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FUSION

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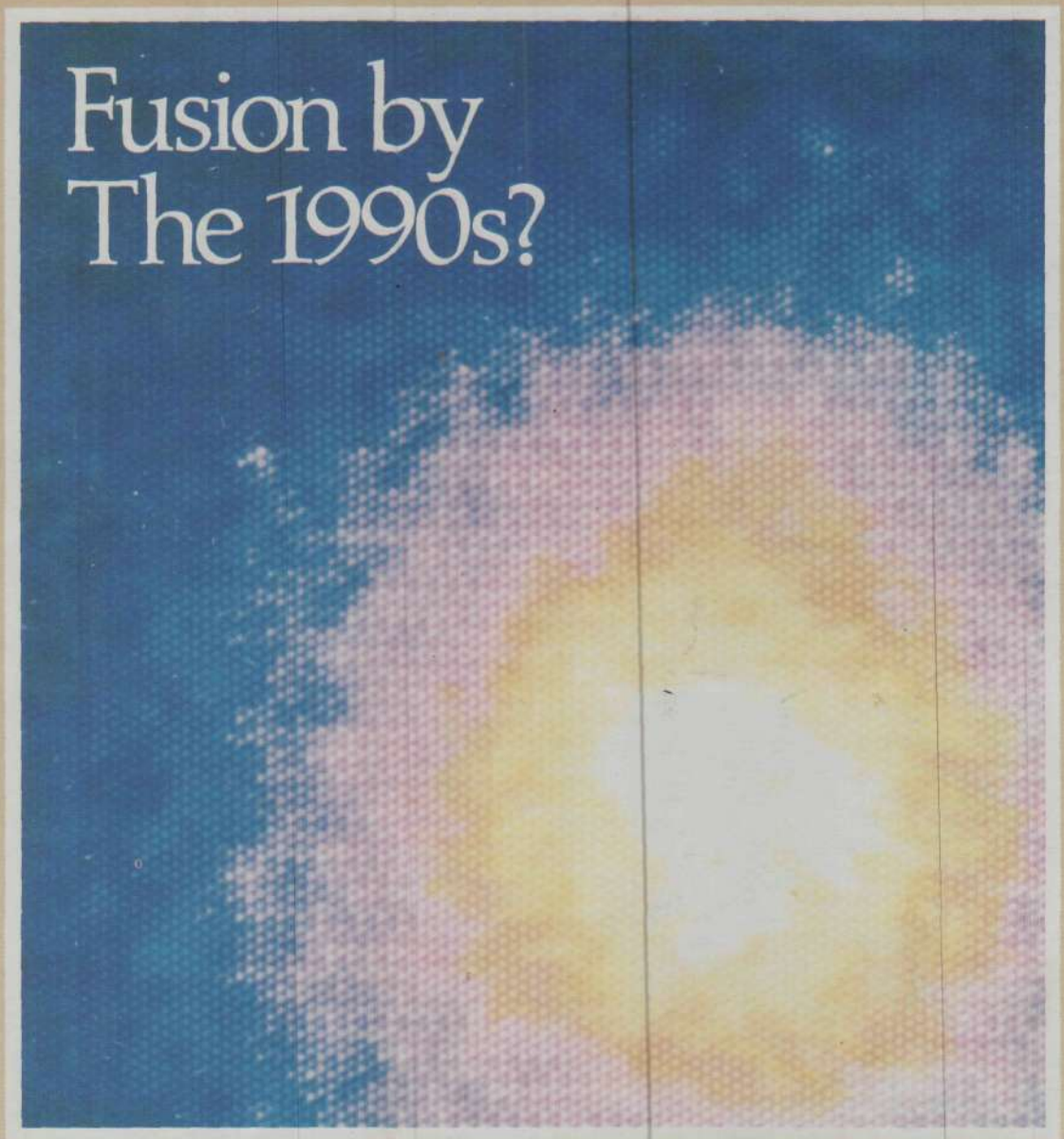
Fusion by The 1990s?



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FUSION

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Note to Readers

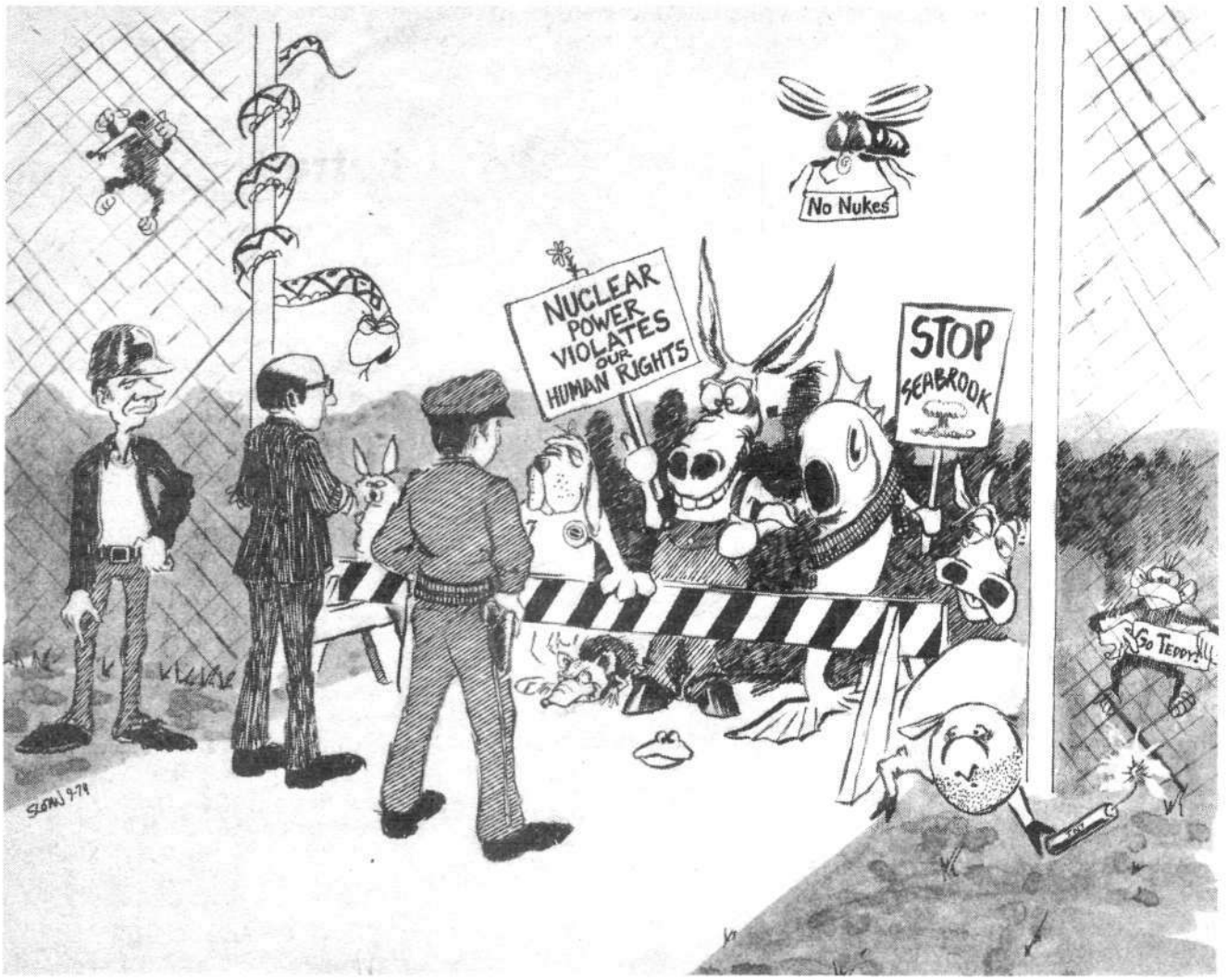
With this issue *Fusion* completes the transition to a new computerized subscription fulfillment system that is geared to accommodate 20,000 subscribers and up. We apologize for the delay that our growing pains caused in the delivery of the September issue, and we are sorry that we could not answer all the inquiries about the issue personally.

From now on, subscribers can expect to receive each issue by mail the week before the beginning of the month that the issue is dated.

Features

News

Departments



Editorials

The Real Choice

Since the Fusion Energy Foundation is in the middle of the fight for nuclear power and progress, we have an unusual insider's view of the politics of energy. From that vantage point we can anticipate that the press and a number of presidential candidates will attempt to offer the population the wrong set of choices on the energy issue. Now is the time to set the record straight.

As the articles on fusion in this issue indicate, fusion energy is as near as a decade away once we begin a crash engineering effort to build a test reactor. At the same time, the harnessing of the most efficient fusion reactions to produce cheap electricity, raw materials, and synthetic fuels will require fundamental advances in theoretical physics that can be achieved only with a broad effort in basic research. We can guarantee the economic resources and the political climate required for both projects to succeed only if the United States pursues a massive program for nuclear fission reactor production and export during the next decade.

Compare this perspective to the choice now offered to the nation by the media: either a modest nuclear buildup as part of militarization of the economy, or a nuclear shutdown inspired by the environmentalists and zero-growthers.

Both these policies have an absolutely common outlook, however. It is the outlook promoted by the New York Council on Foreign Relations in its *1980s Project* and documented in this issue. The Council on Foreign Relations holds that the main enemy is technological *progress;* therefore, the leading advanced industrial nations and the world economy must be put through "controlled disintegration" to maintain the hegemony of Malthusian political and economic institutions.

Two Examples

Two examples of such "choices" are outgoing Energy Secretary James Schlesinger and AFL-CIO Secretary-Treasurer Lane Kirkland. Although they appear to differ marginally in their public statements on nuclear policy, Schlesinger and Kirkland represent exactly the same New York and London-based policy.

Self-proclaimed Malthusian Schlesinger—the man who opened the Atomic Energy Commission to environmental challenges of nuclear licensing and who moved the fusion timetable back 30 years while lying about the availability of oil—declared in his August farewell address that he is now in favor of a slight nuclear buildup in order to prepare for military confrontation in the Mideast.

Meanwhile, British-trained Kirkland wants unions to go antinuclear and prosolar to punish the utilities for what he calls "antilabor" policies.

American businessmen, scientists, and workers should not be foolish enough to buy either of these false choices. As the special report in this issue indicates, such "choices" are the result of a nasty little set-up involving antigrowth elements in both the Atomic Industrial Forum and the AFL-CIO.

The real choice, and the only one in the national interest, is the full nuclear development program we have outlined here and spelled out many times in the past. It is also a policy that the healthy pro-American majority in industry and labor can work for together—and win.

Seabrook and the American Majority

One of the most important tests of the ultimate effect of the Three Mile Island incident will be decided in New Hampshire this fall. Emboldened by the barrage of antinuclear press and the weak-kneed response of most political figures to TMI, the antinuclear forces will be gathering for a showdown at the beleaguered Seabrook nuclear plant October 6.

Unlike past demonstrations called by the Clamshell Alliance and related groups, there is no coyness this time about the intention of the demonstrators to use violence as a crucial tactic in forcing a nuclear shutdown. Therein lies the test. It is not their strength on the nuclear issue as such on which the demonstrators will be acting. Knowledgeable observers know that the Clammies represent only the hard-core environmentalist and terrorist leftovers of the 1960s radical movements. This minority is willing to mount such a provocative challenge only because the majority of the population so far has lacked effective leadership to articulate the way in which nuclear power fits together coherently with a full economic program to restore the nation's economy.

It is this larger issue that the voters of New Hampshire will be intensely debating throughout the fall and winter prior to the February presidential preference primaries. New Hampshire is not a state that takes its presidential politics lightly. Therefore, prodevelopment forces in America have a unique opportunity here.

Fusion magazine promises its readers the following service. We will demand of all the candidates their energy policies and will report faithfully how the candidates rise to the challenge of Seabrook and New Hampshire.

ON SINGULARITIES

To the Editor:

The July 1979 issue leaves me severely disappointed . . . .

The article presenting the Riemannian economic model appears rather ignorant of the current state of economic theory as it pertains to the analysis of jumplike discontinuous economic phenomena. Contemporary economists are in no way locked into a linear view of the world as the article seems to imply. The authors place great importance on singularities but appear unaware of the major applications that have been made of Catastrophe Theory to the analysis of macroeconomic phenomena. I am enclosing one such example by Professor Varian [H.R. Varian, "Catastrophe Theory and the Business Cycle," *Economic Inquiry* 17:14 (1979)] to illustrate what I mean by this . . . .

Kenneth R. Kleefeld
Rockaway, New Jersey

The Editor Replies

You seem to have been confused by our use of the term *singularity.* We have used the term in the original Riemannian sense to describe the appearance in an otherwise smooth manifold of a jump, hole, cliff, or similar structure *whose significance is a qualitative change in the equations describing that manifold.* The occurrence of a phase change is the analogous situation in physics—a singularity means new interactions, new time and length scales, new symmetries, and "higher-order" interactions that cannot, in principle, be described within the old manifold. The singularity in a Riemannian sense is *not* part of the old manifold that gave rise to it; it is part of the succeeding manifold.

Catastrophe theory, which, as you point out, is the best conventional economists have done, deals with a totally different sort of singularity. The

Continued on page 4

Letters

Continued from page 3

Varian article merely examines the folds that appear in the manifolds of some simple differential equations in economic theory, but the question of qualitative change, technological development, and of singular processes are neither raised or dealt with in the paper. Varian and other economists deal with a *fixed* set of equations. The basic question of the evolution of those equations, a process always mediated through Riemannian singularities, is totally foreign to their approach. Our Riemannian model is the first attempt to use these ideas in mathematical economics.

Dr. Steven Bardwell

COLLABORATION REQUESTED

To the Editor:

I hope the research efforts of the American Society of Agronomy, of which I am a member, will put the environmentalists to sleep. The environmentalists have advocated replacing tractors with horses and mules, which would require much of our farmland to feed. You can imagine what this would do to our agricultural exports, and possibly also to our domestic food supply.

Environmentalists also complain that high-cost imported fuel is being used to produce agricultural products. They don't seem to realize that our agricultural exports total in the neighborhood of $27 billion each year; our oil imports total about $44.5 billion. In other words, using only 3 percent of the total U.S. energy supply, agriculture is able to make more than one-half of the money we spend to import oil, plus supply all of the food and fiber we need for our domestic market . . . .

Not one barrel of oil should be used for generating electricity. Plutonium-based high-energy nuclear reactors should produce 100 percent of our electricity, and by exporting these reactors together with agricultural exports we can pay for all the oil we need.

I request that you collaborate with the ASA for putting to sleep every environmentalist idiot who has diverted the attention of all of us committed to scientific research to defending our work. Then we can get back to research for developing new technologies to feed the world and solve the problems of mankind.

Brian Wilson
Fort Hood, Texas

To the Editor:

As a biologist with a PhD and a biological research company, I have always been amazed how ecologists and conservationists *defeat* themselves in their paranoid attempts to make the human race live in the Stone Age—and prevent other life forms from change . . . .

We have enough nuclear fuel in storage to furnish the United States with 500 years worth of energy. We can blame the environmentalists for the waste of our precious fuels and the higher fuel costs.

The ecologists try to keep most life forms, including the human race, from evolving by stopping its "mechanism" of environmental change and progress. No group will ever stop mankind, science, and evolution . . . .

Dr. Michael P. Kiefer
President, M.P.K. Omega Co.
Amarillo, Texas

To the Editor:

. . . I am an electronics engineer . . . and have been favorably impressed with the two issues [of *Fusion*] I've read.

I do some spare-time research on mechanics and gravitation and do find comments in *Fusion* refreshing and illuminating as to direction of needed changes in physical theory.

John A. Holly
Palo Alto, Calif.

To the Editor:

I commend your efforts to raise the political consciousness of this country against the uninformed and misguided liberal element in our government headed by Senator Ted Kennedy of Massachusetts.

Although my own feelings on nuclear energy are ambivalent, I would like you to accept the enclosed donation and keep up the good work since I heartily agree with your proposal to retire Mr. Kennedy from public office.

Jack Welch
Basking Ridge, New Jersey

The Lightning Rod

My dear friends:

You don't hear it talked about much now, but King George III of England was one of the leading environmentalists of his day. When I was the United States of America's first ambassador to France, I received a message that King George's consumer experts had decided my lightning rods were unsafe. Since the king, what with Buckingham Palace and all his country estates, was probably the leading consumer of lightning rods in the whole British Isles, the people who sent me the news thought I would be pretty upset to hear that he had ordered all my sharp-pointed rods taken down, to be replaced with blunt-tipped specimens. ("We do not follow the designs of rebels," I believe George III said.)

I wrote to my friends in London: "The king's changing his pointed conductors for blunt ones is a matter of

small importance to me. If I had a wish about it, it would be that he had rejected them altogether as ineffectual. For it is only since he thought himself and family safe from the thunder of Heaven that he dared to use his own thunder in destroying his innocent subjects."

Whether it is a king's whim or a multitude's, science is no respecter of opinions, but only of God's truth.

***

Our Constitution-fiddlers are playing a new tune, I am told: Jimmy Carter and John Connally have each proposed a constitutional amendment limiting the president to a single term of six years. If memory serves me right, this experiment has been tried before . . . in the constitution of the Confederate States of America. That same document prohibited the South from using taxes or tariffs to promote internal improvements—roads, canals, railroads and so forth. Well, we all remember who won that round. Isn't it about time Americans got down to the business of teaching our politicians to stop *tinkering* with the Constitution, and do a little scientific investigation of how we old folks made it work?

Yr. obt. svt.,

Calendar

October

17-19
Nuclear Power Systems
Symposium and Exhibits
San Francisco, Calif.

24-25
Third Annual International
Conference on Energy
Washington, D.C.

29-Nov. 1
Second World Energy
Engineering Congress
Atlanta, Ga.

News Briefs

Pushing antinuclear terror

ANTINUCLEAR GROUPS PLAN VIOLENCE AT SEABROOK

The antinuclear demonstration at the Seabrook, N.H. nuclear plant Oct. 6 will mark a turn of the U.S. environmentalist movement toward overt terror tactics, according to several different sources. The Seabrook event, which features Jane Fonda and Tom Hayden, is sponsored by the Clamshell Alliance and the Coalition for Direct Action at Seabrook and is supported by campaigners for California Governor Jerry Brown and state organizers for Senator Ted Kennedy.

Organizers for the demonstration intend to trigger a violent confrontation with the New Hampshire police authorities that will serve as a jumping-off point for a series of civil disturbances at other nuclear plant sites across the country. As a spokesman for the Boston chapter of the Coalition for Direct Action at Seabrook described it: "It's going to be an action demonstration. We're going to take over the site . . . . We're tired of civil disobedience . . . . We've allowed them to drag us off before; this time we're not going to. We're not recognizing the authority of the government or the police."

"We're prepared to have a mass fence takedown . . . enabling two to three thousand to have one point to get in," the organizer said.

One ominous tipoff to the surfacing of violence appeared in a recently published pamphlet, *Midnight Notes*, that is circulating at "movement" bookstores. *Midnight Notes* is authored by a collective in Brooklyn, N.Y. that also constitutes the "Committee Against Repression in Italy," a group that supports the terrorist Red Brigades. The pamphlet calls for the antinuclear movement to give up on its stand for passive resistance and adopt the violent resistance tactics of the European terrorist groups.

As a model, the pamphlet cites the bombing of a nuclear power station in Spain by ETA, a Basque terrorist group that killed two construction workers. The bombing, the pamphlet says, ". . . did not impede the antinuclear movement, but widened its impact . . . . At first the official nonviolent organizations denounced these actions as 'directed against the movement and harmful for its growth,' but later this hard line weakened and they accepted bomb attacks, if the bombings were carefully and cleanly executed without damage to the environment, nature, or 'living creatures'."

The Fusion Energy Foundation and the *Executive Intelligence Review* will issue a full report on the persons and plans involved in the terror scenario. In a preliminary report on the terror plan, the *Executive Intelligence Review* revealed that Kidder, Peabody Co., the major investment house selling stocks used to build the Seabrook plant, has a representative on the board of the Fund for Peace, one of the key funders and controllers of the antinuclear movement.

United Nations

World-Bank-style development

WORLD BANK ISSUES ANTIGROWTH REPORT

The second annual "World Development Report," released by the World Bank Aug. 16, continues the agency's antiprogress campaign. Complaining that the "impetus for urban growth is inexorable" in the Third World, the report proposes "to meet the needs of the majority of residents at low cost" by ending such services "for the wealthier" as subways and substituting for water-borne sewage systems "upgraded pit latrines."

NRC FINDINGS SUPPORT FEF CHARGES OF SABOTAGE

"The detailed evidence in the just-released report of the Nuclear Regulatory Commission on its investigation of Three Mile Island supports the possibility that sabotage was the most likely cause of the closing of both emergency feedwater system block valves prior to the start of the March 28 incident at the

nuclear plant." This was the conclusion of Jon Gilbertson, Fusion Energy Foundation director of nuclear engineering, in a review of the NRC report.

Gilbertson concludes that NRC investigators did not want to investigate the sabotage possibility, even though they had eliminated the other five of six possible causes for the valve closure. The NRC report states firmly that the closure of these valves produced reactor conditions that misled the plant operators and had a definite effect on the progress of the incident during the first 20 to 30 minutes.

The Gilbertson review will appear in the November issue of *Fusion*. Pre-publication copies are available from the FEF at $10 per copy (free for FEF members).

FRENCH HAIL RIEMANNIAN ECONOMIC MODEL

The fortnightly French magazine *Tendances and Conjonctures*, which is widely read by Gaullists, reviewed the Fusion Energy Foundation June conference in Paris on the industrial development of Africa in its July 16-31 issue, giving special emphasis to the presentation at the conference of the new Riemannian economic model. Under the headline "Capital Formation Is an Economic Imperative," the magazine wrote: "In this period of rapid evolution . . . the perfecting of forecasting techniques is particularly precious. The new cybernetic tool recently evoked . . . on the occasion of a meeting on the development of Africa, stands qualitatively and numerically superior to the present input-output econometric models.

"The new 'Riemannian model,' conceived by Uwe Parpart, Steven Bardwell, and a team of economists, computer analysts and physicists, starting from a conception of Lyndon LaRouche . . . assumes the essential task of simulating the real impact of discontinuities corresponding to the shock waves studied by Riemann, and has allowed for the conceptualization of an effective computerized forecasting model. This tool allows one to measure the variation represented by the qualitative change from one technological model to another . . . ."

SAFE FOUNDER ON ANTINUCLEAR BOARD

A research report on the environmentalist movement by the *Executive Intelligence Review* has revealed that Alfred Slaner, a founder of the Society to Advance Fusion Energy (SAFE), is a member of the board of trustees for the Fund for Peace, a foundation that has helped sponsor antinuclear activities. Also on the Fund for Peace board is Barry Commoner, the arch foe of nuclear power and technology who recently formed the "Citizens Party" to advance antinuclear environmentalist issues in the 1980 presidential campaign.

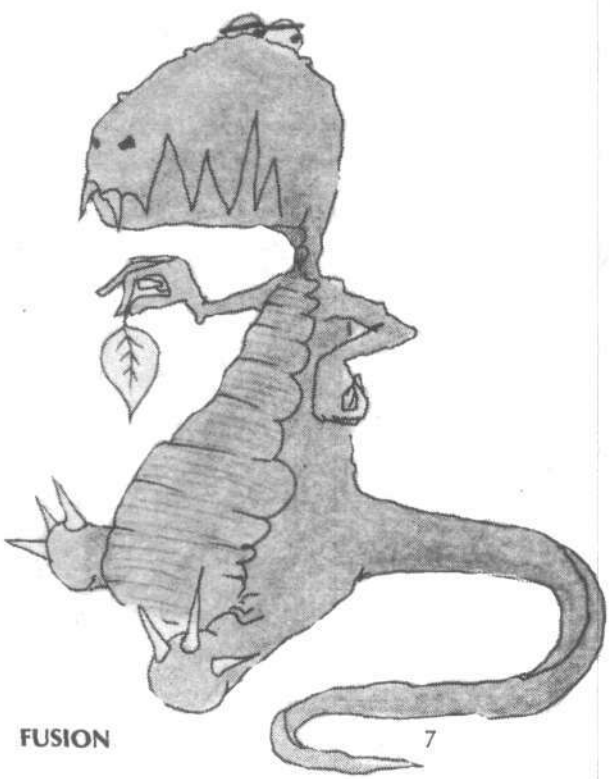
Fusion's August-September issue exposed SAFE as an organization set up explicitly as an antinuclear group concerned with stemming the political impact of the Fusion Energy Foundation.

LOUSEWORT LAURELS TO AID NUTRITIONIST

This month's lousewort laurels award goes to Samuel Kahn, senior nutrition advisor for the U.S. Agency for International Development in Washington, D.C. Kahn has proposed the addition of leaves to the human diet "to improve the nutritional quality of foods."

"Right now, leaves are the most abundant protein source in all of nature, and we would never run out of food," Kahn said.

The lousewort award committee is investigating the connection of Kahn's proposal to the many bills in Congress that would fund leaf-raking projects for the unemployed.



Is the Atomic Industrial Forum Antinuclear?

For the majority of Americans who are pronuclear, it is distressing to see the nuclear industry take a beating from the pint-sized environmentalist movement without fighting back. As this special report indicates, the problem stems from the very top of the industry and its trade association, the Atomic Industrial Forum.

This report was compiled by Leif Johnson, a correspondent for the Executive Intelligence Review. *The candid interview with Roger J. Sherman, upon which parts of the report are based, was provided by a Washington, D.C. source in early August 1979.*

The editors note that there are several AIF staff members who more accurately reflect the majority view in the nuclear field and who do not share the views of AIF board chairman Sherman and AIF president Carl Walske.

"I was in the small minority who wanted a limited moratorium on nuclear plants just after Three Mile Island to dampen the public backlash. But then I didn't support the Kennedy six-month moratorium because there already was a de facto moratorium and I didn't see the need for anything else."

The words of a moderate environmentalist? Perhaps an underling of James Schlesinger or a think-tanker from Brookings Institution?

The comment came from Roger J. Sherman, chairman of the Atomic Industrial Forum, Inc., a worldwide trade association for the nuclear industry. Sherman is also chairman of the board of Ebasco Services, a top U.S. nuclear contractor and prime contractor at the Princeton Large Torus experiment.

The candid Sherman remarks are likely to cause a quiet but far-reaching scandal. For many of the contractors, manufacturers, law firms, engineers, nuclear power operators, and other nuclear users who make up the 600 worldwide members of the AIF and its $4 million annual budget, the unavoidable conclusion is that the trade association for the nuclear industry is antinuclear.

Consider the following record:

(1) The AIF never objected to the October 1978 report on nuclear wastes by Acting Undersecretary of Energy John Deutch, whose misleading conclusions about the impossibility of implementing a near-term solution for nuclear waste storage was an immediate danger not only to the industry that the AIF purports to represent but also to the future generation of power for the nation in which the great majority of its members live.

(2) The AIF never objected to the June 18 appointment of environmentalist Mitchell Rogovin as head of the Nuclear Regulatory Commission's independent investigation of Three Mile Island. Rogovin was the general counsel to the openly antinuclear Common Cause and served as vice chairman of the Center for Law and Social Policy, a group that has developed "radical lawyers" who defend terrorists and that has filed three suits to prevent the export of nuclear fuel to India.

Rogovin is a fellow and general counsel to the Institute for Policy Studies, which is known to be connected to the funding, training, and deployment of environmentalist-terrorist groups, including the Weatherunderground, Black September, and the Baader Mein-

An Interview with AIF Chairman Roger J. Sherman,

Ebasco

Sherman: "In the small minority."

Question: What do you think about the cabinet shakeups, specifically Schlesinger's ouster?

Schlesinger was a good man, a brilliant kind of guy . . . but sometimes abrasive. You know, he had a hell of a job to do pulling together all those disparate groups into the DOE.

Question: But he was known as antinuclear.

Oh no, he was pronuclear, very much. I really don't know how he stood on fusion. I don't think an unproven and new concept like fusion needed all the funds the government originally asked for. I think what we have is enough. You can't put a lot of money into something that may not pay out. . . .

Question: Nuclear export policy is a big item in Washington now . . . .

We have to probably go with the fast breeder. France is going hell bent for this. I think that France blew up the Iraqi deliveries. Everyone is worried about proliferation, the French too, and one possible solution is regional reprocessing plants under broad supervision.

Question: Why would the French blow up the Iraqi nuclear deliveries?

hof gang. Currently, Rogovin is a member of the New York Council on Foreign Relations, whose *1980s Project* documents demand a "controlled disintegration in the world economy."

