emergence of simplistic demands that development, or technology itself, must be stopped for the problem to be solved. This is a crisis of confidence which must be addressed.

This speech, if you'll permit me a personal moment, is the first time I've spoken in public on any subject in six weeks. My wife and I have been in Johns Hopkins Hospital, at the bedside of our son, who was hit by an automobile. I've been living in the world of medical science, pursuing the

goal of restoring our son to health. Ten years ago, a child with his injuries would have had several surgical interventions which doctors now realize are unwise, given the greater likelihood of the body healing itself where some injuries are concerned.

Yet, two days after the accident, when doctors were unable to stabilize internal bleeding, my wife and I naively hoped that same natural healing process would take care of that problem and make any surgery unnecessary. If the doctor had relied not on science but on us, we would have unwisely urged against an operation. But doctors have acquired sufficient knowledge to realize that the body should be allowed to heal itself when it can do so. At the same time, they know there are some instances where intervention is essential to save life.

Similarly, we must acquire sufficient knowledge of the earth's system to judge when it can heal itself, and when it is necessary for us to intervene. For example, when 40,000 children die of disease and starvation every 24 hours, we obviously must intervene. But it is past time to recognize that many of society's interventions in the environment have been and are unwise. Much ecological destruction is subsidized by governments. We need more knowledge, more experience, and the kind of sensitive judgments that modern doctors have learned to make.

The cross-cut between the imperatives of growth and the imperatives of environmental management, represents a supreme test for modern industrial civilization. The test is whether we can devise very dynamic new strategies which will accommodate economic growth within a stabilized environmental framework.

That is an extreme demand to place upon technology. There is no real assurance that such a balance can in fact be struck. Nevertheless the effort must be made. And because of the urgency, scope and even the improbability of complete success in such an endeavor, I am strongly tempted to use a military term for a metaphor. To deal with the global environment, we will need the environmental equivalent of the Strategic Defense Initiative, a Strategic Environment Initiative.

I have been an opponent of the military SDI. But even opponents of SDI recognize this effort has been

A Strategic Environment Initiative

remarkably successful in drawing together previously disconnected government programs, in stimulating the development of new technologies, and in forcing upon us a wave of intense new analysis of subjects previously thought to have been exhausted.

We need the same kind of focus and intensity, and similar levels of funding, to deal comprehensively with global warming, stratospheric ozone depletion, species loss, deforestation, ocean pollution, acid rain, air and water, and groundwater pollution, and all of the problems degrading the world's environment. In every major sector of economic activity -- energy, agriculture, manufacturing, and transportation, for example -- a Strategic Environment Initiative must identify and then spread sets of increasingly effective new technologies: some that are already well in hand; some that need further work, though well understood in principle; and some that are revolutionary ideas whose very existence is now a matter of speculation.

Let me briefly illustrate:

Energy is the lifeblood of development. Unfortunately, today's most economical technologies for converting energy resources into usable forms of power (as in burning coal to make electricity) release a plethora of pollutants. An Energy SEI should focus on producing the energy of development without compromising the environment. Chief on the near-term list of alternatives are energy efficiency and conservation; on the mid-term list, solar power, possibly new-generation nuclear power, biomass (with no extraneous pollutants and a closed carbon cycle), as well as enhanced efficiency; and long-term, nuclear fusion, as well as enhanced versions of solar, biomass, and nuclear energy, and energy efficiency.

In agriculture, we have witnessed vast growth in Third World food production through the Green Revolution, but often that growth relied on heavily subsidized fertilizers, pesticides, irrigation, and overall mechanization, sometimes giving the advantage to rich farmers over poor ones. We need a second green revolution, to address the needs of the Third World's poor: a focus on increasing productivity from small farms on marginal land, with low-input agricultural methods.

These technologies, whose components are not only technological, but financial and political, may be the key to satisfying the land hunger of the disadvantaged and the desperate who are slashing daily into the rainforest of Amazonia -- leaving behind the depleted soil of their first homesteads. It may also be the key in the battle to arrest the desertification of sub-Saharan Africa, where human need and climate stress are now operating in a deadly partnership.

Fortunately, the next wave of agricultural improvements is almost upon us -- from biotechnology. In my view, we should carefully push forward work on new crop strains with genetic encoding that allows "natural" resistance to pests, disease, and droughts; not to mention improved yield. Of course, biotechnology will not completely solve the problems that arise from inadequate distribution of food supplies -- they are most often due to a failure of politics, not crops.

In addition, new industrial processes, new materials, and increased use of recycled materials, will all become important to "sustainable" development.

Needed in the U.S. probably more than anywhere, is a Transportation SEI focusing in the near term on improving the mileage standards of our vehicles, and encouraging and enabling Americans to drive less. In the mid-term, come questions of alternative fuels, such as biomass-based liquid fuels or electricity. And in the mid- and long-terms come the inescapable need for re-examining the entire structure of our transportation sector, and its inherent demand on the personal vehicle for efficient transport.

Funds to promote these research objectives could be drawn from very modest US energy taxes, eventually perhaps even a CO₂ tax, although that is not yet politically viable. The U.S. government should organize itself to finance the export of energy-efficient systems, and of renewable energy sources. That means preferential lending arrangements through the Export - Import Bank, and Overseas Private Investment Corporation.

Encouragement for the Third World should also come in the form of attractive international credit arrangements for energy efficient and en-

vironmentally sustainable processes. Funds for this lending stream would be generated by institutions such as the World Bank, which, in the course of debt swapping, might dedicate new funds to the purchase of environmentally sounder technologies.