Nevertheless, an AIF spokesman was quoted in the *Washington Post* June 18 as approving Rogovin's appointment because "he doesn't seem to have an axe to grind."

(3) The AIF has consistently refused to investigate the possibility of sabotage at Three Mile Island, despite their technical expertise that would confirm that the occurrences at the plant must have involved deliberate intervention. In fact, Roger Sherman told one interviewer: "At least the industry is no longer calling TMI an incident, but is being honest about its being a 'major accident'."

(4) In a speech to the European Nuclear Congress in Hamburg, West Germany May 8, AIF president Carl Walske contributed to the pessimism and hysteria after Three Mile Island by declaring: "We shall be considering the lessons from Three Mile Island and . . . I am hopeful that we shall be through this period in one, two, or three years at most. I have anticipated two or three years of near zero orders for nuclear plants and coal plants as well. There will remain, as we now project the future, the small probability of accidents that can kill thousands."

(5) AIF chairman Roger Sherman is supporting John Connally for the Republican presidential nomination, despite the fact that Connally told 15 million Americans on ABC's "Issues and Answers" program Sunday, July 29, that he favored synthetic fuels and he ignored direct questions on the subject of nuclear power.

(6) Marie Dunkel, an AIF staff member in Washington, told the internal security director of the American Legion the deliberate lie that the FEF was a "radical organization" that advocated "nationalization of the nuclear industry"—resulting in the cancellation of the FEF's scheduled speech on nuclear power before the Pennsylvania American Legion convention in Pittsburgh July 13.

Not coincidentally, Marie Dunkel is the AIF official to whom energy specialist Milton Copulos of the Heritage Foundation refers callers interested in learning about pronuclear events. The AIF participated in the British-run Heritage Foundation's allegedly pronuclear conference last winter that tried to keep pronuclear organizing contained to a local level. Earlier last year, Heritage Foundation official Francis Watson was the source of an anti-FEF slander that Heritage circulated among business and industrial layers.

(7) Perhaps most telling, the AIF has no national program or strategy for nuclear power development to which the organization is committed—a fact that was put to them strongly not by their own members, but by the heads of the building trades union in a mid-July meeting in Washington, D.C.

It gives them a couple of years to replace them. . . .

Question: What is shaping up after Three Mile Island?

I was in the small minority who wanted a "limited moratorium" just after Three Mile Island, to dampen the public backlash. I didn't support the Kennedy moratorium because by that time the public opinion polls were swinging back to nuclear—you know crises have only a certain half life—and there was a de facto moratorium anyway, which was sufficient. In fact, the NRC can't process any application right now because they have their top hundred people on the Three Mile Island case and there's just no supervision for the intricate process of guiding an application through.

The Hart amendment was—I suppose is, I don't know where it is—really crazy. More people would get hurt in evacuations than in any accident. I'm glad, by the way, that the industry is no longer calling Three Mile Island an incident but is being honest about its being a "major accident."

Question: Who is organizing the pronuclear demonstration in Rocky Flats, Colorado? I hear that General Haig is speaking.

. . . I was delighted to hear that Haig will be there. He's one hell of a good speaker. I heard him in Washington just after Erlichman and Haldeman were out and he gave a hell of a good speech. As far as being a presidential candidate, I don't know where his base would come from. Personally, I think a Connally-Anderson ticket would be just right. Connally would pick up the conservative Texas millionaire and oil support—he's got a lot of money—and Anderson would pick up the liberals. Haig could be the man above politics, that's the military image, and I think Reagan would be a bloody disaster.

Handsome

But Connally is very impressive. I know him personally, have been with him in small meetings like a dozen to 14 persons in executive situations and he is just brilliant, quick, incisive, and decisive. I knew him when Ebasco was a subsidiary of Halliburton. He was on the Halliburton board. He wouldn't alienate the liberal and he is very handsome on television. The ladies would go for him.

Question: But what about Connally's attempts to eliminate the Davis-Bacon Act? The unions wouldn't go for that.

Well, Connally is very astute. You know, if it came to that, I think he would just count up the votes and make up his mind. Ebasco isn't that affected and I'm personally not against Davis-Bacon as long as it's reasonably administered. . . .

Just last week I had a meeting with the building trades leaders in Washington. I felt that I had to attend—otherwise the meeting would have been handled by Paul Turner, who set it up—because the union presidents felt the industry had slackened off from nuclear support. I tried to assure them there was no erosion of industry support.

Question: Did anything concrete come from the meeting?

I didn't want to say anything too concrete. You know these guys are consummate politicians. They sit on every word and make more of what you say than what you meant. . . . I know the minds of these guys. I was one of the four industry people on the Nuclear Construction Stabilization Agreement. . . .

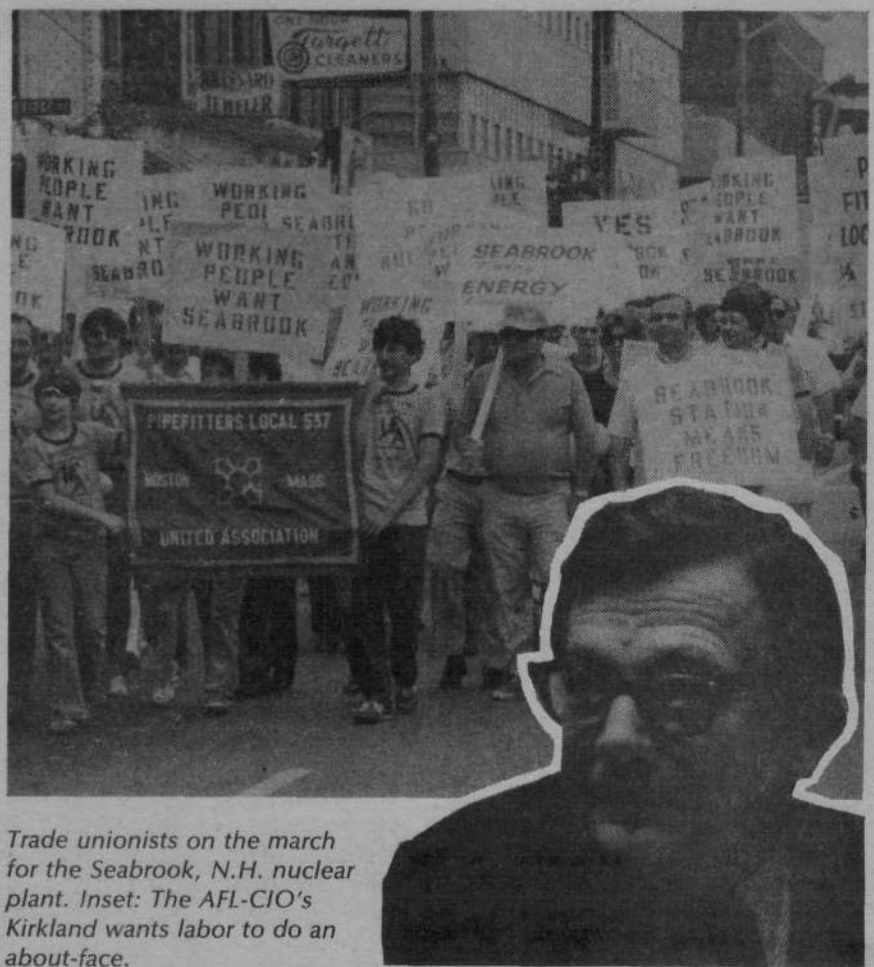
AFL-CIO Leadership Goes Antinuclear

The 35 members of the AFL-CIO Executive Council decided at their August meeting in Chicago to abandon the labor organization's priority commitment to nuclear power development in the United States.

According to Al Zack, AFL-CIO public relations director: "Since the Three Mile Island incident, we have had to redefine our support of nuclear energy. People are afraid . . . . We can no longer support nuclear energy until it has regained the full support of the people . . . ."

Zack said that the AFL-CIO "no longer could view nuclear energy as a priority solution to either the nation's energy requirement or as a source of jobs for AFL-CIO members."

This turn toward the Carter energy austerity program is under the direction of AFL-CIO secretary-treasurer Lane Kirkland, a Council on Foreign Relations member and the heir apparent to George Meany, the organization's 84-year-old president. Kirkland reportedly had been working behind the scenes to stymie proposals from AFL-CIO leaders—especially those in the building trades—for a full-scale offensive for nuclear power.



Trade unionists on the march for the Seabrook, N.H. nuclear plant. Inset: The AFL-CIO's Kirkland wants labor to do an about-face.

Industry Stonewall?

One labor source said that Kirkland was aided in this operation by Atomic Industrial Forum chairman Roger Sherman and other industry spokesmen who tried to convince labor leaders to lie low in the wake of an alleged post-Three-Mile-Island public backlash against nuclear power. The source said that every request by union leaders for joint industry-labor pronuclear actions was "either stonewalled or put off into the far distant future."

Under counsel from Kirkland, this antinuclear activity took a strange turn when formerly pronuclear Building Trades Department head Robert Georgine wrote a letter to utility executives telling them that labor support for nuclear power was contingent on an end to the utilities' attacks on the Davis-Bacon Act. The act guarantees payment of union wages on federal construction jobs.

While Davis-Bacon is an important issue in its own right, this particular battle is a set-up. Any anti-Davis-Bacon sentiment among the utilities has been carefully nurtured by the Heritage Foundation, which funded a research study concluding that Davis-Bacon was a depression program that is not applicable today. Heritage targeted the utilities last year, roping them in to its Energy Coalition to discuss pronuclear strategy. (Just how pronuclear the Heritage intentions are can be surmised from the admission of Heritage energy specialist Milton Copulos that the coalition was focusing utilities on local issues and avoiding any national pronuclear campaign.)

The political intention of the Kirkland faction and the Heritage group is to use Davis-Bacon to justify an AFL-CIO shift from a nominally pronuclear position to effectively endorsing the antinuclear position of the United Auto Workers union. This would help set up a larger labor base for an antinuclear presidential candidate like Ted Kennedy and at the same time force nuclear supporters to back whatever other candidate comes out with a mildly pronuclear Heritage Foundation position.

Locals Not Informed

According to local Building Trades leaders that *Fusion* has contacted, the AFL-CIO is not discussing the antinuclear shift with locals. Instead, the Building Trades Department placed an advertisement warning the utilities not to count on the Building Trades for nuclear support in *The Democratic Left*, magazine of Michael Harrington's Democratic Socialist Organizing Committee, which is aimed at the pro-Kennedy constituency.

The Carter Energy Program:

Less Energy for More Money

The energy program President Carter announced to the nation July 15 and 16 focused not on producing more energy or cheapening the cost of energy but on import reduction. Specifically, Carter proposed a grab bag of schemes to reduce U.S. consumption of OPEC oil and to substitute synthetic fuels produced from coal for imported oil and nuclear power.

The Carter administration's energy plan makes clear that its primary goal, so-called independence from the Organization of Petroleum Exporting Countries, is to be achieved without regard to the costs to the economy—cost of energy, cost of capital investment to build alternate energy sources, and cost of unreliability of decentralized energy systems.

Equally dismal for the consumer, the Carter program assumes that the growth rate for primary energy and electricity until the turn of the century will be approximately half the rate of growth seen in the United States since World War II.

Cost Ineffective

The conservation subsidy is an example of how the Carter program will cost the consumer more. The president announced the allocation of about $2 billion to subsidize conservation in homes and commercial buildings to save approximately .5 million barrels of oil per day. The total direct cost of this conservation, however, is more than *$11 billion*. This includes $1.4 billion lost in federal taxes through the $300 tax credit to families that spend $2,000 for home conservation investment and approximtely $8 billion that the 4 million families involved would spend on this equipment.

Over a decade, it is projected that this $11 billion project will save about 1.8 billion barrels of oil. Yet, for that same cost, the nation could install more than 10 gigawatts of nuclear-generated electrical power.

The administration's program for converting oil-burning utilities to coal is another example of this cost ineffectiveness. On July 16, President Carter proposed a target of reducing oil imports by 750,000 barrels per day by 1990 through conversion of oil-burning utilities to coal. Back in 1977, the Edision Electric Institute estimated that the cost of converting existing plants and the guidelines for future coal-burning plants would add $50 billion to the construction and operating costs of the utilities, making the program what they termed "financially disastrous."

Since the experts agree that the utilities cannot financially or physically comply with the administration's proposed 50 percent cut in the use of oil by 1985, 1990, or at any time, the only real effect of this policy will be to shut down about half of the existing oil-burning capacity or force the electrical utilities to burn synthetic liquid fuels, which will *double* the cost of delivered electric power to their customers.

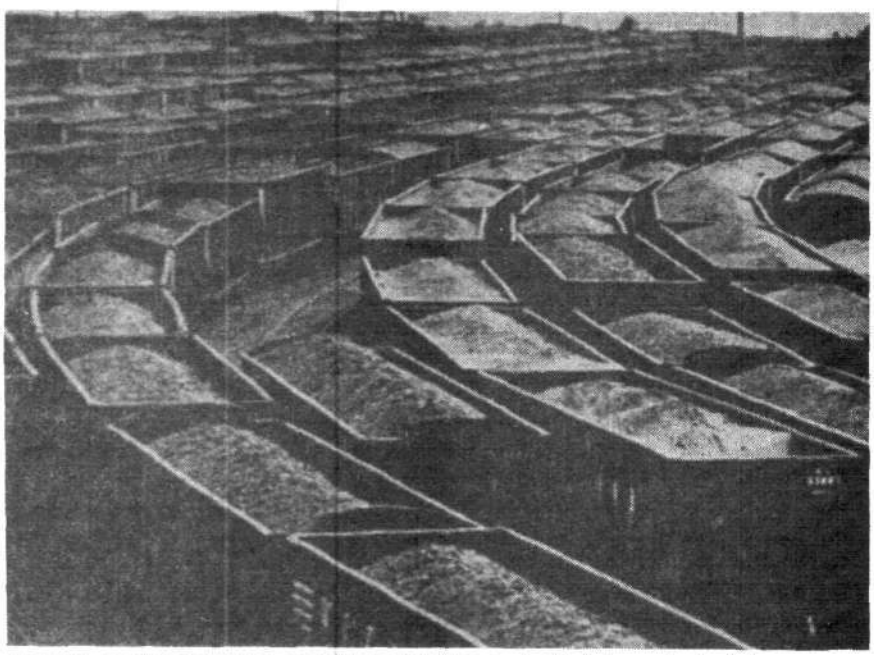
In total, the cost of the president's energy proposals for the 1980-1990 period is $142.2 billion, or $14.2 billion per year. This includes $88 billion for the proposed Energy Security Corporation to produce 2.5 million barrels per day of synthetic fuel by 1990; the $2 billion conservation program mentioned above; $24 billion in subsidies to low-income families; $5 billion to utilities for coal conversion; $1 billion for oil shale tax credits; $1 billion for unconventional natural gas development; $16.5 billion for mass transportation efficiency; and $3.5 billion for the solar bank proposed in the president's April 5 speech.

In addition, earlier proposals as part of the National Energy Act allocate another $2.099 billion for nonproductive energy technologies—conservation, solar energy, and coal synthetics.

In sum, this is a $144 billion tax on the standard of living of U.S. citizens that will be used for subsidies to produce energy that people will not be able to afford.

The Synthetic Fuel Hoax

The largest single component of the increased cost of energy projected under the administration's scenario is the assumed rise in the price of oil to the level required to make the synthetic fuels program feasible—$42 per barrel of oil. (See *Fusion*, Sept. 1979



Carter's coal conversion would double *the cost of delivered electric power.*

for an analysis of why coal synthetics won't work.)

Aside from the $88 billion projected construction cost of 25 synthetic fuels plants and the $18 billion annual subsidy required to hold the price of 2.5 million barrels per day of synthetic fuels down to market prices, there are other enormous costs for the synthetics program.

First, coal hydrogenation requires gigantic amounts of water. In a 1977 study for the Department of Energy on the subject of synthetic fuels, the Hudson Institute concluded that virtually the *entire available water supply* of North and South Dakota and Wyoming would have to be used, presuming that the synthetic fuel plants were located at the mouth of coal mines in those states. This would wipe out agriculture in these states.

Second, there are predictable cost overruns in capital equipment for the construction of synthetic fuel plants. Since the capacity does not now exist in the steel industry, for instance, to produce the required amount of steel tubing to build the synthetic plants, the cost of capital goods would have to rise.

Third, there would be great damage to other capital goods sectors. Building the proposed number of synthetic fuel plants would cripple the capital goods sector of the economy, absorbing the entire stock of several categories of capital goods.

Economic Damage

The damage the Carter energy program would do to the economy was analyzed by the *Executive Intelligence Review* in terms of the Riemannian economic model (described in "Economics Becomes a Science" in the July *Fusion*). The costs and other consequences of the synthetic fuels program show the virtual disappearance of economic activity by the late 1980s in terms of reinvestable surplus, capital available for tangible consumption of the goods-producing labor force, and capital for the total raw materials and machinery costs of production.

The *Review*'s economists concluded: "Short of a dictatorship enforcing lower living standards or some comparable transformation, the Carter program is impossible.

An 'American Solution':
The LaRouche Program For a Nuclear-Based Economy

This is the first in a series of reports on the energy policies of the 1980 presidential candidates.

What would a 1980s Atoms for Peace program look like and what will it take for U.S. industry to achieve it?

These were the main tasks Lyndon H. LaRouche, Jr., an independent 1980 presidential candidate, set for the economic and scientific task force he commissioned in July to develop a nuclear energy policy for his campaign.

"The American people have refused to swallow President Carter's energy hoax," LaRouche commented on the president's July 15 and 16 speeches on energy policy. "Now we need to get on with an American solution to this problem. Nuclear technology defines the competent scientific future for us and for the world."

LaRouche told the task force: "Now is the time to mobilize the nation's resources to move our society rapidly toward a fully nuclear-based economy and also to make this nation again the principal exporter of nuclear plants and technology throughout the world. Environmentalist objections to this necessity are to be put aside as the unscientific mumbo jumbo they are."

The report of the LaRouche task force is summarized here in the accompanying table and figures. The detailed projections for manpower and materials, as well as the figures on existing industrial capacity, were worked out in consultation with experts from the major nuclear and high-technology firms around the nation.

The Program

In brief, LaRouche proposes the following:

- Use the nuclear power development program as the basis for city building in the United States and in other sectors of the world economy, especially the Third World.
- Install 1,000 gigawatts of domestic nuclear capacity by the year 2000.
- Export 1,500 nuclear reactors of 1,000-megawatt capacity to the developing sector by the year 2000.
- Create 750,000 high-skilled jobs in nuclear plant construction for American workers by the year 2000.

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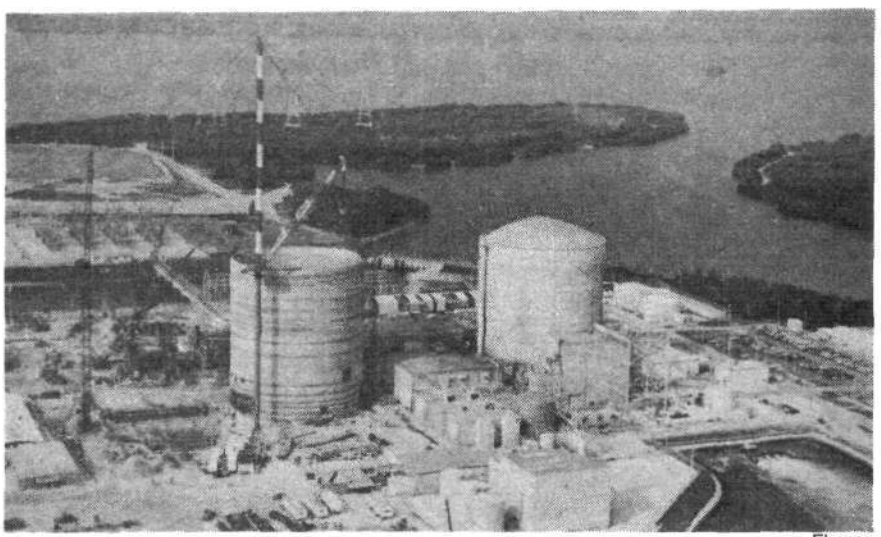


Ebasco

Construction on Florida Power and Light Company's St. Lucie site.

Figure 1
GROWTH OF U.S. NUCLEAR PLANT PRODUCTION TO THE YEAR 2000

The nuclear energy development program has set its goal as the installation of 1,000 gigawatts of domestic nuclear capacity and the exporting of 1,500 nuclear reactors of a 1,000-megawatt capacity to the developing sector by the year 2000. This program is based on using a mix of nuclear reactors that are commercially available today—such as the light water reactor (LWR)—or can be reasonably expected to be available in the near future—the high temperature gas cooled reactor (HTGR) and the liquid metal fast breeder reactor (LMFBR)—given a national commitment to develop nuclear energy as a primary power source.

These projections are based on considerations that assume that the length of time necessary to construct a nuclear plant can be reduced from the current 10 to 12 years to 6 years.

Such production expansion is feasible only by instituting standardized designs, a concept that has been implemented by all the U.S. manufacturers of the LWR. In addition, the export requirements can be met only by the assembly-line mass production of entire nuclear plants in facilities like the floating nuclear plant factory now two years from completion by Westinghouse in Jacksonville, Florida.

Initially, the focus will be on domestic production, siting 500 gigawatts in the United States by 1990 so that nuclear power comprises 55 percent of domestic electrical energy production.

The projected mix of reactor types is based on construction capabilities that, although optimistic relative to current projections, are judged to be attainable given a gear-up of the economy and investments. These estimates are based on discussions with experts associated with the production facilities that manufacture the reactors and their components, including those involved in floating nuclear plant construction. Most agreed that their industry could meet these goals, given the appropriate political climate.

Figure 1

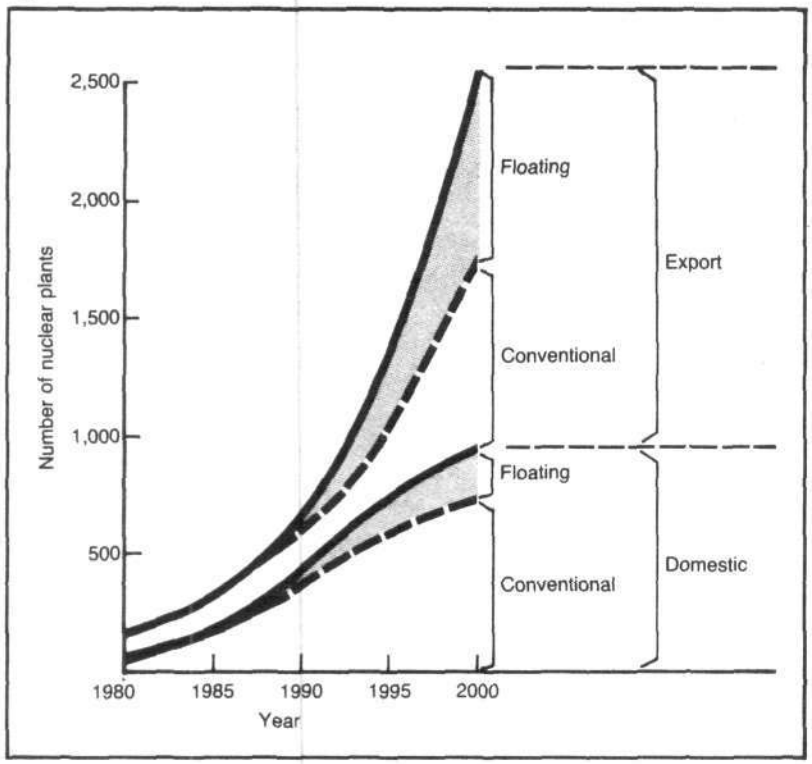


Figure 2

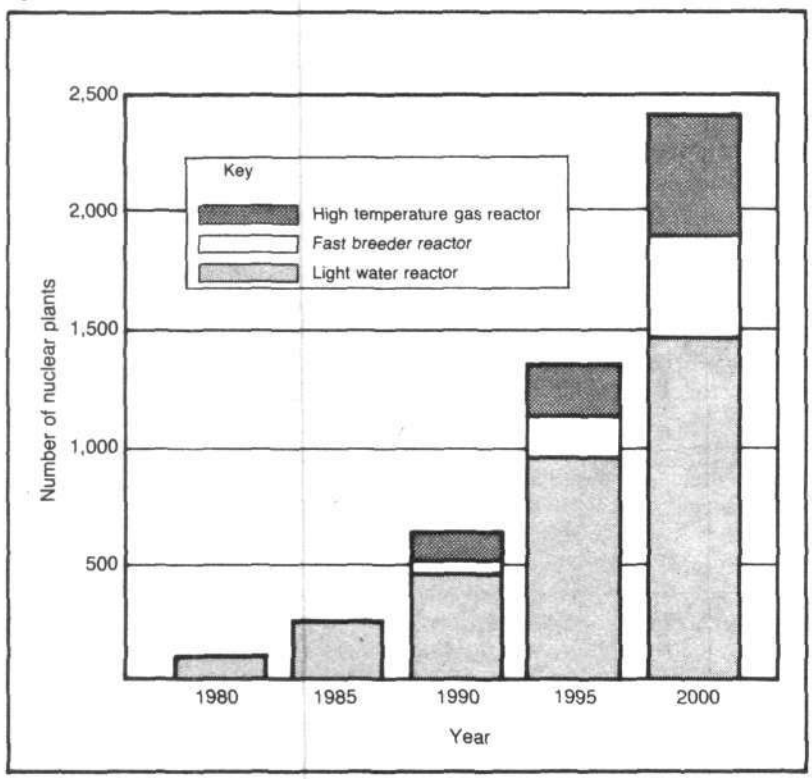


Table 1
FABRICATION AND PRODUCTION PLANT GOALS
FOR NUCLEAR EXPANSION PROGRAM

Year	Number of component* fabrication plants (10-20 components/yr.)	fuel production (metric tons of UO_2)	Number of fuel enrichment plants (2,300 metric tons/yr.)	Number of fuel fabrication plants (600 metric tons/yr.)	Number of fuel reprocessing plants (1,500 metric tons/yr.)	Number of floating plant assembly sites (8/yr.)
1980	3	3,750	2	6	0	0
1985	7	9,450	5	16	5	3
1990	9	27,900	12	47	11	8
1995	14	52,650	23	88	25	19
2000	20	90,300	40	151	45	NA

*Includes pressure vessels and steam generators only.

Table 1
FABRICATION AND PRODUCTION PLANT GOALS FOR NUCLEAR EXPANSION PROGRAM

The data here show the estimated growth of primary production facilities required to meet the goal of 2,500 gigawatts-electric by the year 2000. Heavy components and equipment such as reactor vessels, steam generators, turbine generators, and so on represent the long lead-time items, and their production capacity must be immediately upgraded and expanded. Therefore, the first step will be to bring the component production industry, now operating at less than 50 percent capacity, to full capacity and to expand these existing facilities by another 50 percent in the next two years.

Within four years, at least one new vessel fabrication plant must be built. The vessel production capacity of these plants can be raised to 45 per year by 1981 or 1982 and to 65 by 1983 if a single plant with an annual output of 20 vessels comes on line. Every succeeding year or two it will be necessary to bring on line another vessel production plant, until 20 are in operation by the year 2000.

To fuel these reactors, more fuel enrichment, fabrication, and reprocessing plants must be built. The United States now has three fuel enrichment plants. Each plant has a capacity to produce 2,300 metric tons per year of UO_2, the chemical form in which the fuel is fabricated into pellets. The average 1,000-megawatt-electric nuclear plant requires a charge of 90 metric tons to start up; 30 metric tons are replaced each year. On this basis and on the basis of the number of reactors projected to be in operation by the year 2000—both domestic and exported — 40 enrichment plants will be required.

Fuel fabrication into configurations of rods and bundles now occurs at five or six plants each with a capacity of 600 metric tons per year of UO_2. At that unit size, 150 such plants will have to be in operation by the year 2000.

The Barnwell, South Carolina nuclear fuel reprocessing plant has a potential capacity to handle 1,500 metric tons per year of UO_2. It should be completed by 1981 if it gets the go-ahead. The best estimates at the present time are that a facility with twice the capacity, or 3,000 metric tons a year, would be optimally cost effective. It will be necessary to construct 17 such plants (equivalent to 34 plants at 1,500 metric tons per year) by the year 2000, in addition to 11 smaller plants at 1,500 metric tons per year, to meet the demand for fuel reprocessing.

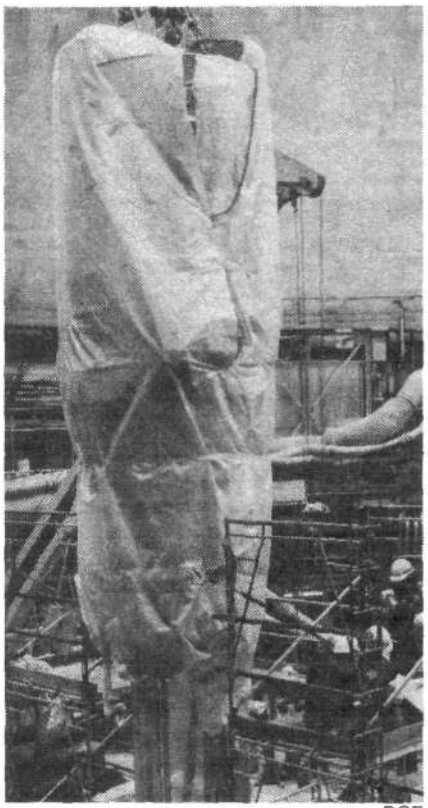
Floating Reactors

A large proportion of the nuclear-reactor output by the year 2000 will be of the floating variety, both for export and for domestic use. These floating reactors are built on barges at special facilities similar to shipyards and then towed to their destination along a coastline or in a river. The special advantage of this method of construction is that the plant can be constructed in advanced-sector countries where the skilled labor currently exists, and little land-based infrastructure is required to site and utilize these plants in developing nations. In fact, floating nuclear plants can be used to begin development of areas that otherwise would have to depend on labor-intensive means of energy production.

The one partially completed floating nuclear plant facility in Jacksonville, Florida will be capable of assembling four plants each year. This facility should be completed in 1981, with the first four plants floating off the assembly line in 1985. Expansion of this facility and construction of 19 additional plants with larger capacities (eight per year) will meet the requirements of constructing some 950 floating nuclear plants for both domestic use and export by the year 2000.

The Bottlenecks

One serious bottleneck to the gear-up of basic industry is the machine tool and metal working equipment sector. At present, the lead time for delivery of the most advanced machine tools, such as a computerized boring mill, is two years. New capital goods production technologies must



DOE

Reactor vessel handling equipment in construction at Hanford, Wash. site.

be introduced to cut these lead times.

Quality control of reactor materials, especially the thick pressure vessels, is now time consuming and adds to the delay of reactor component fabrication. More advanced testing methods, such as X-ray techniques and ultrasonics must be applied to quality control in the nuclear industry. Other advanced methods such as neutron radiography must be developed and implemented quickly.

Without the introduction of computerized and highly automated production technologies, the United States will not have enough qualified engineers and technicians to meet a high-technology 7 percent per year growth rate in electricity production. Technologies to produce standardized reactors based on the Henry Ford concept of assembly-line production—now in operation at the Soviet Atommash facility—will eliminate the one-of-a-kind engineering requirements of the current U.S. nuclear industry.

Continued from page 12

- Expand and modernize basic U.S. industry, most immediately the steel and machine tool sectors.
- Implement an oil-for-nuclear-technology trade policy with major Third World nations.

The task force, which included several Fusion Energy Foundation specialists, began its work with two major assumptions.

First, coal, oil, and gas—the so-called fossil fuels—are much too valuable as feedstocks for the petrochemical industry to be wasted by combustion. However, in order to bridge the gap over the next decade when nuclear generation will be fully brought on line, the task force proposed a one-time expansion of oil refinery capacity to provide the fuel for transport and other energy needs now provided by gasoline and oil.

Second, the task force assumed that a desirable and feasible rate of nuclear energy growth is on the order of 7 percent per year. This growth rate is compatible with the required rates of growth in the other productive sectors in order to increase nuclear output—for example, the steel and machine tool sectors—and is also consistent with historically achieved rates of growth during the 1950s.

Fusion Development

Successful realization of an Atoms for Peace plan, the LaRouche policy states, will be based on the continual development and introduction of ever more efficient types of nuclear technology. The ultimate goal of this effort must be a crash program for thermonuclear fusion power development to guarantee the vast energy and raw materials supplies needed for the next century. This will require an initial investment of $50 billion for advanced nuclear technologies research and development over the next decade.

The specific LaRouche recommendation for the fiscal year 1980 fusion budget is an increase to the level required to maintain the construction schedule for the engineering test facilities for both the magnetic confinement and the inertial confinement programs and to begin the design and development work for an engineering power reactor by the year 2000.

After the funding requirement is met, the LaRouche program states that the remaining bottleneck in gearing up for a crash program for fusion power development is the inadequate number of available trained scientists and engineers necessary to solve the remaining basic theoretical questions of plasma physics and to build a whole new series of industries needed to develop commercial fusion reactors. The remedy is a brute-force educational program of the sort NASA set up for the Apollo project.

Another major goal of the LaRouche energy program is to develop hydrogen and hydrides as the fuels of the future. The policy statement outlines two major areas of application for hydrogen as a fuel: first, in the form of fuel cells in heavy-duty transport—as in trains—and for stand-by electrical generation; and second, direct use of hydrogen in modified internal combustion engines.

The LaRouche task force is continuing research on the production and use of hydrogen fuel.

LaRouche has stated on many occasions that only by going nuclear will the nation enter a period of economic boom. This was the precise conclusion of a series of computer-generated analyses of alternative energy scenarios for the United States carried out by the *Executive Intelligence Review* using the Riemannian economic model (described in detail in the July issue of *Fusion* in "Economics Becomes a Science").

When the *Review*'s economic staff programmed the LaRouche plan for a crash commitment to nuclear development at a rate sufficient to generate an additional 7 percent of capacity per year, it produced an economic growth rate after 10 years that exceeded any previous postwar growth rate. In contrast, the Carter program based on synthetic fuels (described in an accompanying article in this section) caused an economic breakdown by the late 1980s.

LaRouche, a noted economist, is the chairman of the U.S. Labor Party. He is the author of several books and pamphlets, including *How to Defeat Liberalism and William F. Buckley, The Power of Reason: A Kind of Autobiography*, and *The Theory of the European Monetary System*.

Table 2
MATERIALS AND LABOR REQUIREMENTS PER PLANT

Type	Materials (tons) Steel	Stainless	Alloy	Cement	Concrete	Man-hours Labor	Comments
LWR	47,900	2,030	4,870	59,700	564,000	12 million	
FBR	30,700	1,720	3,510	33,400	317,000	14.2 million	for a 1,000 MWe plant
HTGR	73,760	3,192	11,600	49,440	426,400	13 million	
Reprocessing plant	51,400	4,520	7,080	88,000	745,000	16 million	LWR reprocessing 1,500 metric tons/yr. capacity
Enrichment plant	331,000	16,400	32,100	120,000	1,200,000	69 million	Diffusion plant, 2,300 metric tons/yr.
Fuel fabrication	22,010	169	304	2,800	27,300	1.3 million	No PU recycle, 600 metric tons/yr. capacity
Fuel fabrication	21,040	60	134	4,025	40,100	1.2 million	With PU recycle, 150 metric tons/yr. capacity
Basic component fabrication plant	30,000 tons of basic structural steel				50,000	3 million	to build all kinds of fabricating plants—pressure vessels, generators, turbines, etc.
Floating nuclear plant construction facility	40,000 tons of basic structural steel				500,000	70 million	This plant will initially produce 4 1,000-MWe plants/yr., but later will be expanded to 8 plants per year

MWe = megawatt electric LWR = light water reactor FBR = fast breeder reactor HTGR = high temperature gas reactor

Tables 2 and 3
MATERIALS AND LABOR FOR THE NUCLEAR CONSTRUCTION PROGRAM

To manufacture 2,500 nuclear power plants by the year 2000 will demand a full mobilization of existing U.S. basic production plant and equipment and the expansion and growth of basic U.S. industry. The combination of these two tables illustrates the "bill of materials" needed to produce the 2,500 gigawatts electric of nuclear power over the next 20 years. Included are the basic materials—steel, concrete, and labor— to build the nuclear plants as well as to build the primary manufacturing and production facilities necessary to support this massive construction program. Material and labor requirements for the large array of secondary industries required are not included in these estimates and are expected to be quite large.

Labor Power

More than 140,000 engineers will have to be trained to design, build, and staff the nuclear reactors even as standardized design and assembly line production becomes the mode of manufacture. There are now about 32,000 engineers in the nuclear industry. Tens of thousands of highly skilled construction and manufacturing jobs will have to be filled by the next generation of workers, intensively educated and trained on the job, to build a mass production industry out of what is now a handicraft. A total of nearly 760,000 skilled workers will be needed by the year 2000; currently only about 160,000 are employed.

To build a typical LWR nuclear power plant requires at least 48,000 tons of carbon steel, 2,000 tons of stainless steel, and 5,000 tons of other alloy steels, as well as more than 600,000 tons of concrete and cement. To complete the plant requires more than 12 million man-hours of labor.

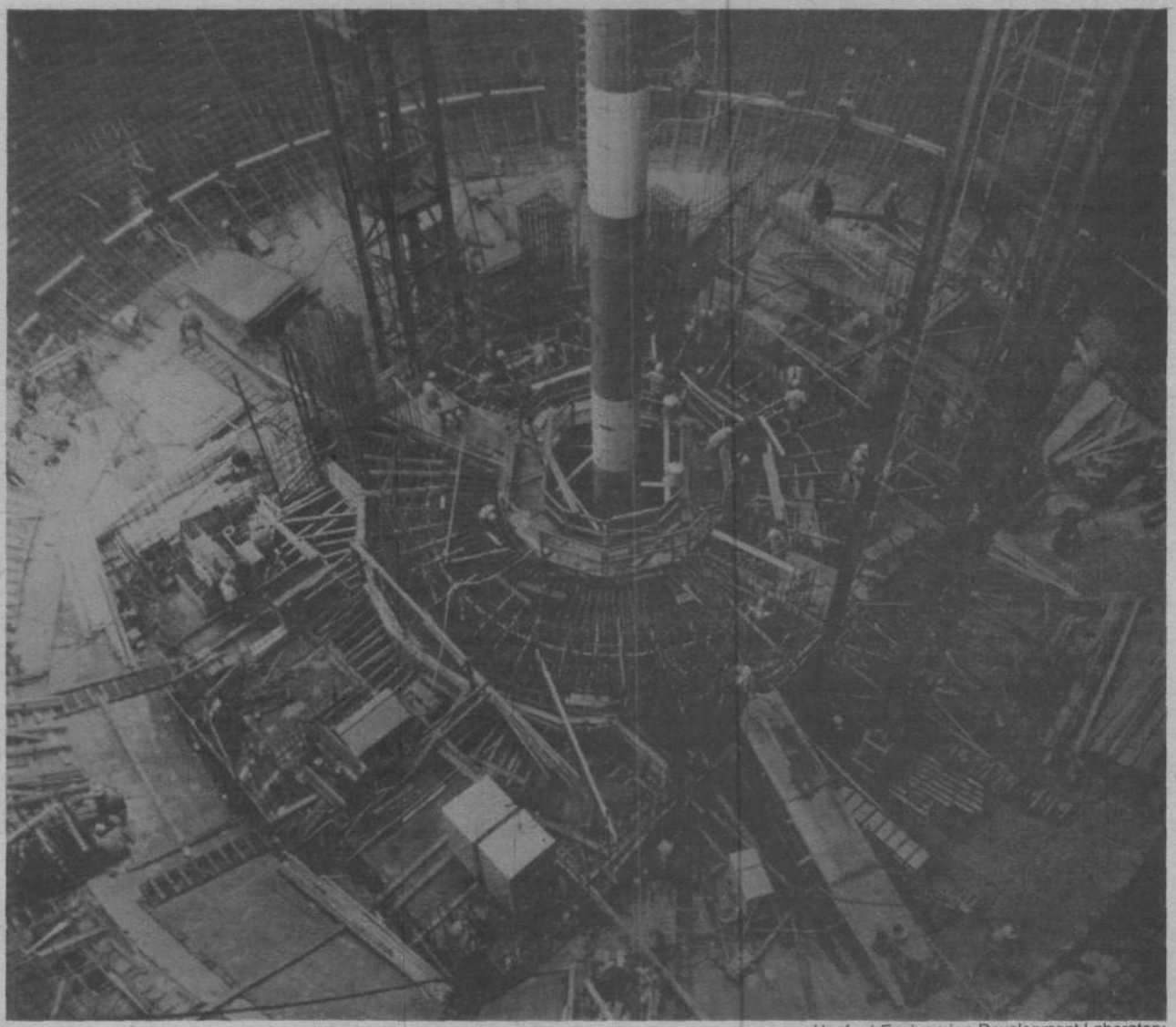
Material requirements for other plants are given in Table 2.

Table 3 summarizes basic inputs, providing cumulative totals to the year 2000 for the 2,500 nuclear reactors slated for production, the fabrication facilities to build the pressure vessels and steam turbine systems for reactor production, and the fuel cycle and fabrication facilities. The amount of steel needed just for this program requires the construction of at least two 8-million-ton per year greenfield plants, in addition to the upgrading and expansion of existing capacity.

Steel Demand

Most projections indicate that the U.S. steel industry will not be able to meet expected demand by the early 1980s. More than 30 million tons of additional capacity will be needed by the mid-1980s just to meet basic demands; even more will be needed for the large-scale nuclear program projected.

Specialty steel capacity was significantly expanded in the 1960s in anticipation of an expanding nuclear industry. Much of that capacity is now "excess" and idle. By the mid-1980s, additional stainless and other specialty capacity must be on line.



Hanford Engineering Development Laboratory

The interior floor of the Fast Flux Test Facility in Hanford, Washington under construction.

Table 3
TOTAL MATERIALS AND LABOR FOR NUCLEAR CONSTRUCTION PROGRAM*

Year	Steel (millions of tons)		Cement and concrete (millions of tons)	Manpower		
	Carbon	Alloy		Total (millions of man years)	Skilled workers	Engineers
1980	7	0.6	15	0.8	158,000	32,000
1985	19	1.7	41	2.0	332,000	68,000
1990	45	5.7	136	5.4	454,000	86,000
1995	90	14.4	373	11.4	625,000	114,000
2000	158	25.2	654	19.9	760,000	140,000

*All figures are cumulative.

New HEW Agency To Constrict Medical Technology?

A new oversight agency with far-reaching influence was set up in the Department of Health, Education, and Welfare in April to evaluate all biomedical research and technology—the National Center for Health Care Technology or NCHCT.

NCHCT was mandated by legislation sponsored by Senator Ted Kennedy (D-Mass), and like the rest of Kennedy's health care program proposals, NCHCT's main theme is to cut costs by evaluating new medical technology as unnecessary and wasteful.

The goals of the agency, stated in its draft program, include "the containment of health care costs by making available to the practicing community and the public the best collective, broad-based judgments concerning health care technologies." What this means specifically was spelled out by the agency's acting director, Dr. Seymour Perry: "Medical instrumentation has reached the point and expense where it must be closely scrutinized. We know there have been truly important advances. Now we have to decide which of them are appropriate and which are not."

The draft program for NCHCT outlines how these decisions are to be made. According to the program, the agency was created in response to what NCHCT calls "Senator Kennedy's request for a 'Technology Management' strategy for the Department [HEW]." This strategy will be formulated by "technology consensus development" conferences sponsored by NCHCT that the agency will summarize as the basis for research priorities. An NCHCT spokesman interviewed August 17 described these conferences as "akin to the Delphi Technique but with less brainstorming and more fixed agenda."

(The Delphi Technique, described in a feature article in the May 1979 *Fusion*, was developed by the Rand Corporation as a method of containing scientific advances by manipulating a prearranged consensus.)

The first such conference was on "Pain, Discomfort, and Humanitarian Care," a continuation of the Kennedy polemic for the "right to die."

Although it does not have final judgment powers over research grant money, the new agency has enormous leverage over the formation of research policy. NCHCT not only has oversight for all research funded by the National Institutes of Health. It also strongly influences the choice of which technologies will be paid for by Medicare, the federal health insurance program for senior citizens.

HEW policy is that all coverage issues from Medicare will be referred to NCHCT, which will serve as the prime mediating body to "synthesize the opinions provided by the review agencies," such as the Public Health Service.

"These 'coverage decisions' can have a profound influence on the rate at which services or technologies are adopted into practice or eliminated from medical practice," the NCHCT program states. Indeed, NCHCT will be deciding, through the state-level Health Services Agencies, whether hospitals will be allowed to purchase important new medical technologies like the CAT scanner.

Zero Growth

NCHCT was given wide publicity as the lead story in the August 5 *New York Times Sunday Magazine*. Ostensibly championing the wonders of modern medicine, the article systematically attacked technology for being "expensive," "dehumanizing," and even "dangerous." The *Times* has also been leading the fight in New York City to close hospitals in order to balance the budget. For example, a *Times* editorial June 4, titled "Shutting Hospitals, Gaining Health," argued that fewer municipal hospitals would mean better health care for New Yorkers.

The fallacy in this cost-cutting campaign is, of course, that the efficiency and hence cost of the health care system depends on more—not less—technology, and that an industrial economy based on growth—instead of zero growth—can generate the funds to invest in the necessary research to continue the development of medical technology.

—Ned Rosinsky, M.D.

International

Mexico to Present Energy Plan at UN

Under the banner "Energy must be the common responsibility of mankind," Mexican President Jose Lopez Portillo will present the United Nations General Assembly Sept. 27 with his proposal for a worldwide energy accord. The primary goal of the proposal is to avoid what Lopez Portillo has termed the "apocalypse" that will result if nations resort to war to meet energy needs.

As presented to numerous world leaders over the past year, the Mexican proposal outlines two approaches to guarantee that energy serves the cause of peace and development. First, Lopez Portillo has called for the optimal distribution and utilization of existing resources. In this regard, Mexico sees the manipulation of production and markets by the oil multinationals as a great obstacle. Earlier this year Mexico bitterly assailed the multis for manipulating the Rotterdam spot market to push up the price of oil.

Second, Lopez Portillo aims to encourage maximum development of new energy sources, especially in the Third World, by new financing and transfer of technology arrangements.

An impressive list of nations have pledged their support for the proposal. During the spring, France, Cuba, and Costa Rica backed the plan with great enthusiasm. In early summer, Mexico enrolled the support of two major Latin American institutions, the Latin American Energy Organization, OLADE, and the Latin Economic American System, SELA. During the past month, ambassadors to Mexico from Iraq, Vietnam, Japan, West Germany, Spain, Canada, Bangladesh, Poland, Bulgaria, and the Soviet Union all pledged agreement.

U.S. Silence

Following the "energy confrontation" strategy of its James Schlesingers and Harold Browns, the United

States government has been notably silent. Questioned on the U.S. approach to the Mexican proposal, Undersecretary of State Julius Katz said contemptuously, "There is no proposal." As for energy development in the Third World, Katz replied: "We've taken action with the World Bank on that. Beyond that, Lopez Portillo has not made his speech to the UN yet. When he has, we'll look at it."

Many Mexican sources see the U.S. administration as implementing a policy that is diametrically opposed to the Mexican energy strategy as well as to what could be a booming U.S.-Mexican trade program—a policy to create a "strategic reserve" of energy throughout the Western Hemisphere. This geopolitical notion, promoted by think tanks like the Mitre Corporation, the American Enterprise Institute, and the Council of the Americas, would put the rich energy resources of the region in Washington's hands to use in global energy blackmail. The primary targets would be the resource-deficient U.S. allies.

These sources do not rule out the threat of direct U.S. military intervention in Mexico to secure such strategic reserves. A front-page *Baltimore Sun* article July 29 recalled earlier U.S. invasions of Mexico and quoted "informed sources" to warn that "both sides know there are limits to U.S. tolerance" of Mexican political and economic independence.

—Timothy Rush

The Ixtoc-1 Oil Spill: Some Facts

"Mexico's state-owned oil company, Pemex, should be congratulated for the work they are doing in controlling the Ixtoc-1 oil spill in the Gulf of Mexico," said Paul Adair, the well-known expert in shutting down oil spills.

In a mid-August statement to the press, Adair commented that despite the U.S. press scare, the Ixtoc spill is not the worst in history and that the company is contributing greatly to the technological development of the oil industry by applying the most advanced equipment to control the spill.

There are now some 14 runaway oil wells in the world. What distinguishes Ixtoc-1 is that it is the world's largest offshore oil deposit; because it is a bigger find, more oil is flowing while efforts to cap the well are in progress.

Pemex technicians managed to cut the original flow of 30,000 barrels per day, which began June 3, by 30 percent in late July. In August, Pemex technicians developed a revolutionary technique that involves dropping specially calibrated steel balls into the shaft opening, and this cut the oil flow another 30 percent.

Experts believe that the problem will be entirely under control in a few more weeks when auxiliary wells being dug to the 3,000-meter level on each side of Ixtoc, will draw off the pressure from the uncapped well.

Fusion asked Mexican physicist Cecilia Soto de Estevez, director of the Mexican Fusion Energy Association, AMEF, to comment on the media outcry against the Ixtoc spill.

"I think it is similar to what the world press did after the Three Mile Island incident," Soto said, "irresponsibly whipping up hysteria against industry, technology, and development in general. In this case it doesn't take much insight to realize that there are special reasons for slandering Mexico's nationalized oil industry. We are demonstrating that a Third World nation can run its own technologically sophisticated oil development program without the oil multinationals. And we are putting the oil revenues into large industrialization projects, capital goods, heavy industry."

Soto noted that this "has made the World Bank crowd very unhappy, and this includes many U.S. government officials who believe Mexico's oil wealth could be more easily controlled from Washington if Mexico were kept as a backward, agricultural country."

Soto also said that the "environmental damage is transitory and much less severe" than the press indicates. "Furthermore," she stated, "Pemex chemists have just announced that some of the oil washing ashore in Texas in fact comes from seepage of Louisiana offshore wells, not from Ixtoc at all—and this has been confirmed by U.S. scientists."

Japan Reduces Commitment To Nuclear, Fusion

The Masayoshi Ohira administration in Japan has proposed to spend $25 billion over the next 11 years on "alternate energy sources" such as coal, coal liquefaction, and solar energy, while reducing the previous 1985 target for nuclear power by 15 percent and the 1990 target by 10 percent. The plan also "includes a removal of nuclear fusion on which a considerable amount of money has been spent," according to the Japanese daily *Mainichi* July 17.

Japanese government sources said that they believe this does not mean a total abandonment of research in fusion but, more likely, a refusal to increase the budget from the current $400 million per year. The sources could not confirm this information, however.

The announced purpose of the program is to reduce Japan's dependence on imported oil—Japan produces virtually no oil itself—from 75 percent of Japan's energy needs to 48 percent by 1985. This drastic shift is deemed necessary to meet Japan's pledge at the seven-nation economic summit in Tokyo in June to limit imports to 6.3 million barrels per day in 1985.

Why?

When Ohira became prime minister in November 1978, most political observers felt that his victory would not be able to significantly alter Japan's independent and progrowth policy associated with his predecessors, even though Ohira was closely allied to Hen-

ry Kissinger and the no-growth faction of the Anglo-American policy-makers.

However, when Japan was put under the gun of the latest oil shortage—including the threat of reduced oil imports from the United States—Ohira was able to begin to move Japan into the Carter administration camp. (Ironically, in an earlier period it was the progrowth, development policy that was considered "pro-American"; indeed, this was the policy of General MacArthur.)

The Ohira energy proposals will fundamentally alter the future course of Japan's economy. In the early 1970s, Japan's Industrial Structure Council—a business advisory body to MITI, the Ministry of International Trade and Industry—developed a long-term economic plan whose core was making Japan a fusion-power-run economy by the 1990s or 2000. All investments in other industries, the rapid development of computers, transfers of technology to developing countries, and other key decisions were to be organized around the key target of bringing Japan into the high-technology "knowledge-intensive era" of fusion power. Nuclear power was seen as the transition to the fusion era.

"By the year 2000, Japan will supply half the world's energy through mass production of fusion power machines." MITI wrote. A not unimportant aspect of this program was the perceived political advantages of energy independence.

With these goals in mind, former prime ministers Takeo Miki and Takeo Fukuda had raised Japan's fusion budget from $40 million in 1977 to a planned $400 million in 1980, including $150 to $200 million as Japan's share of a joint energy research program Fukuda proposed with the United States. Ohira now has relegated commercial fusion to some unspecified time in the 21st century.

Japan's nuclear future is more directly jeopardized. Japanese planners in the early 1970s had envisioned nuclear power as supplying 20 percent of electricity needs by 1980 and 30 percent by 1990. But environmentalist groups, combined with post-1974 economic stagnation, succeeded in slowing nuclear development so that nuclear supplies only 10 to 12 percent of electricity now. And Ohira has reduced the 30 percent projection for 1990 down to 18 percent.

—Richard Katz

Euro-Arab Deals Underway

Negotiations are underway between the French government and four Arab oil-producing nations that may culminate in the formation of a powerful "Euro-Arab zone of prosperity and cooperation," the French daily *Le Matin de Paris* reported Aug. 1. According to well-informed French officials, the story was "commissioned" by a team of high-level government officials working directly under French President Giscard d'Estaing.

Le Matin reported that the French government, with West German support, has discussed possible Euro-Arab economic collaboration with the governments of Iraq, Saudi Arabia, the United Emirates, and Kuwait. The French are seeking guaranteed oil supplies for Western Europe in exchange for the transfer of Europe's advanced technology to the Arab world, including nuclear energy technology, to foster industrial development in the region.

France is also offering military security for the Arab governments that recently expressed alarm at U.S. Defense Secretary Harold Brown's threat to invade the Persian Gulf.

According to *Le Matin*, the Arab countries are discussing whether to price their oil in terms of the European Monetary System's currency unit, the ECU—which means that a gold-backed monetary system is under consideration.

Washington

Research Cuts Threaten Fusion Future

A little-noticed feature of the fiscal year 1980 fusion budget is that although the profusion members of the House Science and Technology Committee were able to maintain the budget at a $340 million level, they may have traded off the theoretical future of the program. Specifically, the committee proposed that $5.5 million be cut from the Applied Plasma Physics portion of the magnetic fusion research budget for fiscal year 1980, and Congress followed the committee's recommendation in a late August vote.

In comparison to the total fusion budget this amount may not appear significant, but the cuts will severely limit the university fusion program and will cripple a vital area of fusion theory.

The only way the cuts can be restored is in the unlikely event that the Carter administration requests specific budget supplements for the Applied Plasma Physics program.

The Damage

Most of the $5.5 million cut will come from the $20 million budget of the university fusion program and will mean that upwards of 25 percent of all graduate students now funded by the fusion program will lose their grants.

In a letter to the House committee members, a leading fusion scientist assessed the damage as follows:

"Such a cut could hardly come at a worse time. The demand for new PhD's to enter the fusion program is at a very high level . . . . In order to guarantee a pool of trained personnel and a broad base of scientific support for the rapidly expanding and vitally important fusion effort, some measure of ongoing financial stability must be guaranteed."

Other fusion scientists have noted that as third and fourth year graduate students are forced out of the fusion

program, it may take years to rebuild it.

In addition to the university cuts, the House Committee on Science and Technology specifically mandated a curtailment of the theoretical research areas of the Applied Plasma Physics program. To quote from the committee's directive on the budget cuts:

"The reduction would cut back on certain level 2 efforts under Advanced Fusion Concepts and delete stellarator and certain generic theory efforts under fusion plasma theory. The theory program requires a focus on device-specific plasma behavior and the committee is unconvinced of merits of further stellarator-specific activity and plasma turbulence studies [emphasis added]. The remaining reduction across the Advanced Fusion Concepts, Fusion Plasma Theory, and Experimental Plasma Research Subactivities should be distributed as an across-the-board reduction . . . ."

Plasma turbulence studies include most areas of nonlinear research in plasma physics, which is essential to *all* types of fusion devices; and this particular cut demonstrates the disastrous effect of the cutbacks.

The aim of the committee in making these cuts was to focus more of the limited fusion effort into developing the mainline approach, the tokamak. But the chief scientific question that remains to be fully resolved in tokamak operation is whether a high enough plasma beta can be achieved to permit the design of economical power plants based on the tokamak approach. (Plasma beta is a measure of the efficiency with which magnetic fields confine fusion plasmas.)

Ironically, the area of investigation most directly involved in achieving high beta tokamak operation is plasma turbulence studies.

A year ago, Princeton researchers made a significant breakthrough in achieving fusion ignition temperatures in the PLT tokamak—five years ahead of schedule. The Department of Energy response? DOE Undersecretary John Deutch announced the administration's decision to put off the date for completion of a demonstration fusion reactor from the year 2000 until the year 2015.