Finally, the United States, other developers of new technology, and international lending institutions, should establish centers of training at locations around the world, to create a core of environmentally educated planners and technicians, in order to "make the ground fertile" for sowing environmentally attractive technologies and practices; an effort not unlike that which produced agricultural research centers throughout the world during the Green Revolution.

With this SEI, we must transform science and technology to make it more efficient, consume less of the earth's natural resources, and emphasize waste minimization, recycling, and the use of renewable resources in harmony with the natural world. We must start by quickly obtaining massive quantities of information about the global processes now underway -- through, for example, the Mission to Planet Earth program of NASA.

And we also must target first the most readily identifiable and correctable sources of environmental damage. Today, for example, I have introduced a new comprehensive legislative package to effectively halt chlorofluorocarbon, carbon tetrachloride, methyl chloroform, and halon emissions, and to promote development of technologies to replace those that now rely on CFCs. Earlier this year, I introduced the World Environment Policy Act of 1989, a far-ranging bill to address virtually every aspect of the global environmental crisis, including CFCs and CO₂.

In order to accomplish our goal we also must transform global politics, shifting from short-term concerns to long-term concerns, from conflict to cooperation.

The evidence of the last six months leads me to believe we have the capacity for this change. Just as the equilibrium of an environmental system can suddenly change from one state to another, the equilibrium of one political system can suddenly change from one state to another. We politi-

"... the solutions we seek will be found in a new faith in the future of life on earth after our own, a faith in the future which justifies sacrifices in the present, a new moral courage to choose higher values in the conduct of human affairs, and a new reverence for absolute principles that can serve as guiding stars by which to map the future course of our species and our place within creation."

cians are frequently adept at symbolic action, a pretense of change without the substance of change. And for that reason, my optimism is tempered by awareness of the power in the forces of greed and fear. But I do believe we have the capacity for what is needed -- because the challenge can now be accurately described in terms of national security.

Some may believe that the idea of the environment as a national security issue is just rhetoric. Most of us in this room, however, accept it as a statement of fact. But, we also know that just as the world has been living with the possibility of man-made disaster in the form of nuclear war, so it now lives with the growing threat of man-made disaster in the form of catastrophic environmental failure.

In many ways, it is the same basic dilemma. In each case, our survival was threatened at a basic, primal level -- the fear of death from attack by an enemy, the fear of death from running out of food. To each threat, we responded with more and more efficiency. The increasing sophistication of our technology has enabled us to confront each threat to our survival with a more powerful response. And in each case, the effort to secure our survival has instead threatened our survival.

Moreover, even if we are successful this time in meeting the needs of our survival and preserving the world environment, it probably won't be the last time we'll face this basic problem. Genetic engineering may pose the same dilemma all over again. In the effort to protect ourselves against disease, we're creating a new and more power-

ful technology that ultimately will confront us with the same historic challenge to human nature and the same hubristic relationship of our species to the limits nature has designed for us as part of the world ecological system.

As a result, it is hard to escape the conclusion that we must also transform ourselves -- or at least the way we think about ourselves, our children, and our future. This last transformation is the most essential, and yet the most difficult. If there is one cause for the prevailing pessimism about our ability to meet this unprecedented challenge, it is the belief by many that we are incapable of the change in thinking required.

And yet, there are precedents which give cause for realistic hope. Human sacrifice and slavery were both once commonplace in human societies, yet both are now obsolete. Our thinking was transformed. These changes, like most changes in global climate patterns, took place over a long period of time. But now, just as climate changes are telescoped into short periods of time, we must create in a single generation changes in human thinking of a magnitude comparable to the change that brought about the abolition of slavery. Yet once again, we must remind ourselves that the pattern of change required is visible only from a distance.

In this case, we cannot rely on science to give us a new point of view for it is partly responsible for the problem. In ways not yet fully understood, the scientific revolution itself changed the way we saw ourselves in relation to the world. We detached

ourselves from nature to examine the physical world. In a kind of Heisenberg Principle writ large, we altered -- without realizing it -- the nature of what we began to examine. The new pattern of thinking we must now create is one in which we once again see ourselves as a part of the ecological system in which we live. What we now lack is a sense of the proper location of our species in the ecosystem. We have lost our eco-librium.

How then can we gain sufficient distance from ourselves to see a pattern which contains ourselves in a larger context? My own religious faith teaches me that we are given dominion over the earth, but that we also are required to be good stewards of the earth. If we witness the destruction of half the living species God put on this earth during our lifetimes as a result of our actions, we will have failed in the responsibility of stewardship. Are those actions, because of their result, "evil"? The answer depends not upon the everyday nature of the actions, but upon our knowledge of their consequences. In an examination of Hitler's lieutenants, Hannah Arendt coined the memorable phrase "the banality of evil." The individual actions which collectively produce the world's environmental crisis are indeed banal when they are looked at one by one: the cutting of a tree, the air conditioning of a car.

"Evil," and "good" are terms not used frequently by politicians. But in my own view, this problem cannot be solved without reference to spiritual values found in every faith. For many scientists on the edge of new discoveries in cosmology and quantum physics, the reconciliation of science and religion sometimes now seems near at hand. It is a reconciliation not unlike the one we seek between man and nature.

But even without defining the problem in religious terms, it is possible to conclude that the solutions we seek will be found in a new faith in the future of life on earth after our own, a faith in the future which justifies sacrifices in the present, a new moral courage to choose higher values in the conduct of human affairs, and a new reverence for absolute principles that can serve as guiding stars by which to map the future course of our species and our place within creation. ■