The response of fusion supporter Mike McCormack (D-Wash), member of the House Committee on Science and Technology and chairman of the Subcommittee on Energy Research and Production, to the DOE "go-slow" policy was to push for an acceleration of the tokamak program.

Specifically, McCormack and colleagues proposed additional funding to the Development and Technology portion of the fusion budget that includes upgrades of various tokamak programs. At the same time, secondary alternatives to fusion and plasma theory studies became a budget casualty as McCormack suggested these areas for small cuts, expecting the cuts to be restored by the full House.

The McCormack tactic backfired. When the fusion budget came before the full House Science and Technology Committee, and then Congress, McCormack's additions were removed and the cuts were maintained.

The ultimate culprit, of course, is the DOE and the Carter administration, which have strangled the fusion budget while dumping funds into technologies such as biomass and solar energy.

McCormack has escalated his fight against this go-slow fusion policy by convening a Fusion Advisory Panel to the House subcommittee that is comprised of noted experts in the fusion community. After a few days of meetings with the panel in mid-July, McCormack wrote to John Deutch to formally request a "more aggressive scenario" for reaching the goal of commercial fusion.

Demonstration Plant by 1995

In a letter entered in the *Congressional Record* July 26, the congressman requested that Deutch prepare a detailed schedule, including costs, for getting a magnetic fusion demonstration plant on line by 1995 and a similar schedule for the year 2000.

"We consider the potential contribution of fusion electricity to our society to be of such great importance that it must not, under any circumstances, be limited by routine budget circumstances," McCormack wrote.

This time around, the McCormack fight will benefit not only from its partnership with the Fusion Advisory Panel but from mending its fences with researchers in the fusion community.

—Charles B. Stevens

Congressional Line-up

House Fights Back on Clinch River

In the first organized counterattack since the Three Mile Island antinuclear hysteria hit Congress, progrowth forces in the House of Representatives voted 237 to 182 July 26 to continue full funding for the beleaguered Clinch River Breeder Reactor. If the full Senate follows the lead of the House, this will be the third time in his three years as president that Jimmy Carter will be put in the position of vetoing a Department of Energy budget that includes funds for Clinch River.

The House vote defeated an amendment by Science and Technology Committee chairman Don Fuqua (D-Fla), backed by the administration, to terminate Clinch River and plan for another demonstration plant to replace it. The vote, which included the defection of 110 Democrats from the administration's position, was seen as a sign of congressional commitment to the development of nuclear power. Another amendment by House Interior Committee chairman Morris Udall (D-Ariz), which canceled the breeder without a DOE study for a replacement, was defeated by voice vote.

Although the so-called compromise amendment was presented by Fuqua, chairman of the House committee with oversight for nuclear energy, both Democratic and Republican members of the committee refused to capitulate. Ranking minority member John Wydler (R-NY) and staunch nuclear advocate Mike McCormack (D-Wash) led the floor fight for full funding, collaring individual congressmen as they en-

tered the chamber for the full House vote.

"If we pass this we are left with nothing but a program of pieces and parts and a vague hope that we are going to do something in the future, and whatever that is, nobody knows," Wydler declared. "I say let us not be a timid Congress."

Fighting for an Energy Future

Committee members used the breeder issue to lambast the zero-growth environmentalism of the administration and its congressional spokesmen. Here is an account of the floor discussion on the breeder, as reported by American Nuclear Society Washington representative John Graham in the Aug. 13 issue of his *Nuclear Report*:

"Marilyn Lloyd Bouquard (D-Tenn) went after Udall directly: '[Will] the good chairman of the Interior Committee [support] efforts to open up . . . our national parks, our wilderness areas, our wildlife refuges, and our national forests for uranium mining to meet demands for nuclear fuel [needed if we fail] to develop the breeder?'

"Udall hedged. Bouquard continued: 'I was wondering if the gentleman from Arizona would be inclined to relax environmental standards so we could put more coal plants on the line.' Udall said he is not in favor of that. Bouquard pointed out that with 40 percent of the nation's uranium ores locked into protected areas, and the full utilization of coal blocked by environmental restrictions, the breeder will soon be the country's only viable means of generating the electricity needed for national survival.

"Rep. Roe (D-NJ), after Fuqua the most senior majority member of the committee, called the House to task on its accomplishments in energy. Consider 'oil shale, tar sands, hydroelectric power generation, nuclear generation.' he said, and asked: 'What new energy have we put into place in the last six months or the last four years—or anything into production to provide one new ounce, one kilowatt of electricity for the nation?'

"But the issue was stated most forcefully, both in terms of the breeder, and more importantly to what has happened to the legislative arm of the government's ability to act independently and responsibly in the nation's interest, by Don Young (R-Alaska). The blame for the energy crisis, he said, 'lies on our shoulders because we have responded to a special interest group, a group that is really the zero growthers, the nonexpansionists, this diverse group that says we cannot allow a man to reach his zenith.'"

Int'l Battle over Breeder Policy

The deliberations of the breeder committee of the International Nuclear Fuel Cycle Evaluation conference, Infce, have predictably turned into a battle over breeder development policy.

The committee, chaired by the Soviet Union, Italy, and Belgium, has published a report projecting the need for 50,000 megawatts of breeder capacity by the year 2000, and France has actively backed the committee's projections.

The United States responded by insisting that the Europeans are "overestimating" the number of breeder reactors needed. Full-scale breeder development, the U.S. representatives said, will encourage the development of a "plutonium economy" and this will lead to weapons proliferation.

Infce, which has been meeting in Europe since the beginning of the summer, was set up last year at the initiative of President Carter to try to convince the advanced and developing countries that nuclear technology causes weapons proliferation and that closing the nuclear fuel cycle by reprocessing and fully developing breeders is unnecessary.

Observers expect that the U.S. representatives will try to get the committee to arrive at a "compromise."

Inside DOE

New Faces, Same Policies

Although the entire top leadership of the Department of Energy has been replaced in the past two months, only the faces are different—the policies remain the same.

The appointments of Charles Duncan in the top spot, and John Sawhill and John Deutch in the second and third positions respectively, ensure that that DOE policy will continue to be made by the same constellation of think tanks, environmentalist groups, and financial interests that has mandated civilian Malthusianism and a geopolitical military strategy that has destroyed the nation's in-depth strategic capability.

A review of the new appointees' credentials makes the point.

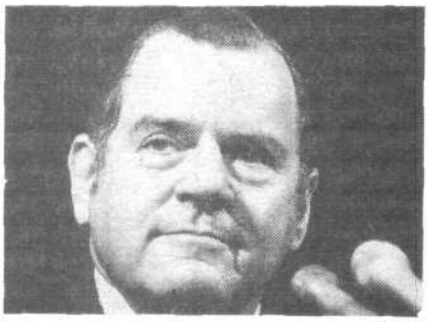
Charles W. Duncan

The only self-defense this Department of Defense official gave during two-and-one half hours of questioning at the Senate Energy Committee confirmation hearings was that he was qualified to be secretary of energy because he knows nothing about energy and, therefore, will be able to keep "an open mind."

Senator Paul Tsongas (D-Mass) complimented Duncan on the fact that energy has not been one of his interests, characterizing Duncan as a "breath of fresh air."

As for his fresh views on energy, Duncan reaffirmed the administration's goal of producing 20 percent of the nation's energy through "renewables" (wind, solar, tides, and biomass) by the turn of the century and described conservation as the "most cost-effective initiative we can undertake." Duncan's prepared remarks never mentioned nuclear energy.

Although much was made of Duncan's nonenergy background, closer examination shows that his actual job in the Defense Department was to develop Defense Secretary Harold Brown's concept of a "100,000-man strike force" ready to invade the Persian Gulf to "secure the oilfields."



DOE

Duncan: The DOD's tabula rasa

This strike force concept, often mentioned by James Schlesinger (including in his parting remarks at a farewell DOE dinner) dovetails with the Carter energy policy of cutting oil imports and scapegoating OPEC in order to promote conservation as an energy policy. Of course, as many political observers have pointed out, such geopolitics will probably get the United States into a nuclear face-off with the Soviet Union.

John Sawhill

Sawhill, nominated for the number two spot of deputy secretary, is an old hand at managing energy crises. Now the president of New York University, Sawhill's career includes the following:

- As the head of the Federal Energy Administration from 1973 to 1974 (during the Arab oil embargo), he oversaw the development of Project Independence. How Sawhill understood "independence" can be seen from the fact that he resigned in January 1975 when President Ford disagreed with his plan to implement *mandatory* conservation measures to ready the population for energy austerity.
- In 1977, Sawhill coauthored the Ford Foundation-Mitre report, *Nuclear Power—Issues and Choices,* which became the foundation for the Carter administration's antinuclear, conservation-oriented policy through James Schlesinger, who sold the president on it.
- A year later, Sawhill wrote the Trilateral Commission's statement on energy, *Energy: Managing the Transition,* a continuation of his austerity ideas.
- Today, Sawhill is part of a Ford Foundation team completing a report by Resources for the Future titled *Energy: The Next 20 Years.*

In addition to these particulars, Sawhill has been chairman of the energy committee of the Aspen Institute and a member of the governing board of the antinuclear lobbying group Common Cause, both the source of zero-growth policy and tactics for the lower levels of the environmentalist movement. In addition, Sawhill is a member of the New York Financial Control Board, the group that has proposed forced shrinkage of New York City's lower-income populations and the expansion of the tourist population by the legalization of gambling.

Sawhill is also currently an official advisor to the Organization of Petroleum Exporting Countries, an interesting role for the man who called for an energy crisis management plan to "curtail demand if we have another disruption in our oil supply" and who proposed taxation measures for federal control of the price and use of imported oil.

Finally, Sawhill's energy economics bear scrutiny by those who believe in the American tradition of growth and progress. At a June 6 Washington conference of the International Association of Energy Economists, Sawhill tried to prove that there is no "lock-step" relationship between energy and GNP growth, asserting that a *doubling* of primary energy costs would lower the rate of economic growth only by *.5 percent.* "We may need to make changes in our lifestyles, which is better than having others dominate our way of life," Sawhill said.

Sawhill also took the occasion to specifically note, "There is no technological fix like fusion or gasohol" that can affect the energy crisis; the focus has to be on getting the nation to adjust to higher prices.

John Deutch

Deutch's promotion to the number three DOE post of undersecretary was confirmed by the Senate after a week of bartering.

Deutch, along with James Schlesinger, came out of the Rand Corporation —the military think tank that is responsible for developing the Delphi Technique for controlling scientific breakthroughs and whose military strategies are viewed as incompetent by traditional military leaders.

In the past two years, Deutch's career has often been chronicled in *Fusion.* In brief, Deutch added 25 years on to the DOE timetable for achieving fusion, actively tried to squelch news of the August 1978 breakthrough with the Princeton PLT tokamak, eviscerated the magnetohydrodynamics program, and drove some of the best DOE talent out of the department.

The delay in Deutch's confirmation was due to Senate horsetrading, not Deutch's record as an antigrowth administrator. Senate majority leader Robert Byrd (D-WV) threatened to hold up the Deutch confirmation in order to bargain for a top DOE position for George Fumich, a former coal company lawyer who has been in and out of government coal programs for the last 17 years.

Fumich staked his reputation on the coal synthetics programs in the 1960s and left ERDA when it was clear this would not be a priority. He was later brought back in as the fossil fuel program director under the Office of Energy Technology set up under the DOE.

Now Byrd wants the prominent "pro-coal" Fumich to be in a top position, perhaps as assistant secretary for energy technology, which was vacated with the departure of Robert Thorne last January. Reportedly Deutch would not give in to such a demand, and the DOE is now considering abolishing one of the two assistant secretary positions left vacant by two recent resignations, to create an assistant secretary for fossil fuels for Fumich.

If such a departmental reorganization were to take place, the assistant secretary for energy technology would be mainly responsible for nuclear energy, fusion, and other scattered technologies.

—Marsha Freeman

FEF Chicago Conf., July 31

The Economics of Going Nuclear

The LaRouche-Riemannian economic model is featured in the July issue of Fusion.

"Energy and the Science of Economics" was the subject of a day-long conference July 31 in Chicago jointly sponsored by the Fusion Energy Foundation and the *Executive Intelligence Review*. Held in the Continental Plaza Hotel, the conference was attended by 50 political, business, and engineering leaders from a half-dozen midwestern states.

Speakers included Dr. Morris Levitt, FEF executive director who chaired the conference; Jon Gilbertson, FEF director of nuclear engineering; Uwe Parpart, FEF director of research; and Lyndon H. LaRouche, Jr., noted economist, chairman of the U.S. Labor Party, and a contributing editor to the *Executive Intelligence Review*.

Jon Gilbertson began the morning session with a review and update of the investigation of the Independent Commission of Inquiry on the Three Mile Island Incident, a group initiated by the FEF to investigate the possibility of sabotage at Three Mile Island. The commission's major goal is the survival of a viable nuclear power industry in the United States, Gilbertson said.

"The first thing necessary is to get out the truth concerning the TMI incident and to complete a thorough investigation into the incident and the possibility that it was caused by sabotage. The commission has also launched a public educational campaign, documenting the facts—economic, safety, environmental—that prove once and for all that nuclear power is the only way out of the nation's economic mess."

A lively 45-minute question session followed Gilbertson's presentation, with many questions concerning who is behind the attack on nuclear power and why such a small percentage of the population has such a disproportionate influence in the United States.

In the luncheon address, presidential candidate LaRouche outlined the steps by which the United States can lead the world out of the depression crisis and into a period of economic boom. LaRouche challenged the audience to grasp the necessary financial and banking mechanisms without which any planning of nuclear expansion and development of new technologies cannot function.

"We need a world monetary reorganization," LaRouche said, which he described in detail as follows: "The central banking facilities of the European Monetary System nations will issue 15-year to 25-year bonds, denominated in gold-pegged currencies and bearing 2 percent to 3 percent yields. These bonds will be purchased by central banks of nations with dollar-balances held either in their own portfolios or in the portfolios of principal banking and corporate entities within their respective nations. This will create a pool of hundreds of billions of dollars of credit within the European Monetary Fund.

"These dollars can be then be lent at base rates of between 3.5 percent and 4.6 percent for hard-commodity commerce and as 15-year to 25-year loans to nations importing high-technology capital goods for projects that are creditworthy on account of well-defined increases in gross and per capita tangible-product output of the borrowing nation.

"Inside the United States, the Eximbank, with an enlarged authorized capital, will serve as the conduit for bringing up to hundred billions a year of new hard-commodity credit into the internal U.S. economy for combined export production and capital investment related to expansion of export production. Our objective must be to funnel this credit through the Exim at a range of 5 percent to 6 percent basic interest rates. This credit will be funneled into the internal economy through local private banks, which issue and administer loans as participating lenders with the Exim bank.

Two-Tier Credit

These "two-tier" credit system measures, LaRouche explained, will be accompanied by a parallel tax policy that provides large and realistic depreciation allowances for investment in productive facilities of R & D, but that taxes retained or speculative earnings at a very high rate.

LaRouche said that the present world depression could end Jan. 21, 1981, when he tells French President Giscard d'Estaing via transatlantic telephone that he has been sworn in as U.S. president. At that point, these new monetary and banking arrangements will be set in motion, LaRouche said, by me and my West European collaborators who founded the European Monetary System.

This is the only way we will be able to finance the vast nuclear production and development program the world needs, LaRouche said, and the practical implications of the new credit system for the industrial heartland will "reach all the way down to the sub-sub-subvendor in East Oshkosh."

The city-building theme emphasized in LaRouche's presentation was further developed by Mel Klenetsky, midwest director of the FEF. Klenetsky announced the initiation of the Louis

Sullivan City-Building Award, to be presented to individuals who make outstanding contributions to the renaissance of American cities and urban life. The award is named after the architect who engineered and designed the first American skyscrapers in Chicago in the late 1800s.

Nuclear Development

In the afternoon session, Uwe Parpart outlined the kind of energy program the United States requires to get the world economy and the U.S. economy back on its feet. "The United States must once again commit itself to a full nuclear-based development program, with fission now and fusion in the future," Parpart said. He then reviewed the specifics of a nuclear program he and a task force of experts had just completed for the LaRouche presidential campaign.

The program calls for the production of 2,500 gigawatts electric of nuclear power by the United States by the end of this century, consisting of a mix of light water reactors, high temperature gas-cooled reactors, and fast breeder reactors (See campaign report this issue for details). Approximately 1,000 gigawatts would be for domestic use, while the remaining 1,500 gigawatts would be exported to the developing nations, mostly in the form of floating nuclear plants.

Parpart also discussed the need for increased funding for developing the advanced technologies to produce hydrogen economically—"the only sensible synthetic fuels program."

In conclusion, Parpart described the totally different consequences of the Carter administration's energy program and the program that the LaRouche task force had laid out. "Carter's synthetic fuels would mean a return to 19th century technology and militarization of a depression-wracked economy," Parpart said. "The LaRouche program would open the way, through nuclear exports and nuplex-based city building, to the development of revolutionary new fusion technologies. These would provide unlimited amounts of cheap energy in the forms of electricity and hydrogen, both produced from a plentiful raw material—water."

—Jon Gilbertson

Fusion News

New Proposal Could Prove Tandem Mirror's Feasibility

A new proposal from Lawrence Livermore Laboratory for enhancing the tandem mirror fusion reactor design promises an early experimental demonstration of the mirror's scientific feasibility.

If the new proposal is pursued, a scientific demonstration experiment could be constructed within the next three to four years to attain energy gains as good as, if not better than, those projected for the Princeton Tokamak Fusion Test Reactor that is due to come on line in 1981 or 1982.[1] The cost would be about $120 million.

With experimental success, development of an economical fusion power reactor based on the tandem mirror approach could rapidly follow. It is even possible that such a reactor could have an advanced fusion fuel cycle—all deuterium fuel—and could directly convert fusion energy to electricity.

How the Mirror Works

The simple magnetic mirror is based on the same type of plasma confinement in the earth's magnetosphere and in astrophysics. Given a magnetic field with two points of increased intensity, a plasma would tend to be trapped between the two points (Figure 1).

The individual plasma electrons and ions are trapped into spiral orbits along the magnetic field lines. When they approach the region of increased magnetic field intensity, they are "reflected" back into the opposite direction.

Some plasma particles are lost in this process if they have a particular velocity component. These are called *end losses*. The simple mirror has so many end losses, in fact, that it is doubtful it could get much beyond simple fusion energy breakeven. Therefore, various modifications of the simple mirror system have been proposed to permit the significant energy gains necessary to make mirror system power plants economical.

The tandem mirror system, the most promising modification of the simple mirror system, was developed independently by U.S. researchers at Lawrence Livermore and by Soviet scientists in Novosibirsk. The tandem system uses two magnetic mirrors to trap a cylindrical plasma in a straight magnetic field with each mirror system placed at an end of the cylindrical plasma.

In a simple mirror, the electrons escape out the ends first, causing a positive electrical potential to develop. The tandem system makes use of this positive potential to confine the cylindrical plasma. The positive potential of each mirror "end cell" prevents the cylindrical "center-cell" plasma from simply flowing out the ends of the straight cylindrical solenoidal magnetic field (Figure 2).

In a reactor, the significantly larger center-cell plasma—and not the lossy end-cell plasma—would generate much of the fusion output.

A major advantage to this system is that it is a straight cylinder. Therefore, it can be constructed economically, with modular units and easy accessibility.

The Improved Tandem

The new and relatively simple proposal to improve the tandem mirror is described in a recent paper by Livermore researchers D.E. Baldwin and B.G. Logan.[2]

Baldwin and Logan propose to add a second mirror to each end. This second mirror would periodically be pulsed off and on and would create a partial thermal barrier between the center-cell plasma electrons and the end-cell mirror electrons. This would have the desirable effect of maintaining the end-cell mirror electrons at a higher temperature than the center-cell electrons. Keeping the end-cell electrons hotter will permit a lower-

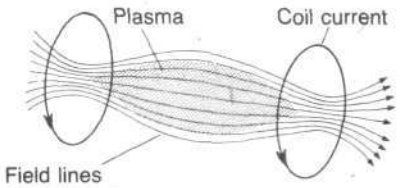


Figure 1
SIMPLE MAGNETIC MIRROR CONFINEMENT

As the plasma particles encounter the stronger magnetic fields at each end of the mirror, they are "reflected" back into the center of the mirror. However, some particles escape out the ends of the mirror.

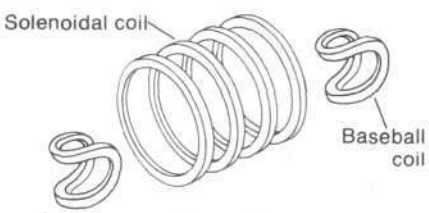


Figure 2
TANDEM MAGNETIC MIRROR CONFINEMENT

The tandem mirror design adds magnetic field coil configurations in the shape of the stitching on a baseball at each end of a solenoidal magnet coil.

density end-cell plasma to effectively confine a higher-density center-cell plasma.

The major capital cost and energy cost in the tandem design is the neutral beam injection power used to heat the end-cell plasma. Since the ratio of fusion power output to the neutral beam injection power required to maintain the mirror end cells is proportional to the center-cell plasma density squared divided by the end-cell mirror plug density squared—n_c^2 / n_c^2—any means that allows the end-plug mirror density to be *decreased* relative to the center-cell density dramatically improves the power output per unit cost of a tandem reactor.

Baldwin and Logan noted that their proposal would make the following specific type of improvement:

"To plug a central cell of density 10^{14} cm^{-3}, temperature 40 keV, magnetic field 2T requires plugs of density 10^{15} cm^{-3} having peak fields of 17T and neutral beam injection energies . . . 1 to 2 MeV . . . . We describe a means by which, for the same central cell conditions, the density of the plugs might be reduced to a few 10^{13} cm^{-3} requiring peak fields 10T and beam injection energies as low as 200 keV."

Within Reach

This improved tandem design is very close to the existing state-of-the-art technology both for magnets and neutral beams. In fact, all one would have to do is build a second MX mirror machine—the large, simple mirror currently under construction at Livermore—and place a center cell between the two mirror machines for a demonstration experiment.

In the meantime, the scientific principles of the proposed improvement could be demonstrated on existing small tandem mirror experiments.

Because of the high temperature of tandem mirrors, it is also quite conceivable that at the higher temperatures an all-deuterium fusion fuel cycle could be utilized, especially if improved center-cell densities can be attained, as projected by the new proposal. This would greatly relax the engineering requirements.

The open-ended mirror system is also perfect for getting out the mostly charged particle energy produced by the deuterium reaction. In fact, Livermore had led the way in developing direct particle electricity converters when this was thought to be needed for making a simple mirror concept work as a reactor.

Is success just around the corner? One fusion manager commented: "The amazing thing is that there do not appear to be any scientific impediments to its working. It really shows the degree of sophistication to which fusion and plasma physics has come in the last few years. It used to be difficult enough to see if anything could work at all and now you can almost design a confinement system to whatever specifications you want . "

—Charles B. Stevens

Notes

1. For an assessment of the scientific status of the mirror see "The Magnetic Mirror Approach to Fusion," *Fusion*, May 1979.
2. The paper by D. E. Baldwin and B. G. Logan, "An Improved Tandem Mirror Fusion Reactor," is a UCRL Preprint, No. 82715.

Advanced Technologies

So. California Edison Plans First Commercial MHD Generator

Southern California Edison Corporation has signed a letter of intent with the Roldiva Company in Pittsburgh to study the feasibility of a magneto-hydrodynamic system for the utility. According to Jack Moore, Edison vice president in charge of advanced engineering, the goal is to develop a demonstration unit and test its efficiency as part of an operating power plant as early as 1985.

Southern California Edison plans to build a 50 to 75 megawatt MHD system onto its 125-megawatt Unit 1 at the Etiwanda Generating Station near Fontana, California, using private corporate funding.

Negotiators for the proposal cited the fact that the Soviet U-25 MHD facility in Moscow delivers power to the city grid to show that MHD is technically feasible and that the United States could commercialize the technology. The Edison planners see their MHD proposal as an intermediate step in commercialization that could push the Department of Energy MHD program forward by 10 to 15 years.

The U.S. government MHD program does not plan to produce an operating power generator before the end of the century. For this reason, private companies that see the need to ensure future access to reliable electric power have tried to circumvent the official MHD program by supplementing government-sponsored research programs with private funds. The pioneer in this endeavor was Reynolds Metals R&D in Sheffield, Alabama, which is concerned with supplying electricity for its energy-intensive aluminum plants in the Northwest.

Although the Reynolds program made very impressive progress, which

led to patents in groundbreaking plasma electrode technology, the $8 million cut in the 1980 MHD budget—down to $72 million—has eliminated funding for the Reynolds work.

The Advantages of MHD

MHD is a direct electrical conversion system that requires no moving parts, such as a steam turbine to produce electricity. Instead, the plasma (ionzied gas) formed from burning any fossil fuel at a high temperature is used as a direct source of electrically charged particles. The plasma particles are pushed through a channel surrounded by a magnetic field that directly draws off a current through electrodes placed along the sides of the channel.

Large-scale, base-load MHD generating stations are projected to achieve a potential conversion efficiency of up to 60 to 70 percent, compared with the average 35 percent efficiency of conventional coal-burning steam turbine plants.

A second major advantage of MHD technology is that the potassium seed used to help ionize the coal gas chemically combines with any sulfur in the coal. This prevents any sulfur emissions from the power plant and eliminates the need for costly and wasteful pollution control equipment.

The proposed small "topping" unit Roldiva plans to build will probably achieve efficiencies of only 35 percent, but Southern California Edison estimates that the savings in pollution control equipment will make the unit competitive—even though the initial cost of about $150 to $200 million will make the MHD system more expensive per unit of power than conventional technology.

The Etiwanda Generating Station is now burning oil, but after the addition of the MHD cycle, Edison plans to convert the plant from oil to coal in the late 1980s. Because of the slowness of pace of the government MHD program, the components for a coal-burning MHD plant will not be available by 1985 when the MHD unit comes on line.

Roldiva proposes to retrofit the existing power station with a small MHD unit that would burn fuel at about 3,500 degrees Fahrenheit and generate about 60 megawatts of electric power. The hot gas emerging from the MHD portion of the system would be ducted into the boiler furnace of the conventional portion of the plant, where its heat will contribute to the production of steam for the plant's turbines. This would decrease the amount of fuel necessary in the conventional cycle.

An In-Line Approach

The Roldiva design is being implemented on an *in-line* approach, where the operation of the MHD unit does not interfere with the operation of the rest of the plant, should maintenance be required. The designers expect the MHD unit to run for 2,000 continuous hours, with the same degree of down time for maintenance that the rest of the plan requires. At the end of the 2,000 hours, the channel would be replaced.

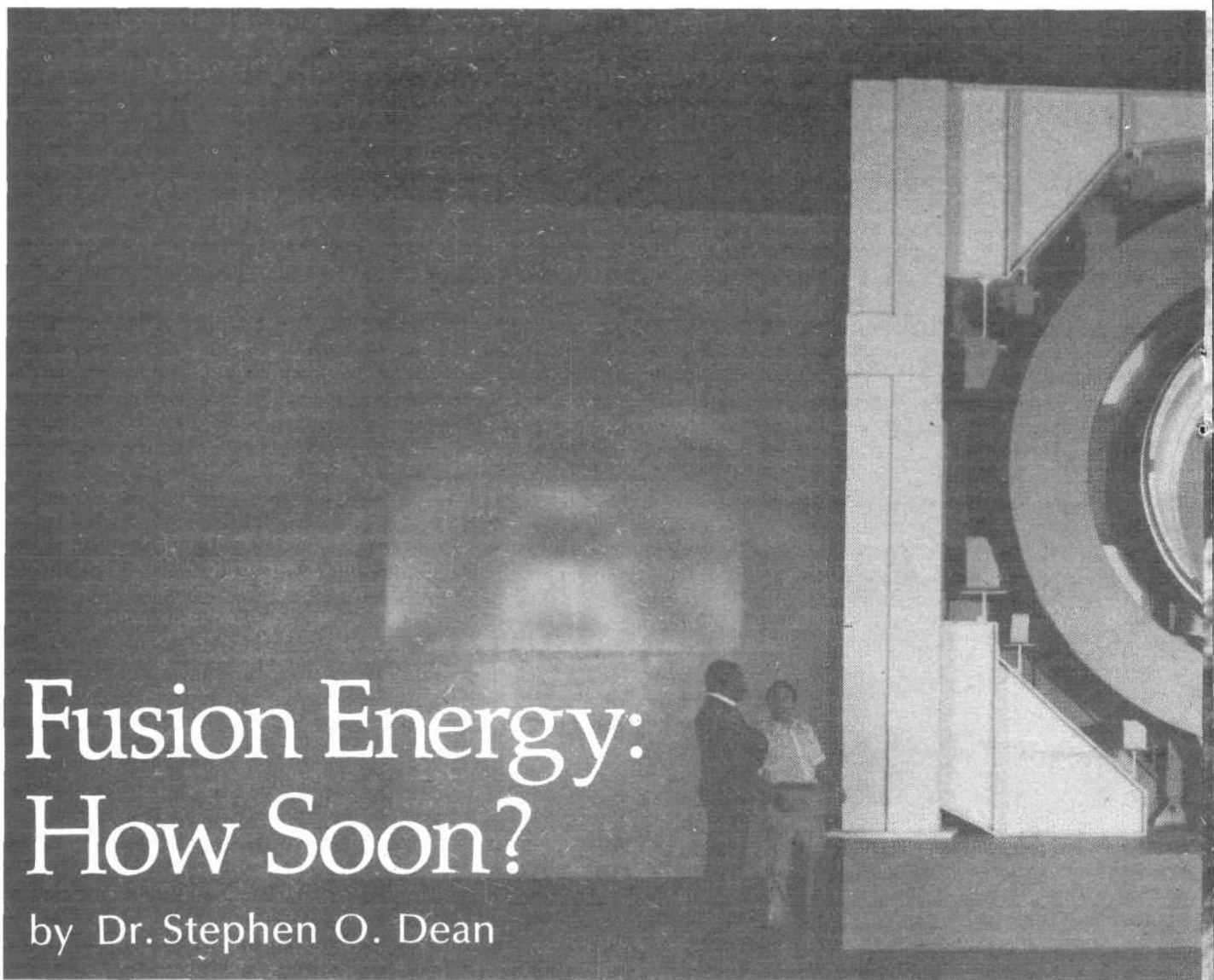
At the point that the technology Edison is planning can burn coal, the entire plant, including the now oil-burning steam turbine cycle, will use the energy from coal. The topping cycle of MHD will provide all of the heat to turn the steam turbine bottoming cycle, eliminating the need to burn oil.

Ironically, this privately initiated program was in part a response to government pressure over the past five years to force utilities to convert to coal. Yet, at the same time, the coal-conscious administration has cut the budget for MHD, the only cost-effective possibility for converting to coal and reducing the nation's dependence on oil for electricity.

—Marsha Freeman

Soviets Plan MHD Generator

The world's first MHD generator, a 600-megawatt combined steam turbine plant, will be operational in 1985, according to an Aug. 7 announcement of Soviet Minister of Electric Power Development and Electrification Petr Neporozhniy. The natural-gas-burning plant will be located in Ryzan, 140 miles from Moscow. The efficiency of the unit is expected to be 50 percent.



Fusion Energy: How Soon?

by Dr. Stephen O. Dean

Dr. Stephen O. Dean is the director of fusion development for Science Applications, Inc., a high technology systems engineering firm. An outstanding fighter for fusion power, Dean is the former director of the Magnetic Confinement Systems Division of the U.S. Department of Energy, Office of Fusion Energy.

This article is an edited version of Dean's Aug. 6 speech at a Lansing, Michigan town meeting on the energy crisis cosponsored by the Fusion Energy Foundation and the Independent Voters League of Michigan. The meeting was attended by representatives of regional farm and civic groups.

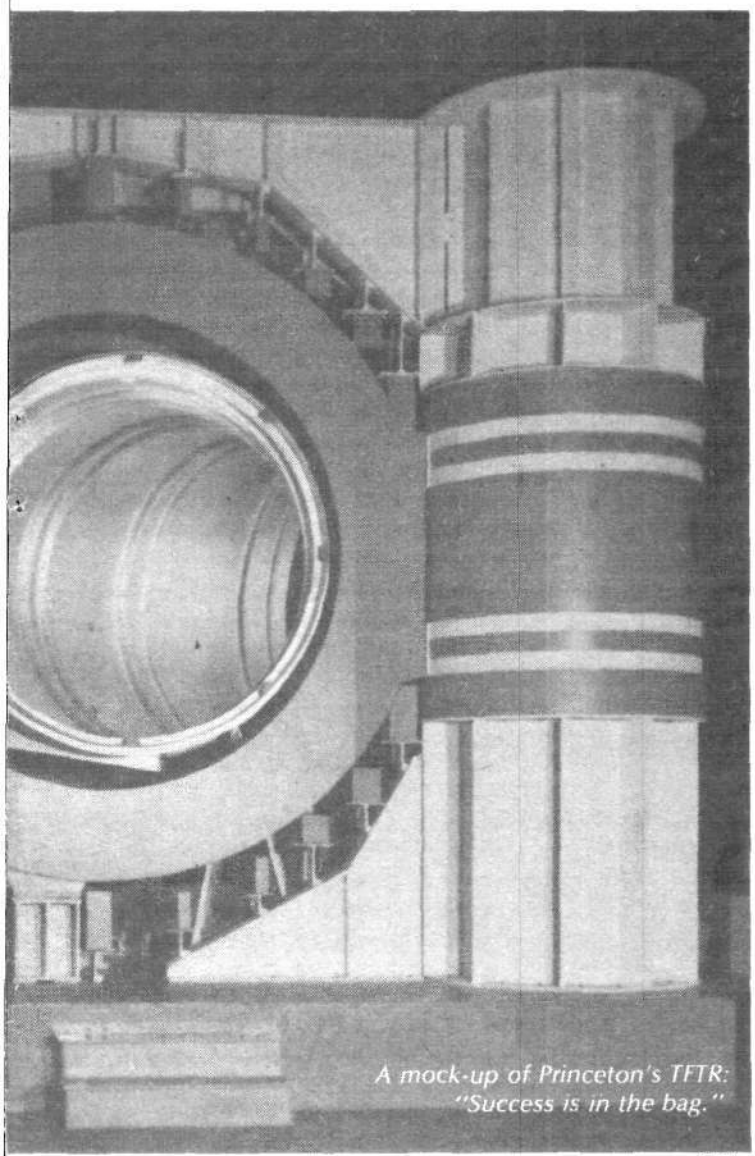
* * *

THE ENERGY CRISIS is really not a crisis of resources and supply. It's a crisis of national will, a crisis of economics —world economics and local economics. It's a crisis that has more to do with getting people to pull in the same direction to solve the problem of resource supply.

Speaking as a scientist and engineer, there is absolutely no question in my mind that the United States can provide the resources it needs for its energy supply and also can lead and assist the rest of the world in finding adequate energy sources. This is true from a technology standpoint. Unfortunately it is not true today from a political standpoint. It is very appropriate, therefore, that questions having to do with energy resources be addressed in the political arena, because the basic reason we have an energy crisis today, or a potential energy crisis coming up in the 1980s, is due to our political policies.

Fusion is one of three possibilities that the United States and the world have in the long term, once the natural resources that we have used in the past—oil, coal, and natural gas—begin to be in shorter and shorter supply. The other two are nuclear power based on fission and solar energy. There has been plenty of debate about these three, as to their r[illegible]itive prospects.

Solar energy has a lot of advocates in the country today and it will certainly have many uses, but people who look



A mock-up of Princeton's TFTR: "Success is in the bag."

PPPL

at it seriously doubt that it can, in fact, replace the large-scale energy sources needed for industry. On the other hand, nuclear power clearly is capable of providing the large-scale energy sources of heat and energy that industrial civilization demands. However, at the present time nuclear energy is under quite a bit of public attack, particularly in this country, and its political future is somewhat uncertain.

Fusion Goals and Applications

The primary goal of the fusion energy development program in the United States is to develop pure fusion systems that will run central station power plants to produce electricity. The program is almost totally supported by government funds because of its long-range nature, but there is some private money going into it from the electric utilities.

Although electricity is the easiest and most straightforward of the applications for fusion—and also, by the way, for fission—there are other potential significant applications (Figure 1). Once you have a large source of heat, there are many other things you can do with that heat besides producing electricity. For example, you can use that heat to produce hydrogen gas or synthetic fuels; you can use it in chemical processing and in those industries that require process heat; you can use it to produce fissile fuel for nuclear fission reactors; and you can use it to deactivate nuclear waste.

I'll briefly describe the last two applications. The fuel used in today's light water nuclear reactors—of which the Three Mile Island plant is the most famous example—is becoming more and more expensive. In fact, within 50 years, the high price of uranium used in fission reactors will become a significant issue. Right now the fuel cost in fission power systems is a negligible part of the cost of the electricity. But beyond the year 2000, sometime around 30 to 50 years from now, we will need a new source of uranium, plutonium, or thorium to fuel such reactors.

There are two ways of getting that fuel. One is to develop the fission breeder reactor; the other is to use a fusion reactor. In what is called a fusion-fission hybrid reactor, for example, the fusion reaction is combined with fissionable material in a blanket outside the reactor to breed fission fuel, thereby multiplying the energy source several-fold. It is possible to make enough fissionable fuel this way to fuel five to twenty light water reactors.

Another problem for nuclear power in this country is what to do with the radioactive waste. You have to store that waste for many years—in some cases for thousands of years. One of the possible applications of fusion energy is to dispose of radioactive waste by what is called *transmutation*; that is, the neutrons produced by a fusion reactor can be used to transform the radioactive fission waste into other, stabler isotopes, thereby deactivating the radioactivity.

Fueling Electric Power Plants

If you look at a schematic of an electrical power plant, you see that the main thing you need in order to produce electricity is some type of thermal energy source (Figure 2). Once you have the thermal energy, or heat, you can make steam. You can then run that steam through a turbine and make the electricity.

There are three basic ways to produce that heat: a fossil fuel fire box that burns coal, oil, or natural gas; a nuclear fission reactor; and a fusion reactor. In all three cases, the source of heat runs through a heat exchanger out to a turbine that produces electricity. What we're talking about in fusion is providing another option as a replacement for or in additon to the heat sources already in use.

In a nuclear fission power plant, the reactor's fuel rods contain uranium (Figure 3). The fission process in these fuel rods generates neutrons, subatomic particles from the nuclei of the atom. These neutrons are moving at rapid speeds. When the neutrons are slowed down, it creates heat in a moderator. Then you pass a coolant through the moderator—like a gas or water—over the hot material to produce the steam that turns the turbine.

The key element in a fusion reactor is a fusion plasma, a very high temperature gas (Figure 4). Essentially, a fusion plasma is a piece of the sun. The sun is a fusion reactor and the stars are fusion reactors. They generate their energy by nuclear reactions that occur in a very high temperature gas. The gas is at such a high temperature that when the nuclei of the atoms in the gas collide, they fuse together and form new elements.

Figure 1
FUSION PROGRAM GOALS AND POTENTIAL APPLICATIONS

Program Goal
To develop pure fusion central electric power stations for commercial applications

Potential Applications
Direct production of hydrogen gas and synthetic fuels
Direct energy production for chemical processing
Fissile fuel production
Fission product waste disposal
Fusion-fission hybrid reactors

By building up these elements, heat is released and carried by the neutrons in the same way that heat is carried in a fission reactor. The neutrons are moving fast and in slowing down they raise the temperature of some kind of moderator. Then you pass a coolant over the high-temperature moderator, which produces steam.

The Fusion Reaction

The key requirement for a fusion reactor is to make a fusion plasma that has high temperatures like those on the sun but that has a very low density. The density of the gas of this fusion reactor is about 100,000 times less than the density of the air in an ordinary room. Therefore, even though the plasma has a very high temperature, its density is so low that it does not melt the materials with which it comes in contact. If this fusion plasma were to come in contact with the reactor wall, the wall would cool the plasma, stopping the fusion reaction. One of the ways fusion researchers keep the plasma from coming into contact with the wall is by using magnets to control it.

Figure 5 shows schematically how the fusion reaction releases its energy.

Let's look at a typical fusion reaction in more detail (Figure 6). You start with a fuel composed of tritium and deuterium, both isotopes of hydrogen. The nucleus of the

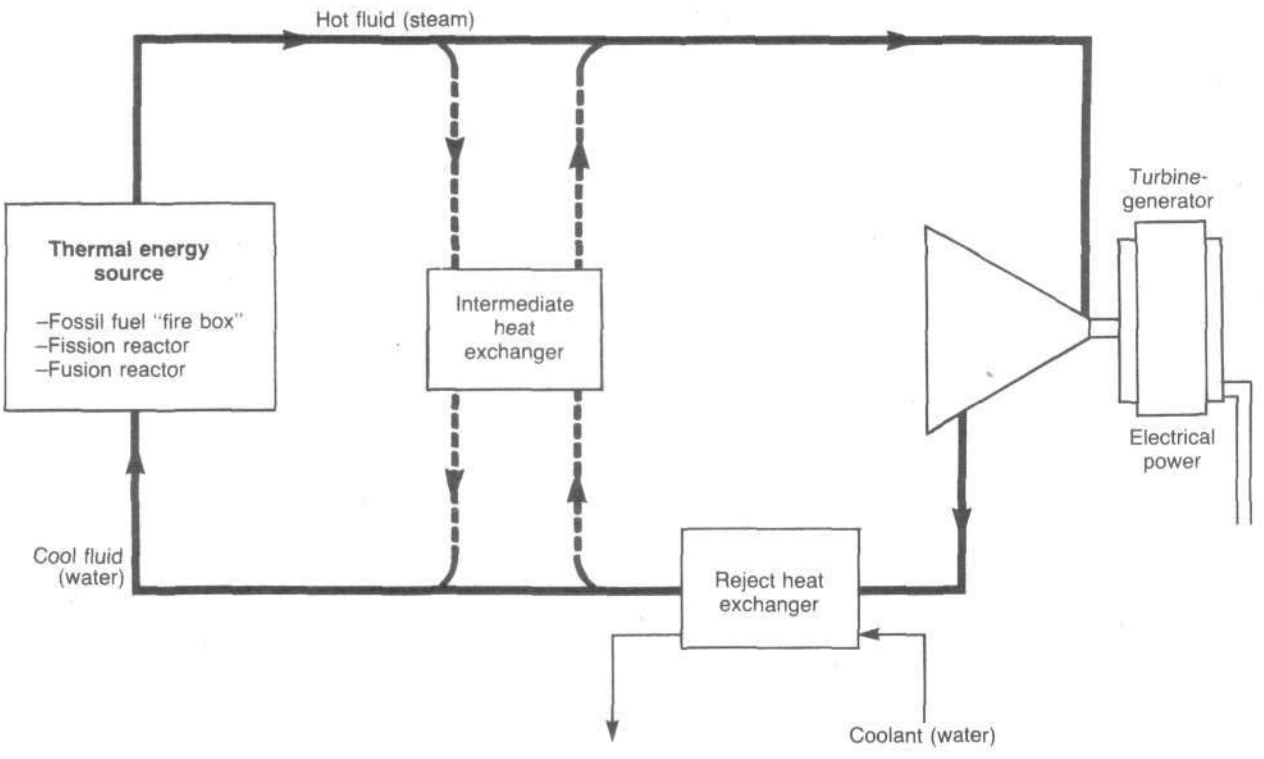


Figure 2
ELECTRICAL POWER PLANT SCHEMATIC
This basic schematic for a power plant shows how in all three cases—fossil fuel, nuclear fission, and fusion—the source of heat runs through a heat exchanger out to a turbine that produces electricity.

tritium atom, a triton, has two neutrons and a proton. The deuteron, the nucleus of the deuterium atom, has one neutron and a proton. These are the nuclei of the atoms in the plasma. When the nuclei collide, all five of these particles come together and release energy in the process. As each triton and deuteron flies apart, four of the particles come out together and form a helium nucleus, while one neutron comes out carrying most of the energy. (Helium, by the way, which is the "waste product" of the fusion reaction, is a nonradioactive, stable, nonpoisonous gas.)

There are two basic approaches to confining the fusion plasma, *magnetic confinement* and *inertial confinement*.

In a typical fusion reactor of the first sort, the fusion plasma is kept in place by configurations of magnets that exert forces on the fusion plasma where the reactions take place. Accelerators attached to the reactor take a nuclei or an element in the gas and accelerate it up to high speeds. At that point, the nuclei are trapped by the magnetic fields in the machine and built up into a very high temperature gas. This magnetic confinement technology, as I discuss later, is well under development.

There are two types of magnetic confinement geometries: an open system or magnetic mirror system, and a closed system shaped like a donut (Figure 7).

The most famous example of this donut type is a Soviet invention called the tokamak. Figure 8 is a photograph of the Doublet III tokamak at the General Atomic Company in La Jolla, California. This machine does not yet have its accelerators, because they are still being constructed and won't be completed until the end of this year.

The largest tokamak machine in the world is the Tokamak Fusion Test Reactor now being built at the Princeton Plasma Physics Laboratory in Princeton, New Jersey, which will be completed in late 1981. This is the first U.S. machine that has been designed with the idea that it will produce more energy than we have to put in to get the

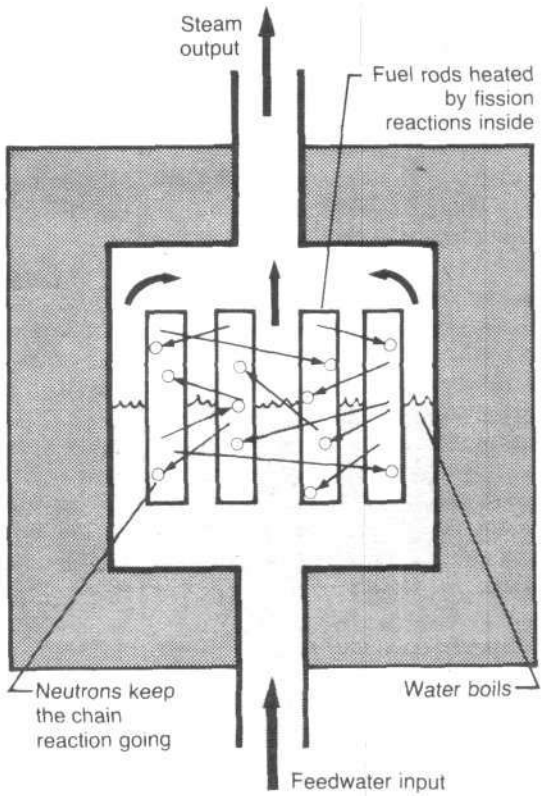


Figure 3
BOILING WATER FISSION REACTOR SCHEMATIC
The fission process in the fuel rods generates neutrons that create heat. This heat causes the water flowing around the rods to boil, creating steam, which flows out of the reactor vessel to the turbine. The steam is then condensed and brought back into the reactor vessel. The boiling water fission reactor design avoids the need for a separate steam generator because the water is boiled in the reactor core itself.

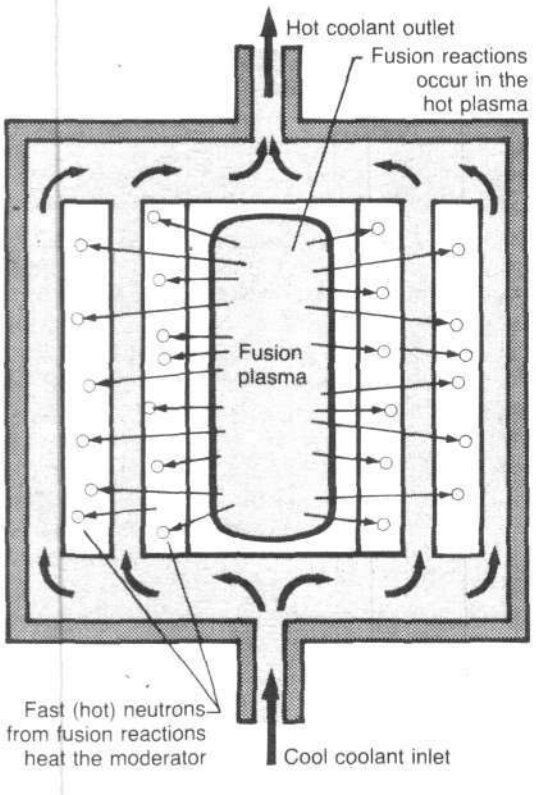


Figure 4
FUSION REACTOR SCHEMATIC
The fusion reaction heats the moderator, and the coolant circulating around the moderator produces steam. The moderator material absorbs and slows down the energy from the neutrons.

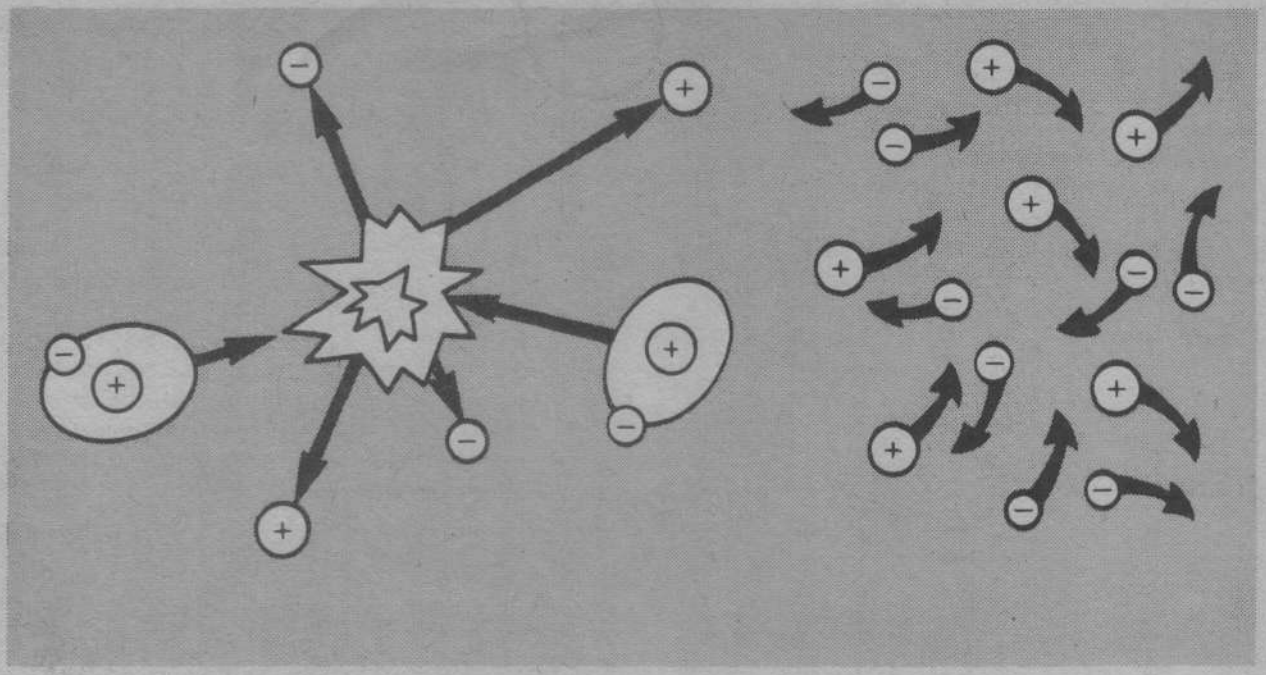


Figure 5
THE FUSION REACTION

When the fusion fuel is heated to high temperatures, the atoms in the gas collide so hard that the electrons are torn off the atoms. The result is a plasma, a gaslike mixture of ions and electrons.

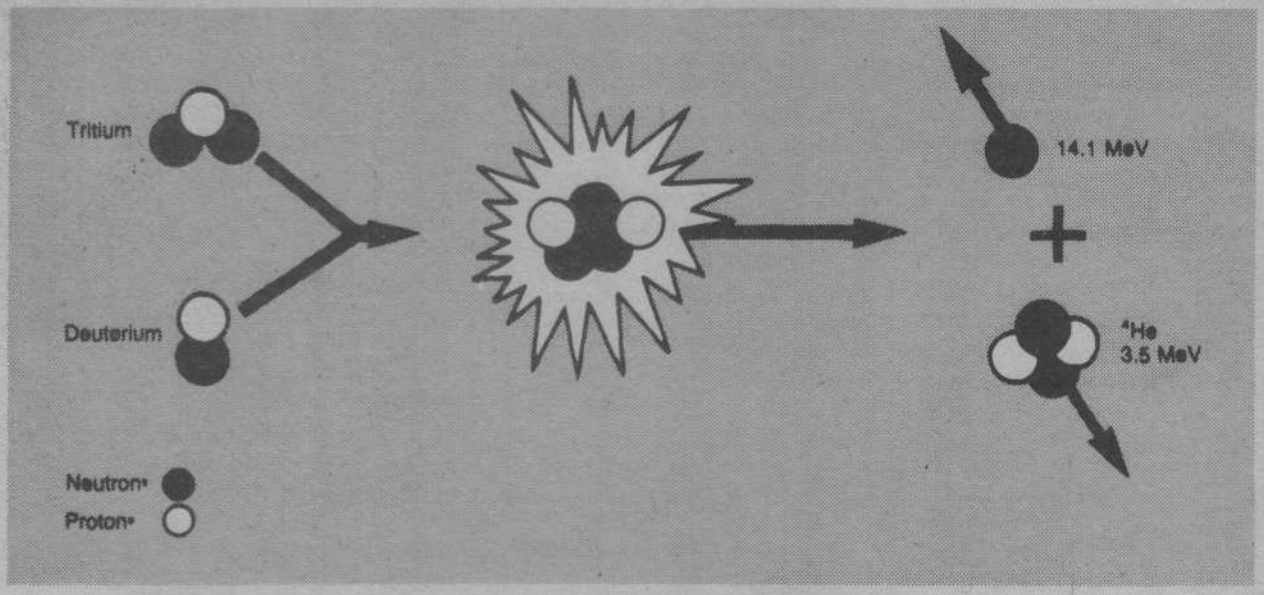


Figure 6
THE FUSION PROCESS

In this typical fusion reaction, the fuel is deuterium and tritium, both isotopes of hydrogen. When the nuclei of the atoms of tritium and deuterium collide, they recombine to form a helium nucleus and one neutron, releasing energy in the process. Most of the energy is carried in the neutron, and there is a net energy gain because the end-product nuclei weigh less than the nuclei of the input fuel.

fusion reaction going. This is a critical point in the fusion program—*breakeven*—where we will start to get a net return on the energy invested.

The second basic approach to fusion energy, inertial confinement, allows you to eliminate the magnetic coils. This process is often called laser fusion, although other methods besides lasers are used to ignite the fusion fuel; for example, ion beams and electron beams.

Inertial confinement uses a tiny hollow pellet—so small that you cannot see it with the naked eye—filled with deuterium and tritium. The spherical pellet is then irradiated with a laser beam or some other kind of beam. This force heats and compresses the pellet to produce a burst of radiation—a burst of energy—before the pellet flies apart.

It is essentially a miniature explosion, the same process that goes on in the hydrogen bomb. But the pellets are so small that the microexplosions, as they are called, don't release enough force to damage the reactor vessel.

The State of Fusion Science

The aim of both types of fusion experiments—inertial confinement and magnetic confinement—is to produce the hot plasma in which fusion reactions take place. This requires an energy investment to create the high-temperature plasma and some type of confining force to keep

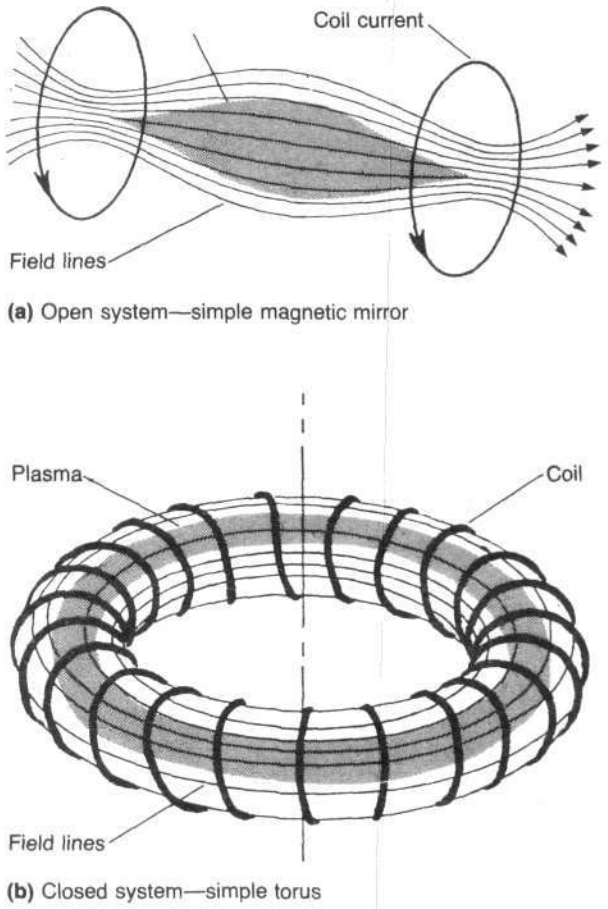


Figure 7
MAGNETIC CONFINEMENT CONFIGURATIONS
The fusion plasma is kept in place by configurations of magnets that trap the plasma in the reactor so that it can be heated to a very high temperature and not lose its heat by hitting the wall of the reactor. Both the open system, a, and the closed system, b, have been well developed experimentally.

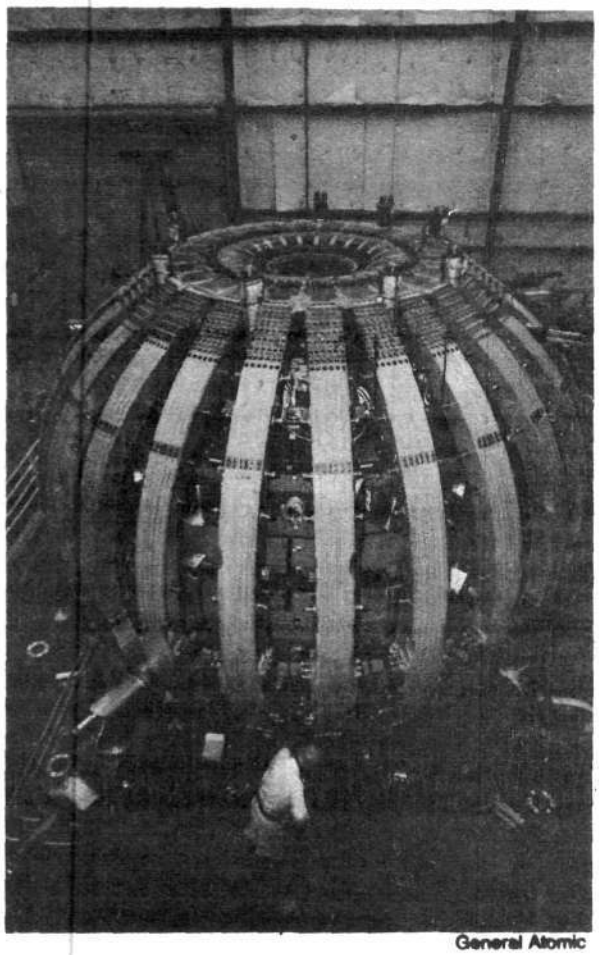
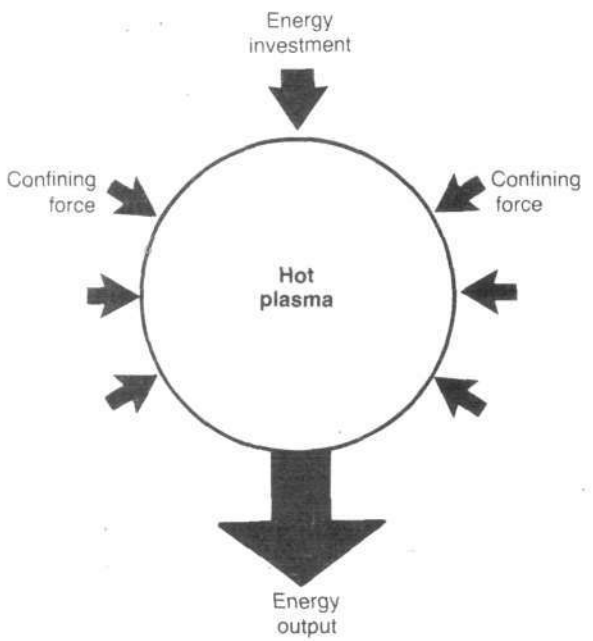


Figure 8
THE DOUBLET III TOKAMAK
General Atomic's Doublet III tokamak is expected to reach the temperatures and density/confinement time required for a working reactor.

the high-temperature plasma where you want it while the energy comes out. If you do this effectively, you get a net energy output. The scientific conditions that you must reach in order to get a net energy output are shown in Figure 9, in terms of two numbers: (1) the temperature of the hot plasma, and (2) the density of the fusion fuel times the length of time it is confined, a measure of the energy output.

The temperature required is about 50 to 100 million degrees. Scientists usually express this in another unit called kilovolts; 50 million degrees is 5 kilovolts. Last summer the Princeton Large Torus tokamak exceeded this minimum ignition temperature for the first time in a tokamak, reaching about 65 to 70 million degrees. This was widely hailed in the world press as a breakthrough because it exceeded one of the two requirements to achieve practical fusion.

The density necessary to achieve fusion is measured in particles per cubic centimeter and the length of confinement time is measured in seconds. In scientific units, the minimum product of density times time necessary is about 10^{14} particles per cubic centimeters times seconds. To give you a feel for what that means, the density of the air in an ordinary room is about 10^{19} particles per cubic centimeter. So a number like 10^{14} is 100,000 times less than the density in the room. If you took the deuterium and tritium gas at the density of ordinary air, reduced its density by 100,000 times, raised its temperature to 50 million degrees, and kept it where you wanted it for 1 second, then you would get more energy back out than you were required to put in. It's not a terribly difficult thing to do in principle, but doing it in practice is very tricky.



Temperature: 50-100 million degrees or 5 kilovolts
Density-confinement time: 5×10^{13} cm^{-3} x seconds $= 10^{14}$

Figure 9
REQUIREMENTS FOR FUSION

In order to get a net energy output, the fusion reactor must meet two basic scientific requirements: (1) the temperature of the fusion plasma and (2) the density of the fusion fuel times the length of time it is confined. The required temperature is 50 to 100 million degrees, or 5 kilovolts. The necessary density, measured in particles per cubic centimeter per second, is about 10^{14} particles per cubic centimeters per second.

To give you an idea of how the U.S. fusion program is doing in terms of reaching these numbers, we can look at the temperature achieved in fusion experiments as a function of years of experimentation (Figure 10). The program started in the 1950s. It reached some progress and kind of leveled off for a while, but since about 1966, there has been a very steady and rapid progress. As you can see in the figure, the PLT tokamak at Princeton exceeded the minimum ignition temperature of 5 kilovolts in 1978. Once the fusion device exceeds 5 kilovolts, the reaction will sustain itself—there will be enough energy produced so that no more energy has to be put in and enough heat will be released by fusion to keep the temperature up.

Success Assured

For a working reactor, a slightly higher temperature is needed, but not much more than what has already been achieved. There are machines under construction now that will do this on a regular basis—General Atomic's Doublet III and Princeton's TFTR. So now we can say with confidence that success is assured. To use a popular phrase, success is "in the bag."

There have been equally good results in terms of the second number required—the product of the density and confinement time. As Figure 10 shows, the progress has been steady over the years. The largest number that has ever been reached is 3 times 10^{13} particles per cubic centimeter. This was done in the Alcator A tokamak at the Massachusetts Institute of Technology. The Alcator's achievement was, in fact, above the minimum number required scientifically for breakeven, but a reactor will need a little bit more, about 10^{14}. Again, the Doublet III, the TFTR, and the Alcator C at MIT are designed to reach the required value. So in this parameter also, success is assured and there is now a very high degree of confidence that what is required to bring fusion from dream to reality now is a serious engineering development program. The U.S. government has not yet shown a willingness to embark on this engineering phase of fusion development.

The engineering goals concern reliability and economics —working out exactly how you would produce fusion energy in a commercial environment. These goals can be accomplished; they are straightforward, albeit difficult, engineering development tasks.

What is it about fusion that really makes it attractive? First, its inexpensive and plentiful fuel. The fuels of the

simplest fusion reactor are deuterium and tritium. It is also possible to design a fusion reactor that uses only deuterium, but the economics are somewhat poorer than if we use deuterium and tritium.

Deuterium is obtainable cheaply and in limitless quantities from water. Unlike oil and gas, deuterium will never be expensive. As long as there is water, there will be cheap deuterium. So fusion offers the world a truly limitless fuel resource. There is enough deuterium in the sea to fuel the world for billions of years—some people calculate 10 billion years—in other words, forever.

Tritium is obtainable from lithium, which is a very abundant resource on earth, as well as being available from seawater. There is enough lithium to produce tritium easily for thousands of years.

What kind of energy do we get from these fuels relative to what is obtained from other fuels? When it fuses, a fusion fuel releases a million times more energy than burning a comparable weight of coal or oil, so it is a very efficient producer of energy per pound or per unit weight of fuel. In addition, a fusion reactor produces about eight times more energy than a nuclear reactor produces from a comparable weight of uranium.

As I mentioned earlier, the energy from a fusion reactor comes out primarily in neutrons and these can be used to make fissionable material to fuel today's light water reactors. One fusion reactor can make enough fuel for about five to twenty nuclear fission reactors. Therefore, if fusion is developed, we can assure a supply of fuel for fission reactors.

To take another measure of the energy content of what is obtainable from fusion fuel: 1 gallon of water from your tap or from the ocean contains about 1 gram of deuterium, which is easily and cheaply extractable. The gram of deuterium has an energy equivalent content of 300 gallons of gasoline, and the cost of extracting this gram of deuterium is about 10¢.

How Soon?

In spite of all these attractive features, the fusion program is not available today in the commercial market although the basic science is fairly well developed and the engineering is ready to be developed.

Government policy today is to take about *45 more years* for development of fusion before practical application begins. This is an unprecedented length of time for any type of technological development. If you look back 45 years and ask yourself what was the technology of this country 45 years ago compared to today, you can see that we have gone through incredible technological development. In the last 45 years, new technologies have completely transformed the world.

There has never been a situation in this world where it has taken 45 years to develop a new technology once the basic ideas have been tested. Therefore, I conclude that the existing government policy—to take 45 years to develop fusion—is overly cautious and conservative, to say the least.

The fact is that a few years ago under the Ford administration, the policy was to develop fusion technology in about 25 more years rather than 45 more years. Even that policy timetable is longer than it should take to develop such a technology. In today's environment it is difficult to do things quickly, but I believe that the commercial viability of fusion as a practical energy source could be demonstrated in 10 to 15 years, if we really put our minds to it.

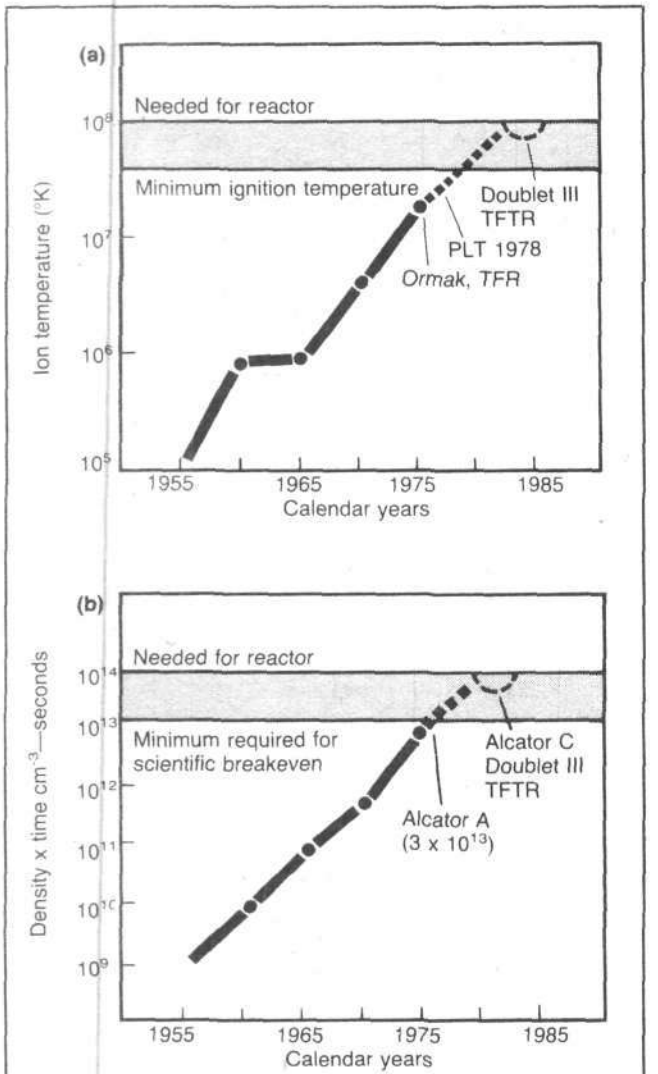
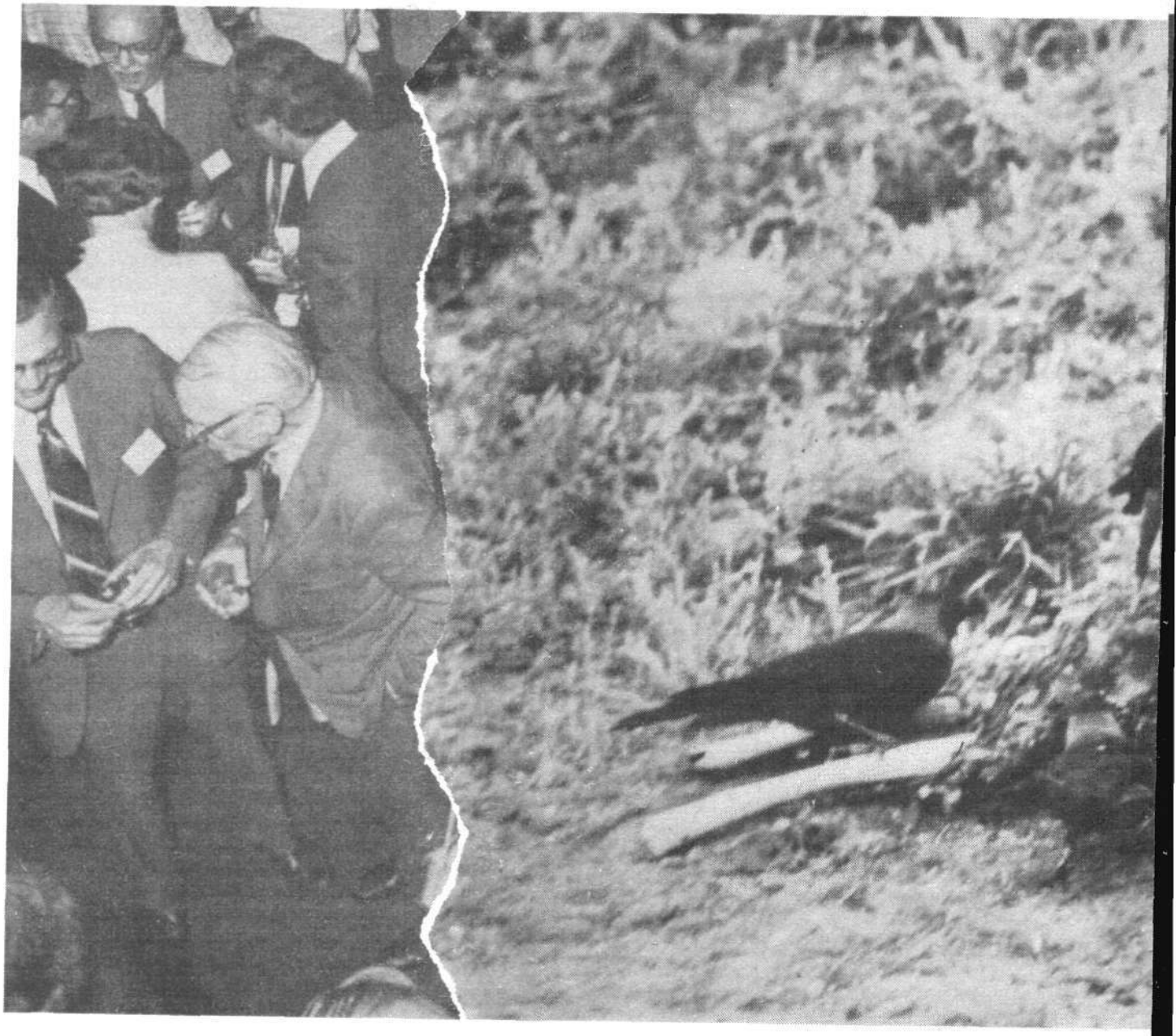


Figure 10
PROGRESS IN TEMPERATURE AND DENSITY-CONFINEMENT TIME REQUIREMENTS

There has been steady progress in achieving conditions near breakeven in various experimental reactors for both temperature and density-confinement time. As shown in a, *both the Doublet III and the Princeton TFTR are expected to reach the temperature conditions necessary for a fusion reactor by 1985. As shown in* b, *both these machines, plus MIT's Alcator C, are expected to reach the density-confinement time requirements for a fusion reactor by 1985.*



The 1980s Project

Blueprint for 'Controlled Disintegration'

by Kathleen Murphy

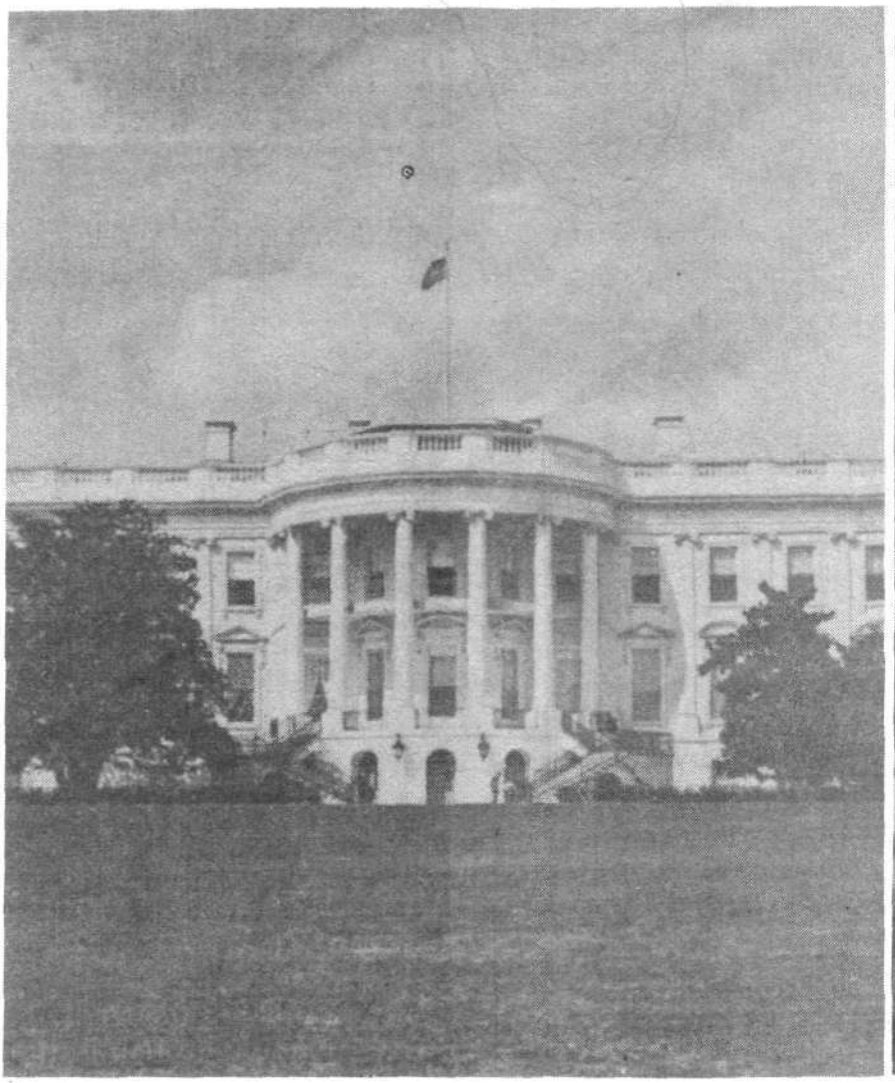
EDITOR'S NOTE: *What you are about to read is hard and sufficient documentation of the fact that the present energy and economic crisis is not the result of mistakes or bureaucracy, but of a conscious policy of Malthusian evil. With that point out of the way, energy can be properly focused on the job of permanently retiring our domestic nation-wreckers and gearing up the country for its rightful role of world industrial and technological leadership.*

MOST AMERICANS, no matter what their political persuasion, have a sense of alarm at the rapid unraveling of the world economy and international politics. The 1979 oil hoax, the fanaticism of Ayatollah Khomeini in Iran, Three Mile Island, and other political events are signs that world "business as usual" is coming to an end; we are at a turning point where the long-time goals of growth, advanced technology, and development are under the gun.

For the New York Council on Foreign Relations, however, this increase in world chaos is right on schedule. For since 1973, when the CFR launched its *1980s Project*, council members have been studying and writing about the "megadisasters" and economic and political catastrophes that would characterize the near future and how the CFR intended to use them. In brief, the CFR has proposed a "new world government" based on Malthusian principles of zero growth that would manage what it calls "the controlled disintegration in the world economy."

Incredible as this may sound, an investigation of the background, membership, and publications of the *1980s Project* shows that the CFR is in dead earnest.

The CFR terms the *1980s Project* "the largest single



effort in our 55-year history" and notes that it was aimed at "describing how [world] trends might be steered toward a particular desirable future outcome." The project began in the summer of 1973 during a series of informal meetings held at the council's elegant townhouse on East 68th Street in New York City, under the leadership of Richard Ullman, the CFR director of research, and Edward L. Morse.

A year later, with abundant financing by the Rockefeller, Ford, Mellon, and Thyssen foundations, together with the German Marshall Fund, these sessions were formally institutionalized as the *1980s Project*, and working groups were appointed to explore specific problems and areas of interest (see box).

In January 1977, the project underwent a major transformation—*nearly 50 percent of its membership took up key posts in the Carter administration to begin the initial phases of implementing the project*. Among those who made the move to Washington were Cyrus Vance, head of the Project's Working Group on Nuclear Weapons, who became Carter's secretary of state; Leslie H. Gelb, head of the Working Group on Armed Conflict, who took on the influential position in the State Department of politico-military affairs advisor for the assistant secretary of congressional relations; Joseph S. Nye, head of the Working Group on the Political Economy of North-South Relations, who was named as an important advisor to the State Department on nuclear proliferation; Marshall Shulman, a member of the Project's Coordinating Group, who was appointed the chief State Department advisor on Soviet affairs; Richard Cooper and W. Michael Blumenthal, also Coordinating Group members, who became undersecretary of state for monetary affairs and secretary of the treasury, respectively; and Samuel Huntington, another member of the Coordinating Group, who joined the National Security Council staff. (Huntington, it should be noted, although his name might not be as familiar as others, is the man who drafted the Federal Emergency Management Agency legislation, along the lines of a book he wrote in 1975 for the Trilateral Commission, *The Crisis of Democracy*, that predicted "megadisasters" and the use of means to deal with them that go beyond what he called our outmoded U.S. Constitution.)

The White House and the Cabinet: Branch offices of CFR headquarters at the Harold Pratt House in New York City?

A number of lesser-known project members, including Edward Morse, also went into the Carter administration, while others, such as Stephen Green, coauthor of the *1980s Project* volume on international disaster relief, took up important posts in other agencies—in Green's case, the United Nations disaster preparedness organization. Most recently, Theodore Taylor, coauthor of the project's study on nuclear proliferation, was named to the presidential commission investigating Three Mile Island.

Meanwhile, the rest of the project members began circulating drafts of the project's proposal to various interested parties and preparing the *1980s Project* findings for publication in a 30-volume series.

What Is the CFR?

Before examining the already published volumes in the *1980s Project*, it's useful to understand exactly what the CFR is.

The New York Council on Foreign Relations is widely regarded as the principal policy center for what is called the Eastern Establishment, yet few Americans appreciate the fact that the CFR was established specifically to further British influence over U.S. policy-making and institutions.

The council was part of a project initiated by British colonialist Cecil Rhodes, who founded the elite Round Table organization in the late 1800s "to extend British rule throughout the world," as he bluntly stated in his will. The Rhodes faction in Britain, which included such notable British empire proponents as Lord Milner and Lord Roseberry, believed that the key to maintaining Britain's global hegemony was to "reintegrate" the United States into the Empire—a task in which the CFR has played a central role.

The seeds of the CFR were planted during the Paris peace conference in 1919, when representatives of the Round Table, including Lionel Curtis, Lord Robert Cecil, and Lord Eustace Percy, met with several highly placed Anglophile Americans to decide upon the most efficient vehicle for coordinating Anglo-American policy in the postwar period. The American group, which included Colonel Edward House, the British agent who virtually ran the Wilson administration; the Dulles brothers, the House

"A degree of controlled disintegration in the world economy is a legitimate objective for the 1980s and may be the most realistic one for a moderate international economic order."

Fred Hirsch, *1980s Project*
Alternatives to Monetary Disorder

of Morgan's Thomas Lamont, and Christian Herter, then returned to the United States and set up the Council on Foreign Relations. The CFR was formally incorporated two years later, in 1921.

During the past 60 years, the CFR has established a near-stranglehold over the most important institutions of the nation. Not only does it function as a "school for statesmen," supplying personnel for the top positions in government, but with a membership boasting leading figures in the media, trade unions, business, academia, and politics, the CFR is in a position to manipulate the public into at least passive acceptance of the policies that its agents in government implement.

The Carter administration is by no means the first national government whose policies have been a matter of CFR influence. Every president elected since 1944, with the exception of Harry Truman, and every secretary of state since Cordell Hull, except James Byrnes, has been a CFR member. More important, CFR members have controlled most other strategic posts throughout the central government apparatus, including subcabinet posts, ambassadorships, and Congress. Recently, the *Christian Science Monitor* estimated that over the years nearly 50 percent of the CFR's membership had been invited to serve in top government jobs. (CFR membership, by the way, is by invitation only.)

The CFR's most recent membership list includes such influential individuals as Secretary of Defense Harold Brown; Ambassador to Italy Richard Gardner; Senators Jacob Javits and George McGovern; *Washington Post* publisher Katherine Graham; *New York Times* editorial board member C.L. Sulzberger; presidential hopefuls George Bush, Howard Baker, Alexander Haig, and Rep. John Anderson (Haig is the CFR's preferred "strong man" candidate); Henry Kissinger; CBS chairman William Paley; United Auto Workers president Douglas Fraser; Chase Manhattan Bank chairman David Rockefeller, who is currently CFR chairman; oil analyst Walter Levy; financiers John Loeb and John Lehman; General Electric chieftain Reginald Jones; New York Federal Reserve district chairman Henry Fowler; and hundreds of other strategically situated individuals.

Controlled Disintegration

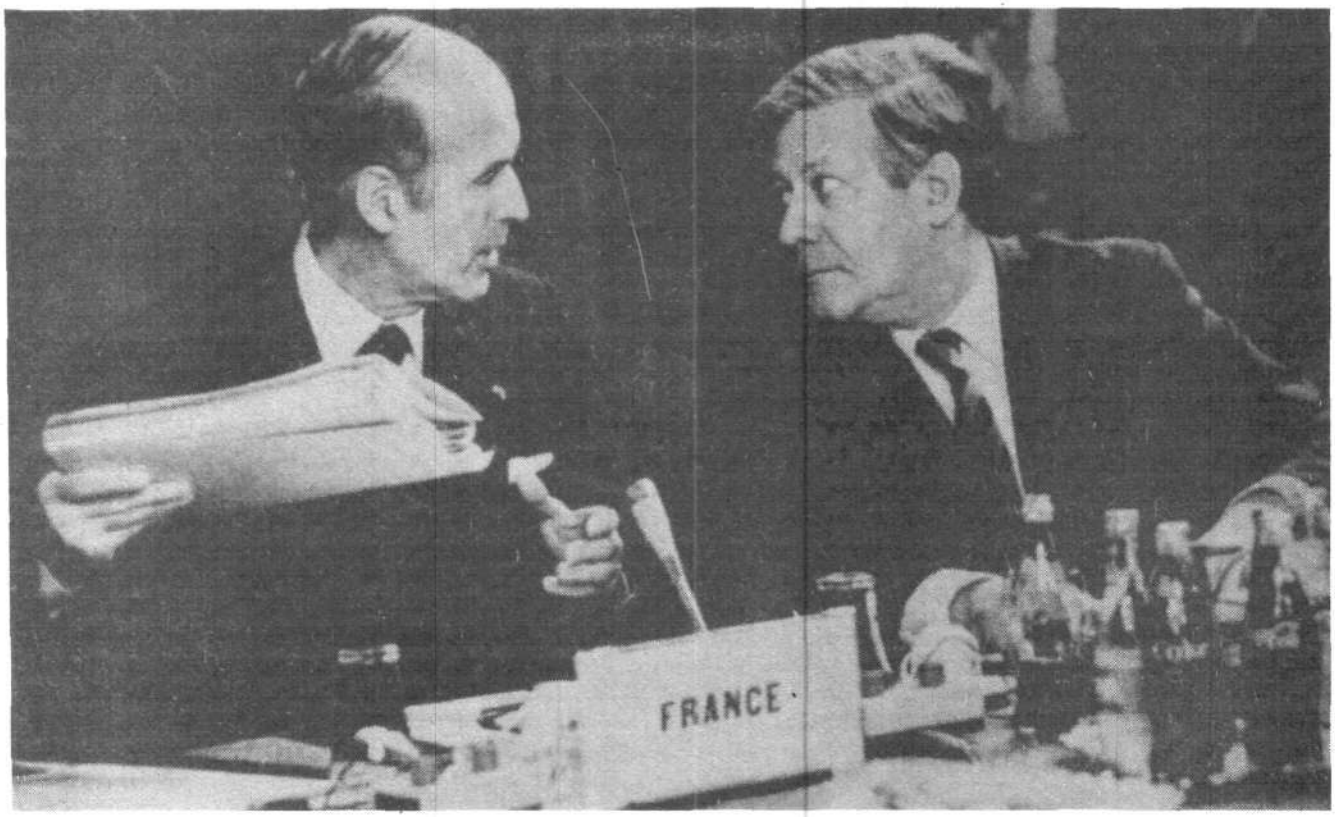
The ends and means candidly discussed in the first 16 volumes the CFR has published in its *1980s Project* would strip the world economy of its productive capacity, force the world population down to 1 billion, and bring on the hideous conditions of disease and destruction suffered in previous dark ages. In volume after volume, the CFR authors predict that the decade of the 1980s will be one of "controlled disintegration," "conflagration," "increased ethnic conflict," "megadisasters," "hard [repressive] states," "competition for vital resources," "shortages," and "inflation."

The essential point here is that these are not *predictions*, but *scenarios* that CFR members are now in the process of implementing as part of their jobs in the Carter administration. It requires no reading between the lines to see that the policies of the administration are the same as the CFR 1980s proposals.

The most succinct presentation of the CFR's concerns is found in the volume *Alternatives to Monetary Disorder*, authored principally by the late Fred Hirsch, senior advisor to the International Monetary Fund and a former financial journalist for the London *Economist*. In his essay "Politicization in the World Economy: Necessary Conditions for an International Economic Order," Hirsch stresses that the main threat that must be dealt with is the possibility that there will be an alliance between the "Hamiltonian" or neomercantilist economies of the developing and advanced sectors with the similarly dirigist economies of the socialist sector *against* the British "free trade" liberalism. "Controlled disintegration" is the best weapon to meet this threat, Hirsch says.

I quote at length from the Hirsch piece:

> The developing world, as challenger of today's balance and structure of political and economic power, sees increasing the explicit politicization of the international economy as an opportunity to forge a new international economic order more favorable to its interests. By contrast . . . Western governments see politicization as a threat to both economic prosperity and political harmony. In their opinion, the containment and reversal of the trend toward increasing politicization are among the most urgent international problems of the next decade.
>
> Politicization of economic issues . . . can be evaluated differently, according to the perspective from which [it is] viewed. Mainstream *liberal* thought . . . traditionally regards the politicization of economic issues as both an inefficient way to create and allocate wealth and a potentially destructive influence on harmonious relationships, both in domestic affairs and among nations. It therefore ought to be minimized. . . .
>
> Another normative approach that now has strong appeal in the developing world has its intellectual roots in *Marxist* and *neomercantilist* thought. . . . The pervasiveness of these perceptions helps to explain the remarkable unity of the less developed countries in their demands for a new international economic order. . . .
>
> These impediments encountered by the liberal ideal are not surprising to persons in the less developed



Dirigists in the Hamiltonian tradition, France's President Giscard (l.) and West Germany's Chancellor Schmidt are fighting for the antithesis of the 1980s Project, *a development policy based on industrializing the Third World.*

world and also in some developed states whose perspectives are Marxist or neomercantilist. . . . Mercantilists see nations, as Marxists see classes, becoming alienated in the process of production and exchange.

These normative nationalist concerns are far from new; they were eloquently addressed by Hamilton in his *Report on Manufactures* of 1790, in which he expressed the opposition of American nationalists to their country's assuming the role of a raw materials exporter to Britain. Nationalists feared and opposed two aspects of this role: the tying of American economic development to the British economy and the growing dependence on Britain for goods vital to national defense. Friedrich List, inspired by Hamilton's observations of American trade policy, outlined in *American Political Economy* what he saw as the proper object for a developing country's commercial policy:

"The object is not to gain matter, in exchanging matter for matter, as it is in individual and liberal economy, and particularly in the trade of the merchant. But it is to gain *productive and political power* by means of exchange with other nations; or to prevent the depression of productive and political power, by restricting that exchange."

. . . These Marxian doctrines are plainly evident in the development strategies of the Second World of Russia, Eastern Europe, and China. And in the First World, mercantilism inspired de Gaulle's challenge to the dominance of the dollar. Both these strands of thought find place in the development programs and campaigns of the Third World leaders in the postwar world.

To prevent an alliance among the neomercantilists (or Hamiltonians) and the Marxists, Hirsch recommends the following prescription:

> A degree of controlled disintegration in the world economy is a legitimate objective for the 1980s and may be the most realistic one for a moderate international economic order. A central normative problem for the international economic order in the years ahead is how to ensure that the disintegration indeed occurs in a controlled way and does not rather spiral into damaging restrictionism.
>
> The problem therefore is not to minimize politicization in the process sense of political intervention in market outcomes; it is rather to create a framework capable of containing the increased level of such politicization that emerges naturally from the changed balance of forces in both domestic economies and the international system. The function of the loosened international economic order would be to provoke such a framework by setting bounds to arbitrary

national action and thereby toward piecemeal unilateral action and bilateral bargaining that may ultimately be detrimental to the interest of all parties concerned.

The Assault on Science and Technology

The CFR's hatred for science, particularly the spread of a scientific outlook among the general population, underlies the entire *1980s Project*.

As would be expected, the project identifies nuclear technology as a major bugbear. Because they do not want to be associated with the environmentalist groups that they fund and control, the CFR project participants do not condemn nuclear power (or science and technology, for that matter) outright. Instead, the CFR objectively enumerates the various "problems" allegedly inherent in nuclear power, including "terrorism," "environmental dangers," the "threat to world peace," and so forth. "To be sure," admits the CFR in its volume on nuclear proliferation, we "are not advocating further international growth of the use of fission power."

To see that fission power is contained, the CFR studies propose a greatly increased role for "international institutions" in the control and diffusion of essential elements of nuclear technology—a reworking of the old Baruch Plan.

After discrediting nuclear energy as overburdened with insoluble problems, the *1980s Project* takes up the bandwagon for synthetic fuels to overcome what it predicts will be an acute oil shortage. In every detail, Øystein Noreng's volume, *Oil Politics in the 1980s: Patterns of International Cooperation*, anticipates the current Malthusian line promoted by Energy Secretary Schlesinger. "The days of inexpensive oil are behind us," Noreng writes, "and the basic issue is how to organize the transition from conventional oil to new sources of energy, such as synthetic fuel."

In addition to higher oil prices, Noreng spells out several other elements of what he terms a "new oil regime," which, not surprisingly, are already being translated into legislative form and rushed through Congress. In brief, these proposals give more power to the multinational oil companies by increasing their top-down control over international supplies. They also give the multis government incentives to pursue development of "alternative energy sources"—specifically coal gas, tar sands, oil shale, and geothermal.

Last but not least, Noreng calls for various measures to get the Organization of Petroleum Exporting Countries to sink funds into these retrogressive energy sources, to be less independent, and to delay industrialization.

> Participation by OPEC governments and their national oil companies [in the new oil regime] would broaden their knowledge and involvement in downstream operations such as refining and marketing, give them secure outlets for their oil, and *perhaps delay their projected building of refining and petrochemical industries*. Last but not least, it would give OPEC governments a stake in alterntive sources of energy and an even greater interest in the energy consumption of the OECD countries [pp. 144-45, emphasis added].

Again, when it comes to the question of running the proposed "new oil regime" (of which I have identified only parts), the CFR proposes the centralization of power in those institutions that are committed to its oligarchical world view, in this case, the International Monetary Fund.

The Cambodia Model for the Third World

The specific variation of controlled disintegration that the *1980s Project* advocates for the developing sector follows what can be called the Cambodia Model—after

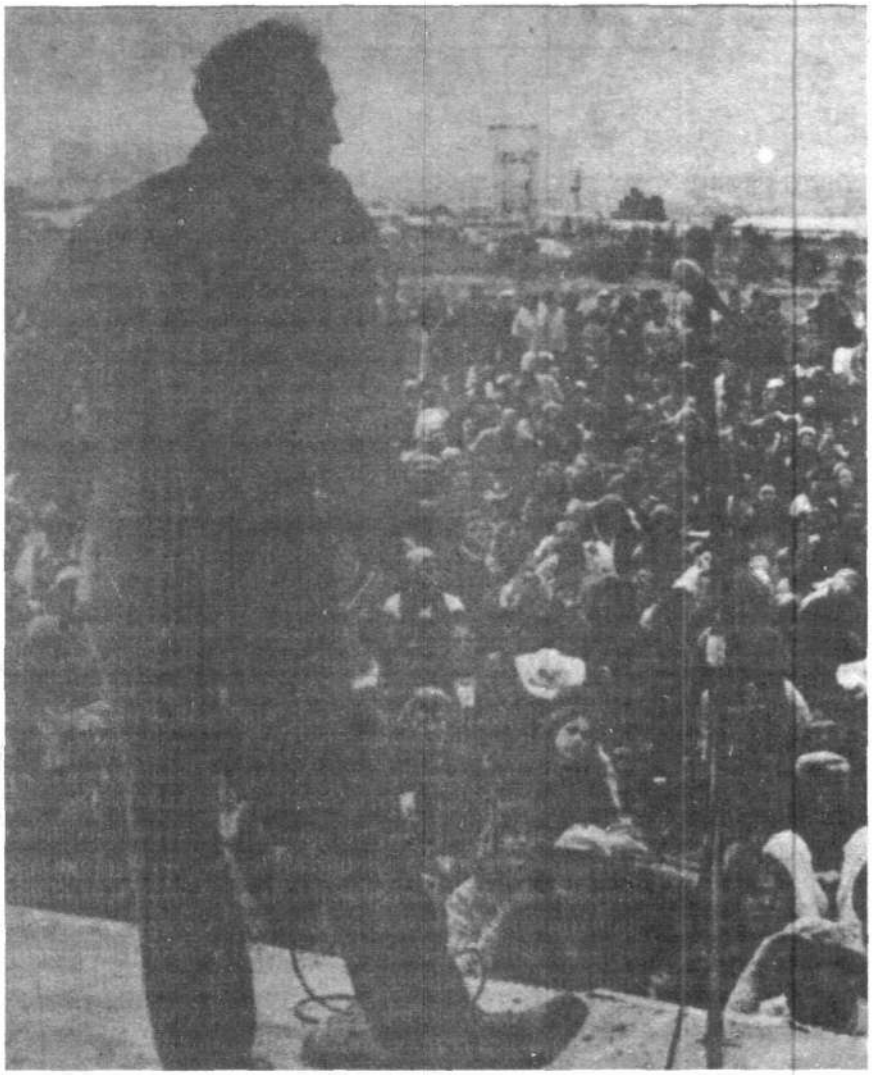
Who's Behind The 1980s Project

Drafts of the initial set of *1980s Project* studies evolved out of a series of 10 Working Groups that met during 1975-76 to discuss major international issues. Along with the Committee on Studies of the CFR's board of directors, which acted as the oversight body of the project, and the *1980s Project* Coordinating Group, which acted as an advisory board, these are the individuals responsible for the megadisaster scenarios spelled out in the 30-volume series. The major notable addition to the list of conspirators since 1976 is Henry A. Kissinger, who is now a member of the Committee on Studies.

Chairmen of the Working Groups
Cyrus R. Vance
Leslie H. Gelb
Roger Fisher
Rev. Theodore M. Hesburgh
Joseph S. Nye, Jr.
Harold Van B. Cleveland
Lawrence C. McQuade
William Diebold, Jr.
Eugene B. Skolnikoff
Miriam Camps

Committee on Studies (1975-76)
W. Michael Blumenthal
Zbigniew Brzeziinski
Robert A. Charpie
Richard N. Cooper
Walter J. Levy
James A. Perkins
Joseph S. Nye, Jr.
Robert V. Roosa
Carroll L. Wilson

Coordinating Group (1975-76)
W. Michael Blumenthal
Richard N. Cooper
Carlos R. Diaz-Alejandro
Richard A. Falk
Edward K. Hamilton
Stanley Hoffman
Samuel P. Huntington
Gordon J. MacDonald
Bruce K. MacLaury
Bayless Manning
Theodore R. Marmor
Ali Mazrui
Joseph S. Nye, Jr.
Michael O'Neill
Marshall D. Shulman
Stephen Stamas
Fritz Stern
Allen S. Whiting



"To be sure [we] are not advocating further international growth of the use of fission power."

1980s Project
Nuclear Proliferation

CFR members like Richard Falk and Daniel Ellsberg are in the leadership of the U.S. antinuclear movement. At left, Daniel Ellsberg addresses a May 5 antinuclear protest at Livermore, California.

the year-long campaign of Pol Pot, with the full support of the People's Republic of China, to eradicate from the country any shred of Western technology and education.[1]

Under the humanitarian-sounding rubric of meeting "basic human needs," the CFR proposes to restore the worst features of the old colonial regimes. Instead of industrialization, the CFR urges the Third World to adopt a "development strategy" premised on a decentralized, labor-intensive, rural economy. Of course, the sector will also be a raw materials exporter, the CFR notes, but this time with an expanded International Monetary Fund running the show.

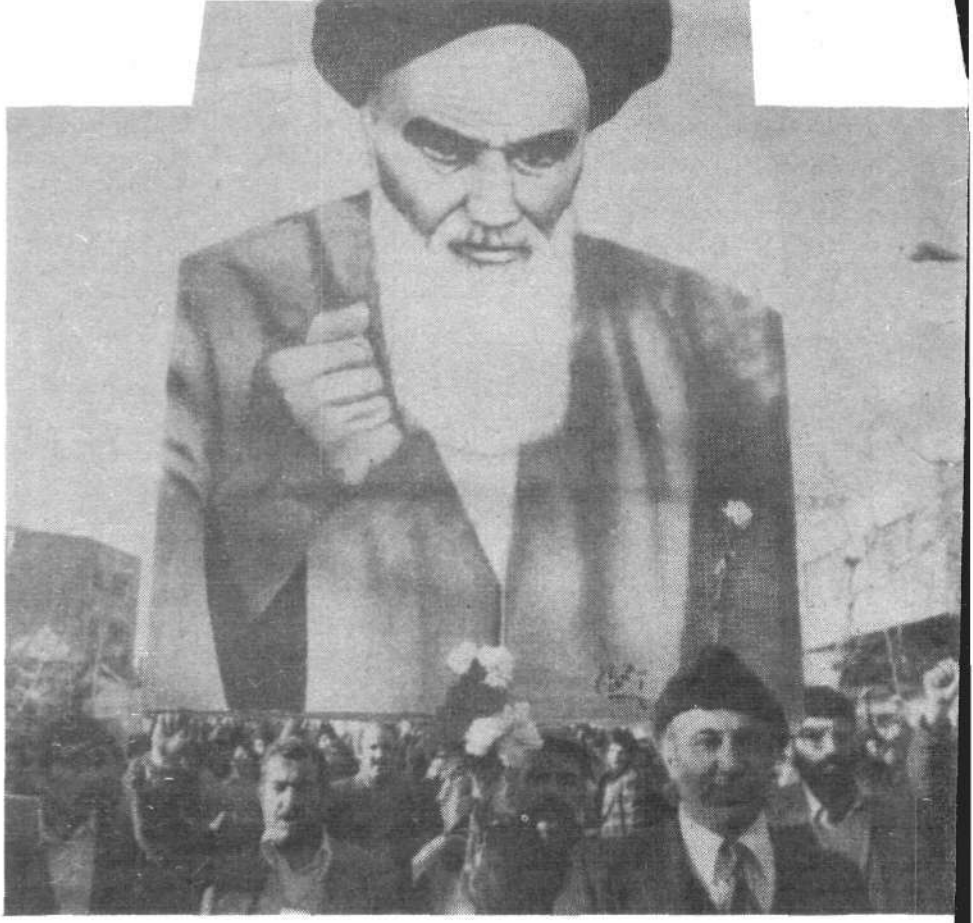
The CFR makes no bones about the fact that the Third World must find new and probably coercive measures of population control, disperse its urban populations to the countryside, and encourage small-scale, appropriate technology farming. At all costs, a number of the *1980s Project* studies stress, "capital-intensive production" is to be avoided.

To take one example of the CFR Third World philosophy, project leader Edward Morse writes in the introduction to *Six Billion People: Demographic Dilemmas and World Politics* by Georges Tapinos and Phyllis T. Piotrow:

> During the next 15 years, almost 1 billion persons already born in developing countries will be between 15 and 30 years old. This flood of energetic individuals will pose major problems for governments, related to their needs and demands for adequate housing, employment, and education and their likely desire to migrate away from overcrowded rural areas to urban centers in the quest for new opportunities. . . . In coping with this human flood, governments will be likely to pursue a mix of five basic strategies, some of which contradict others. . . . But a major requirement will probably be a new focus on development strategy, which centers on integrated rural development based less on agricultural "modernization" than on appropriate means of maintaining an efficient but labor-intensive agricultural sector. . . . Among the features of some of these strategies . . . are efforts to decentralize manufacturing activities, when appropri-

"Is it possible, in a world of rapidly increasing population, not to restrict some elements of freedom?"

Phyllis T. Piotrow
1980s Project
Six Billion People



"Controlled Disintegration" requires religious and tribal warfare to destroy nation states. At right: Khomeini supporters on the march, Kurdish rebels on the Khomeini firing line.

ate, by locating new plants in rural areas to provide adequate job opportunities for rural workers and to reduce migration toward urban centers.

Later, in the same volume, author Piotrow elaborates:

> . . . Integrated rural development, dispersed urbanization, and regional development are explicit population distribution programs designed to counteract the adverse effects of excessively rapid urbanization and rural impoverishment. . . .
>
> Like policies to influence fertility, policies to influence migration or distribution [of population] may be voluntary or coercive, may offer positive benefits or withhold benefits for noncompliance. . . . Significantly the most stringent distribution policies, like the most stringent family-planning policies have been those of the People's Republic of China, implemented under strict totalitarian control, occasionally by coercive measures. . . . *Is it possible, in a world of rapidly increasing population, not to restrict some elements of freedom* [emphasis added]?

Of course, the CFR is quick to point out that the developing sector may not take too kindly to policies which, as the case of Cambodia hideously demonstrates, will mean genocide for large portions of their population. As a remedy, the CFR introduces a strong element of blackmail. Edward Morse puts it delicately:

> Politically, it seems clear that aid from richer industrialized societies to poorer ones, aimed at basic needs, can be used as a bargaining device to modify the intransigence of LDCs [Lesser Developed Countries] on many international issues: law of the seas, trade, finance, energy and other issues in the North-South dialogue.

In another CFR volume on the North-South issue, *Beyond the North-South Stalemate*, Roger Hansen proposes "a new institution to be established by rich and poor nations, North and South, to meet the basic needs of all people by the end of the century." How would this humanitarian-sounding institution work?

It "would receive financial contributions from industrial nations of the North, allocate funds on the basis of need to developing member nations, and monitor the performance of recipient countries in meeting the needs of the very poor." In other words, the new institution would pool all aid to the developing sector in a single bureaucracy that could then ensure that the Third World followed a "basic human needs" formula instead of industrial development—or there would be no aid.

Human Rights?

As the *1980s Project* contributors repeatedly emphasize, a major impediment to their deindustrialization policies is the national elites of developing sector nations. The CFR correctly perceives that these elites are much more

likely to be dedicated to pursuing a "Western" model of development and not as likely as the masses of people to be manipulated by demagogues.

In order to rid themselves of this obstacle to the *1980s Project* implementation in the Third World, the CFR has devised its own interpretation of the human right question. As the CFR notes, "basic human needs" concern "the well-being of the people—not just the states—of the developing world."

What the CFR means by this can be seen in Iran today. Richard Ullman, the *1980s Project* director, boasted in a recent interview that the overthrow of the Shah of Iran was an example of the proposals for getting rid of alleged repressive regimes and asserting the human rights of the people that Richard Falk outlined in his CFR volume, *Enhancing Global Human Rights*.[2]

A law professor at Princeton University and a leading environmentalist, Falk applauds the overthrow of centralized leadership because this frees the ethnic minorities within the state to establish "their own thing"—albeit after bloody battle. But this bloodshed and the natural disasters that accompany the chaos and disintegration of society are what the CFR sees as the basis for a "new world order." I quote from Falk:

> In opposition to the "state" as a juristic, territorial center of military and bureaucratic power is the notion of "community" as an experiential, nonterritorial nexus of affinity and value. . . . The notion of "global community" is the animating ideal of an alternative world order system, leading to a dialectical emphasis on the unity of the whole and on the dignity of the individual and distinct substatal groups. The tension between particular and general is, in essence, the proper foundation for the appreciation and protection of human rights. It implies there would be no territorial enclave that could flout global community norms [p. 252].

And what kind of "global community norms" should be encouraged? Falk suggests "rock music festivals."

Beneath Falk's counterculture gibberish about "human rights" lies the heart of the CFR strategy to create a New Dark Ages: the destruction of the nation-state as the primary political and economic entity. The nation-state is the chief enemy because the CFR knows that a strong nation is, of necessity, based on a commitment to the continuous expansion of its industrial base, a process that depends in turn on the proliferation of scientific knowledge throughout the general population. A population committed to progress and technology poses the single most dangerous threat to the emergence of the primitive Dionysian world order envisioned by the CFR.

To back up his human rights policy, Falk identifies seven "severe violations of human rights," including "ecocide," that could serve as the reason for mobilizing intervention into the offending nation. The "specific types of coercive action that the international community might apply to

"Disaster relief has become a growth enterprise."

Stephen Green, *1980s Project International Disaster Relief*

The 1980s Project expects to thrive on disasters and megadisasters. At right: The Dominican Republic in the aftermath of Hurricane David.

the offending government," according to a CFR press release on Falk's proposal, "involve combinations of domestic struggle and international intervention, psychological and diplomatic pressure, economic sanctions, boycotts and embargoes, and lastly military force."

Specifically, Falk recommends establishing an international strike force under United Nations auspices: "to carry out human rights missions. Such a force could, for example, rescue hostages, safeguard tribal minorities, or release unjustly confined prisoners."

In his introduction to the volume on human rights, the *1980s Project* director Richard Ullman identifies the real target of the "human rights" campaign:

> Falk is one of the most penetrating critics of the current state-centered organization of the international system. He is deeply offended that the mere existence of a state frontier should alter profoundly the ways in which persons on either side of it live their lives and relate to government authorities. Territoriality—state sovereignty throughout a demarcated territorial space—is, in effect, too often the refuge of racists, bigots, or just plain scoundrels. So long as the territorial state remains the centerpiece of political organization, Falk says, the international community can do nothing to prevent and little to remedy even the most egregious violations of human rights by governments.

Disasters and Megadisasters

A similar assault on national sovereignty is presented in the *1980s Project* international disaster relief proposals. Authored by Stephen Green, who is now implementing his recommendations for the United Nations, the international disaster relief proposal is a blueprint for nation-wrecking.

Again, the developing sector elites come in for special abuse. Green accuses them of deliberately sabotaging relief efforts in past disasters (disasters brought on, for the most part, by the antiindustrial policies that the CFR is conspiring to maintain), of "wilfull malfeasance," and "coverup." As Richard Ullman put it in his introduction to the disaster study, "Seen as a human right, disaster relief cannot be allowed to be impeded by the political sensitivities of elites in power who might be willing to trade avoidable losses of life for continued incumbency . . . ."

Ullman also makes it clear that the real concern is not

the plight of the victims of disasters, but the opportunities such disasters present to help achieve the CFR's ultimate aims. I quote from Ullman:

> Such a point of view [disaster relief considered as a human right], should it gain currency in the 1980s, would represent a dramatic transformation in international relations—a shift from a primary focus upon relations among states to one instead emphasizing relations among societies. Such a transformation would pose very difficult questions regarding, inter alia, appropriate criteria for "legitimate" intervention into what are customarily regarded as the domestic affairs of sovereign states. Such a shift in perspectives would reflect increasingly widespread dissatisfaction with the constraints posed by the recognition of sovereign jurisdictions. The 1980s will be a period marked by the beginnings of international (or transnational) society . . . .

As with the human rights issue, the CFR proposes to take disaster relief out of the domain of national sovereignty and place it under the institutions representing its new world government in embryo. Specifically, in his volume on disasters, Green recommends upgrading and integrating all current disaster relief efforts, expanding the United Nations Disaster Relief Organization into an international "traffic coordinator" for relief efforts, and bolstering the powers of the International Committee of the Red Cross. Specifically, Green assigns the Red Cross to monitor the implementation of his proposed new Geneva Convention, which would make disaster relief, including "environmental damage," a "basic human right."

That disasters and megadisasters are an essential part of the *1980s Project* implementation can be seen from Green's optimism about the future opportunities for his schemes:

> During the 1980s, with the populations of disaster-prone areas continuing to rise, with prospects of food and energy shortages and adverse climatic change, there is reason to believe that human failings will exact a great toll as increasingly large areas of the developing world become vulnerable to disasters of a scale hitherto unknown. In turn, these "megadisasters" will create conditions of political instability and, in all likelihood, of conflict, which will further erode the capacity of societies to cope with natural disasters. It is this prospect that makes the organization of disaster relief so imperative today. Indeed, there may well be a need for "laws" against the avoidable human elements of disasters, for in the 1980s, today's disasters may seem small in retrospect.

"Disaster relief," Green happily observes on page 17, has become a growth enterprise."

Kathleen Murphy is on the staff of the Executive Intelligence Review and writes on U.S. political affairs.

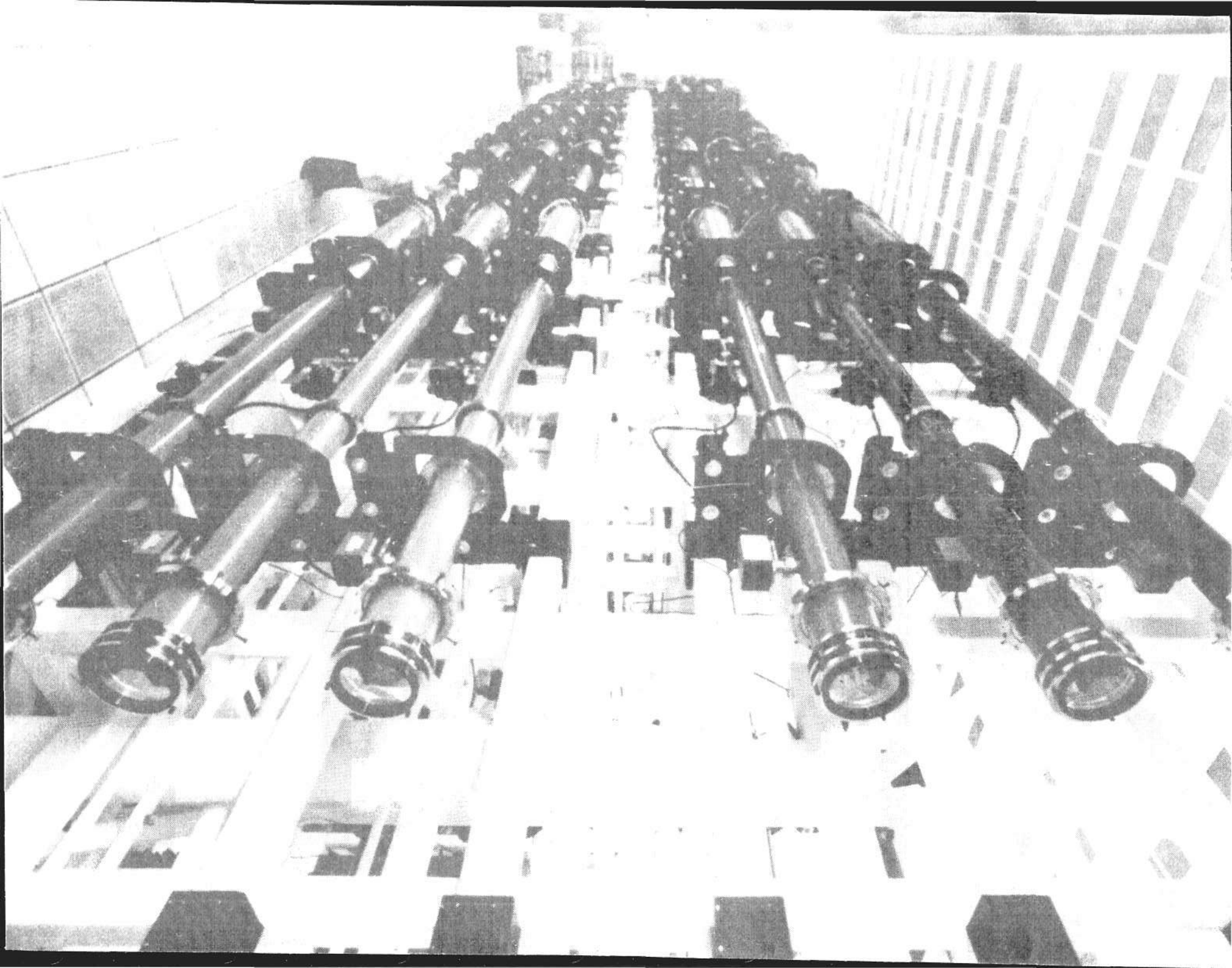
Notes

1. A horrifying first-hand account of Pol Pot's destruction of Kampuchea (Cambodia) by Polish journalist Wieslaw Gornicki can be found in the *Executive Intelligence Review*, Vol. 6, No. 25, July 2, 1979. Gornicki's report was written after a five-week stay in Kampuchea between the end of January and early March 1979. Excerpts of his text were published in a few other U.S. newspapers.
2. Ullman's candid remark that the overthrow of the Shah of Iran was "definitely" what Falk was talking about appeared in an interview published in the *Executive Intelligence Review*, Vol. 6, No. 23, June 18, 1979. Falk was in Iran shortly before the Shah was ousted.

The 1980s Books

The *1980s Project* plans to release 30 books discussing regional areas of the world and such issues as "resource management, human rights, population studies, and relations between the developing and developed societies." *The volumes released to* date, all published by McGraw Hill, include the following:

- *Africa in the 1980s: A Continent in Crisis*, studies by Colin Legum, I. William Zartman, Steven Langdon, and Lynn K. Mytelka
- *Alternatives to Monetary Disorder*, studies by Fred Hirsch, Michael W. Doyle, and Edward L. Morse
- *China's Future: Foreign Policy and Economic Development in the Post-Mao Era*, studies by Allen S. Whiting and Robert F. Dernberger
- *Controlling Future Arms Trade*, studies by Anne Hessing Cahn, Joseph J. Kruzel, Peter M. Dawkins, and Jacques Huntzinger
- *Diversity and Development in Southeast Asia: The Coming Decade*, studies by Guy J. Pauker, Frank H. Golay, and Cynthia H. Enloe
- *Enhancing Global Human Rights*, studies by Jorge I. Dominguez, Nigel S. Rodley, Bryce Wood, and Richard Falk
- *International Disaster Relief: Toward a Responsive System*, by Stephen Green
- *Nuclear Proliferation: Motivations, Capabilities, and Strategies for Control*, studies by Ted Greenwood, Harold A. Feiveson, and Theodore B. Taylor
- *Nuclear Weapons and World Politics: Alternatives for the Future*, studies by David C. Gompert, Michael Mandelbaum, Richard L. Garwin, and John H. Barton
- *Oil Politics in the 1980s: Patterns of International Cooperation*, by Øystein Noreng
- *Reducing Global Inequities*, studies by W. Howard Wriggins and Gunnar Adler-Karlsson
- *Rich and Poor Nations in the World Economy*, studies by Albert Fishlow, Carlos F. Diaz-Alejandro, Richard R. Fagen, and Roger D. Hansen
- *Six Billion People: Demographic Dilemmas and World Politics*, studies by Georges Tapinos and Phyllis T. Piotrow
- *The Middle East in the Coming Decade: From Wellhead to Well-Being?*, studies by John Waterbury and Ragaei El Mallakh



Laser Fusion

A Review of the Lawrence Livermore Report

by Charles B. Stevens

THE LAWRENCE LIVERMORE Laboratory *Laser Program Annual Report—1977*, published this spring, is the third 1,000-page annual report of the largest U.S. laser pellet fusion research program.[1] Although this latest annual report maintains the professional competence and thoroughness of the previous reports, many significant scientific developments must be found "between the lines" of the written text.

For example, reading between the lines, we find that LLL probably has plans to explore the use of fission "triggers" in laser fusion pellets—a truly microscopic H-bomb—on the Shiva Nova upgrade of the existing LLL Shiva laser system. Such a line of approach would be pursued only if pure fusion types of high-gain target pellets did not achieve success. Insofar as the Livermore scientists can openly discuss target pellet design, it appears that no pure fusion target design approach can meet all of the stringent requirements of cheap, high-gain fusion energy targets needed for economical power plants.[2]

A more general observation that can be read between the lines is that basic scientific questions have arisen in the research that are not being addressed, and it is clear that it is necessary to comprehend the fundamental processes involved in a nonlinear fashion. This problem is discussed in more detail below.

Laser Fusion: An Overview

Although many scientific and technological problems remain unresolved, the 1977 *Annual Report* demonstrates that LLL is still deeply committed to an early demonstration of commercial laser fusion, a goal the national laboratory has pursued for the past 10 years.

Looking back from target room along 6 of 20 arms belonging to the Shiva laser system. Lawrence Livermore Laboratory

The official U.S. effort to harness the virtually unlimited energies of nuclear fusion reactions using inertial confinement began in the late 1960s. The idea was to use the focused energy of powerful lasers to compress fusion fuel to extremely high densities at which the fusion reaction would proceed with sufficient speed.

In this reaction only a small core region of the compressed fusion fuel need be raised to hundred-million-degree fusion ignition temperatures because the fusion energy output from this core region is absorbed by the outlying layers of the compressed fusion fuel and driven in this way to ignition temperatures. Successfully achieving this result is termed setting up a *thermonuclear burn wave*.

Given compression to sufficiently high densities and the successful setting up of a thermonuclear burn wave, the majority of the compressed fusion fuel undergoes the fusion reaction before the compressed fuel blows up. The only thing keeping the fuel confined during this brief period (a few billionths of a second for the tiny fusion pellets that are compressed to a few microns and a few millionths of a second in the case of the compressed core of H-bombs) is the *inertia* of its own mass.

In this laboratory approach to inertial confinement the laser, ion, or electron beam replaces the immensely larger nuclear fission atom bomb used to drive the compression (implosion) of the fusion fuel in the H-bomb.

The first laser-generated fusion reactions were reported by Soviet scientist N.G. Basov in the late 1960s. Electron-beam-generated fusion reactions were also first achieved by a Soviet scientist, L. Rudakov in 1976. In the United States, the first laser fusion was attained at KMS Fusion in Michigan in spring 1974. KMS is a private company pursuing laser fusion research, which now gets some government financing. Shortly after the KMS success, LLL also obtained small amounts of laser-generated fusion.

However, these early experiments generated an insignificant amount of fusion energy compared to the laser energy needed to achieve the fusion reaction. The measurements of the energy output are precise. Each fusion reaction of deuterium-tritium generates one neutron. Fusion energy output can then be measured by counting the number of neutrons produced.

The initial experiments put out only about 1 million fusion neutrons. Something like an output of 1,000 trillion fusion neutrons would be needed to break even; that is, to generate as much fusion energy as that put in by the laser. And in a power plant, the number of neutrons generated would have to be on the order of 1 million trillion for each fusion pellet microexplosion.

Figure 1 gives the measure of the number of neutrons generated in various laser fusion experiments since 1974. The large Shiva glass laser system at LLL holds the record with something like 100 billion neutrons generated, but even this is far short of breakeven. LLL has projected an upgrade of the Shiva laser that would be completed by the early to mid-1980s and, if everything works as planned, could achieve breakeven. However, to reach the sort of fusion energy gain needed for an economical power reactor, a further upgrade would be needed.

And even if the further upgrade proves successful, it is highly likely that a new type of laser or "alternative driver" like an ion or electron beam would have to be developed because the high-power glass lasers now used in scientific experiments do not appear capable of attaining the repetition rates (several times a second) or the efficiencies of operation needed for an economical power reactor.

The 1976 LLL Laser Program Annual Report, published last year, projected that an accelerated effort spending on the order of $10 billion overall could lead to a commercial power plant demonstration by 1996. LLL currently receives about $34 million out of the total fiscal year 1980 government budget for inertial confinement research of about $130 million, far short of what is required to develop a demonstration power plant.

LLL Laser Program Summarized

The 1977 *Laser Program Annual Report* contains more than 1,000 pages of condensed reports on the many aspects of the LLL laser effort. I summarize the chief sections here.

The Solid-State Laser Program gives a review of the successful initiation of the 20-beam neodymium glass laser system, Shiva, the world's most powerful laser with a power level of 30-trillion watts. This section also details the development of the Shiva upgrade, Shiva-Nova, giving reports

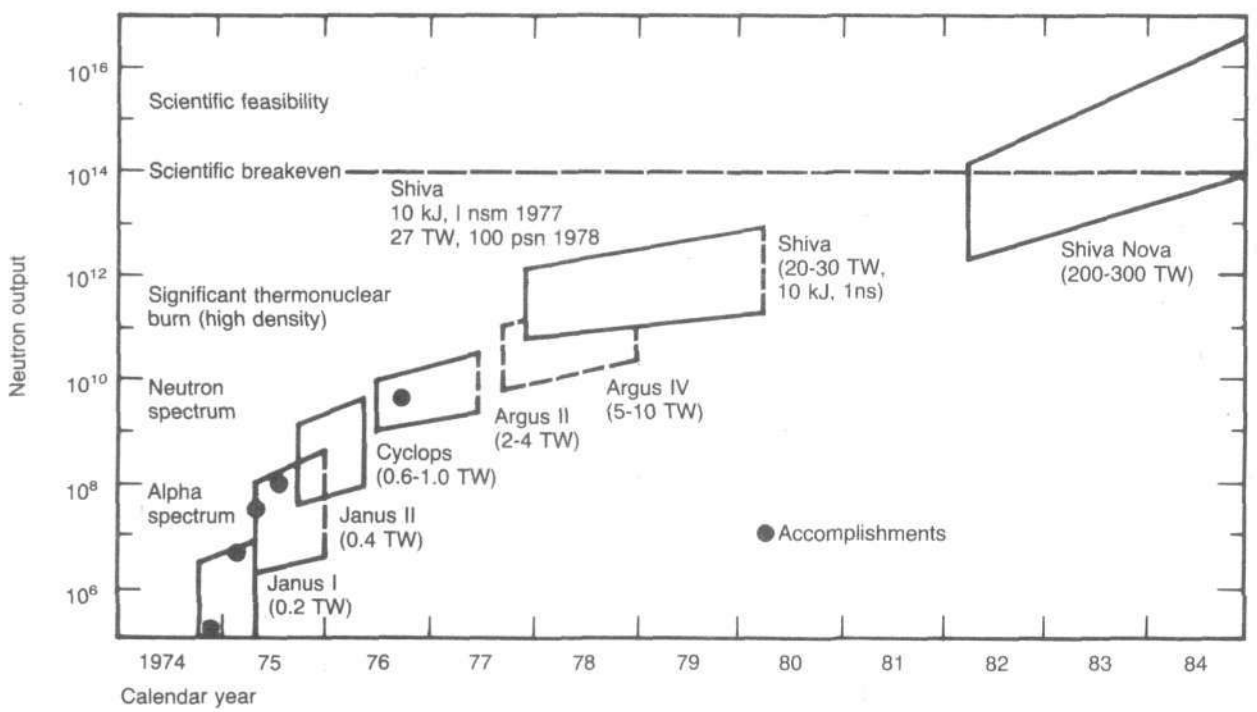


Figure 1
LASER FUSION ENERGY YIELD

The fusion neutron output of various Lawrence Livermore laser systems is shown here by year. The dots designate the achievements of the program since 1974, and the boxed areas indicate the program goals through the 1980s. The Shiva-Nova laser, now under construction, is expected to reach scientific breakeven and feasibility in the mid-1980s.

The laser power is given in terawatts.

on laser materials development, laser optics, target chamber, and diagnostics design.

Table 1 charts the projected cost and operating capabilities of Shiva, along with its actual accomplishments. The Shiva output is a major achievement, because when it was designed Shiva was more than one-hundred times beyond the then-current state of the art in laser technology.

The Fusion Experiments Program gives a detailed description of the diagnostics developed for the Shiva system. For each pellet of fusion fuel shot, researchers will carry out as many as several hundred separate scientific experiments. Shiva experiments must routinely achieve time resolutions as small as 6 trillionths of a second (infrared light measure) to 15 trillionths (X-rays) and space resolutions of 1 micron on these same time scales.

Fusion Target Design is the heart of the scientific effort involved, and I deal with this in detail below.

Target Fabrication is a key component of the ability to carry out current experiments and will eventually be an essential aspect of the economics of laser fusion power plants. Many of the most difficult problems in laser fusion research result from the stringent design requirements for surface finish, concentricity, and target material composition for laser fusion pellets.

For example, the surface finish on a glass sphere required for high-density implosion experiments may be 100 to 300 angstroms (one angstrom equals a hundred-millionth of a centimeter) with a few peaks of 200 to 300 angstroms permitted on the entire surface of the pellet.

Surfaces of such high quality are seldom found or studied in materials research, development, or use situations. The pellets not only must be produced with extremely smooth surfaces, but also their quality must be measured.

The simplest type of target currently used is a hollow glass sphere between 50 to 250 microns in diameter. High-pressure D-T gas is introduced by diffusion through the glass walls of the micro balloon pellet at high temperatures. The D-T gas is trapped by suddenly cooling the pellet.

For more advanced studies, targets consisting of complex though uniform layers of various materials must be constructed. LLL is developing techniques to do this.

Laser Fusion Experiments and Analysis gives detailed results on the Argus two-beam glass laser system, an 8-trillion-watt laser developed as a demonstration of technology on the way to constructing Shiva. Before Shiva began firing, Argus held the record, generating more than 1 billion fusion neutrons per shot.

It was recently reported that Argus was able to compress D-T pellets to more than 40 times liquid density. This is a key requirement for high-gain laser fusion pellets; compressions to between 1,000 to 10,000 times liquid density may be needed for reactor-grade pellets.

Advanced Lasers, as noted above, are needed if the United States is to develop commercial laser power plants. In fact, a recent Department of Energy study by the Foster Committee found that the development of advanced lasers was a key element of the inertial fusion effort not receiving sufficient attention. The Foster Committee called for upgrading the entire laser fusion program so that an efficient high-repetition rate driver could be developed at the same time that breakeven experiments are going on with glass lasers. (This study is now being kept under wraps.)

Table 1
SHIVA CAPABILITIES, COST, AND OUTPUT

	Design goal	Measured performance
Maximum energy from 20 beams	10kJ*	10.2 kJ (0.95 ns)
Maximum energy, single beam	500J*	620 J (0.95 ns)
Design and construction	4.5 years	4.8 years
Cost	$25 million	$25 million

Systems and Applications Studies are another aspect of laser fusion research not receiving enough attention, according to the Foster Committee report. Although the LLL effort in this area is relatively small in financial terms, it has produced important results that I will describe below in detail. The main points of this effort are: development of a workable laser fusion reactor design; explorations of economical target fabrication; examination of fissile and hydrocarbon fuel generation via laser fusion; other alternative applications such as space rocket propulsion; and, finally, analysis of the rates at which fusion energy can be brought on line to meet U.S. energy needs.

Fusion Target Design

Since the beginning of the laser fusion effort, LLL has noted that the isentropic compression of fusion fuel to more than 1,000 times the liquid density of hydrogen—several times greater than that in the center of the sun—is essential to achieve high-gain fusion target pellets.

The problem is that man has never before measured compressions to these densities, although they may have been generated in H-bombs. The size and amount of energy generated by the smallest fission trigger prevent the scientific direct measurements of what goes on in the compressed core of H-bombs. In fact, scientists have not been able to measure successfully isentropic compression of any significant degree. To accomplish these measurements is the raison d'etre of the laser fusion program—and the chief goal of the military applications aspect of this program.

Isentropic compression literally means that while the fusion fuel is being compressed to thousands of times liquid density, its entropy heat loss does not increase. This is achieved by keeping the fuel "cold" while it is being compressed and allowing it to be heated only when maximum compression is reached. To put it another way, the

fuel must remain "well-ordered" if high densities are to be attained; entropy is a measure of order.

A look at the problem from the macroscopic side shows why this must be the case.

The more hollow a fusion pellet that researchers can uniformly implode, the greater the amount of energy per fusion fuel mass that a given laser can impart to it. This is simple to see. If a given mass of fusion fuel is made into a hollow sphere, for example, it will have a greater distance over which it can be accelerated before implosion begins. The problem is that if the hollow sphere begins to break up before or during implosion, no significant compression can be achieved. In other words, a nonuniform implosion would lead only to pieces of the sphere splattering against one another, and the total energy of the accelerated imploding sphere would not be concentrated.

This breakup of extremely hollow spheres is predicted by the Rayleigh-Taylor hydrodynamic instability, a basic hydrodynamic process.

A simple form of this type of instability can be seen by placing a layer of water over a layer of lighter oil in a glass. If done carefully and not disturbed, the two layers will remain intact. But once slightly disturbed, the surface between the two layers will begin to oscillate. These oscillations will grow until globs of oil pass through the water layer to the surface. Gravity is the driving force in this example of the Rayleigh-Taylor instability.

In laser fusion pellets, the force of acceleration during the implosion is the driving force; the outer layers of fusion fuel take the place of the water and the void in the hollow pellets takes the place of the oil.

LLL began to solve this problem by using thick-shelled fuel pellets to avoid the onset of the Rayleigh-Taylor instability, but this approach has encountered several new problems.[3] The higher power density levels needed to drive these types of targets (more than 1,000 trillion watts per square centimeter) lead to a laser light-pellet interaction called *Brillouin backscatter,* in which a significant

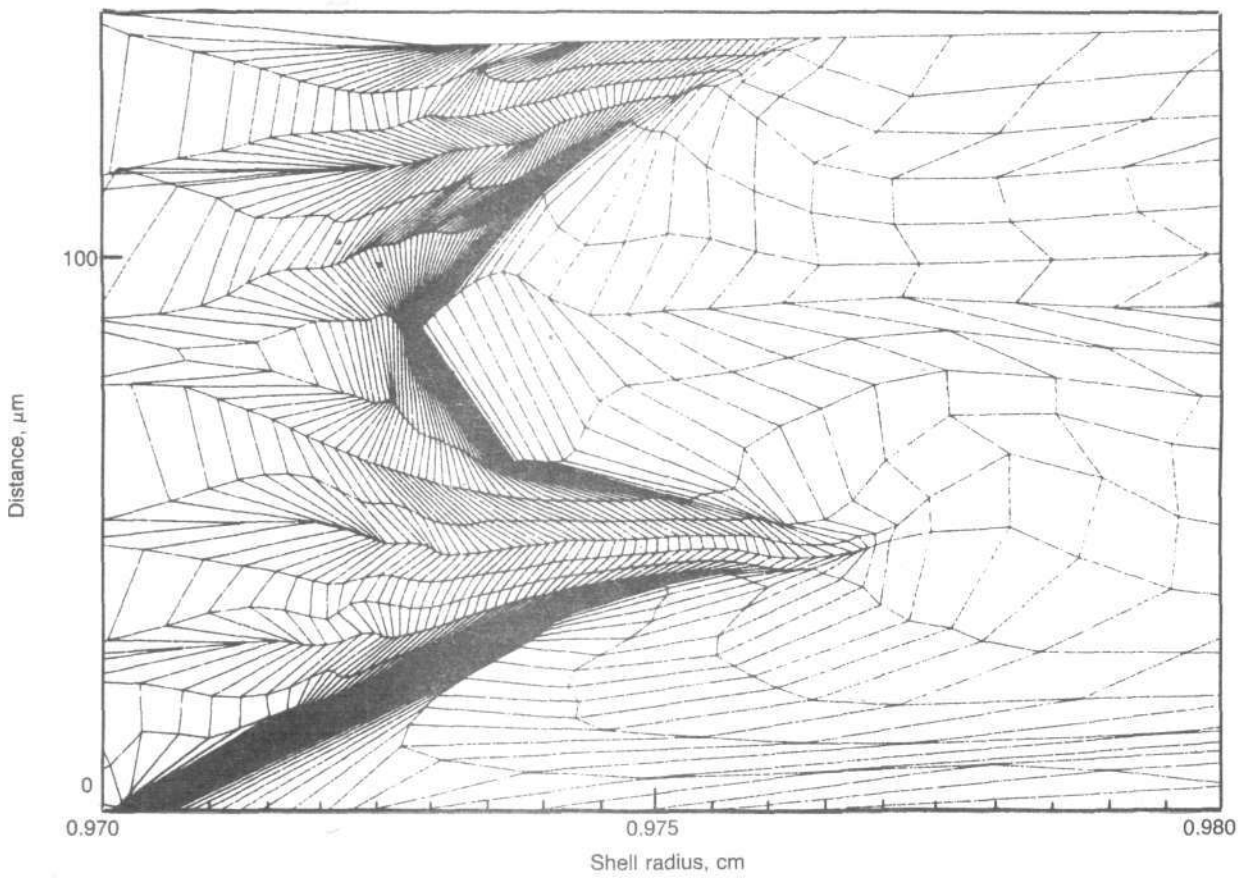


Figure 2
COMPUTER MODEL OF A THIN-SHELL PELLET IMPLOSION

Lawrence Livermore reports that the thin-shell type of target pellet proposed by Basov would break up and implode in a nonuniform way, as shown in this computer model of the implosion. This frame of the computer movie represents a quarter of the pellet sphere in the later stages of implosion. The lines represent the density of material. The beryllium shell of the pellet is 100 micrometers thick with a 1 centimeter radius. The laser is 200 terawatts.

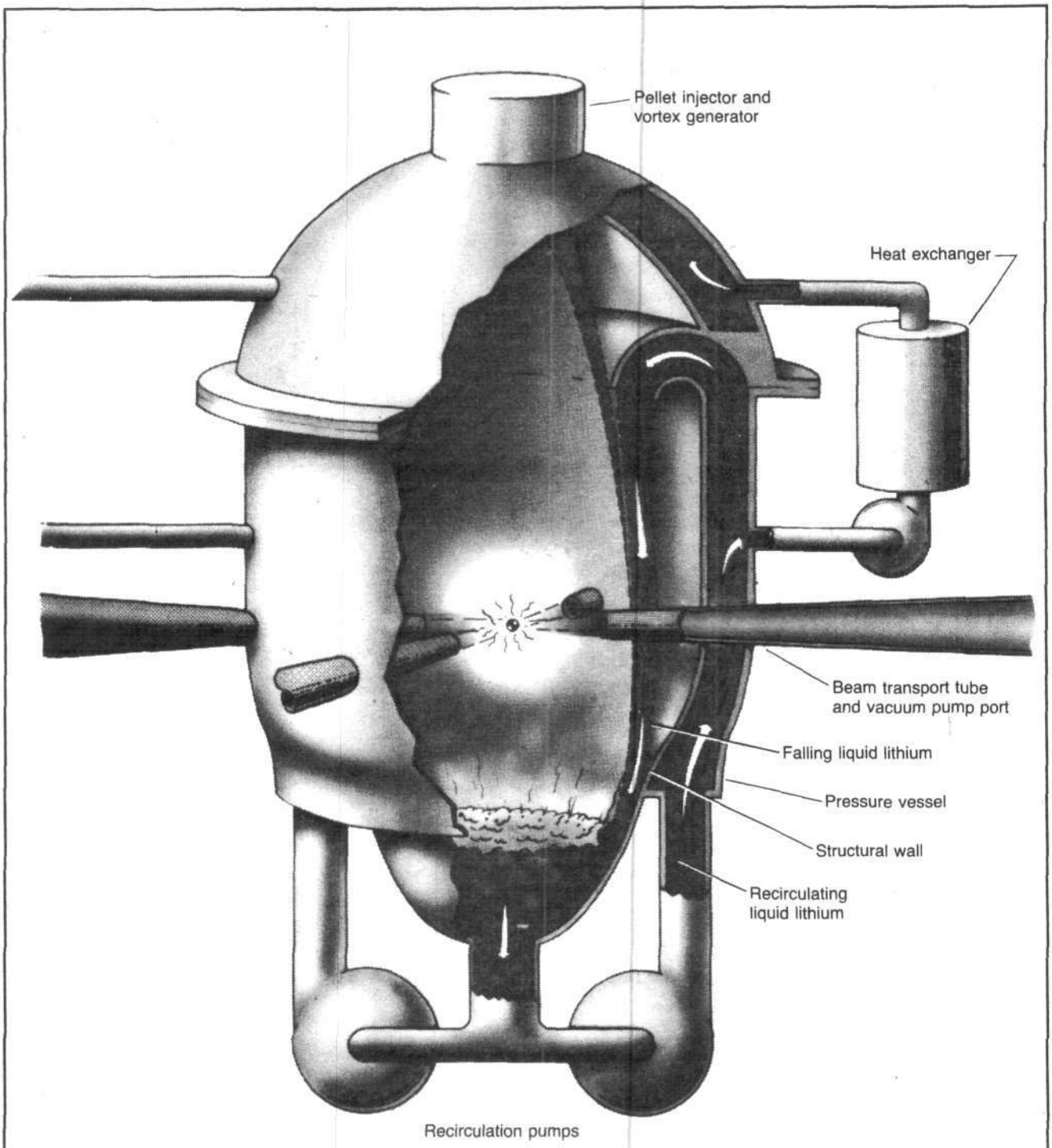


Figure 3
LIQUID LITHIUM WATERFALL/LASER FUSION REACTOR MODEL
In this closed-cycle system, the neutron and X-ray energy from the implosion is absorbed in the liquid metal lithium that forms a thick wall around the center of the reactor. The lithium, circulated through a series of heat exchangers, is also the heat-transfer fluid. Electricity is produced with conventional turbine generators.

portion of the incident laser light is backscattered away from the target and does not become absorbed into the compression process.[4] Other laser light-matter interactions at these high-power levels also tend to generate greatly accelerated electrons and ions (hot electrons and ions) that because of their increased energy penetrate and preheat the interior of the fusion target.

LLL has responded to these developments by adopting an approach previously put forward by the Los Alamos Scientific Laboratory and somewhat similar to Soviet-proposed designs that use a "central" ignitor. The outer shell of the pellet is imploded inwardly and prevents any preheating of the inner-core shell.

Based on this approach, LLL scientists project that the laser requirements for a power plant would still be in the high-power range. The overall requirements would include laser efficiency just greater than 1 percent, laser light wavelength from 1 to 2 microns, total laser input 1 million joules, peak laser power greater than 100 trillion watts, pulse rate 4 per second, target surface finish less than 1,000 angstroms, and target cost less than 30¢ each. Each fusion pellet would produce about 1 billion joules; at 4 per second, this would lead to 4,000 megawatts thermal power output and an electrical power output of 1,000 megawatts—which is about the same as existing nuclear fission power plants.

As the LLL report points out, there are still major problems to overcome with this central ignitor approach. First, there is the question of whether the hydro efficiency (that portion of the laser light energy input that ends up in the implosion process) can be obtained for values greater than 10 percent. Second, there are reasons to believe that while the ignitor may reach fusion temperatures, the thermonuclear burn wave may not actually be able to ignite the outer shells of fusion fuel pellets, thereby significantly cutting the total fusion energy output. (This is because the power density of the burning fusion region is not sufficient to heat the denser outer fuel regions to fusion temperatures.)

Alternative Approaches

The LLL report raises and criticizes several alternative approaches including very low density targets (a gas target set up by a laser prepulse), very thin (hollow) targets like those proposed by the Soviet scientist N.G. Basov, targets with large magnetic fields (magnetic insulated targets), and nonablative acceleration.

For the very low density targets, suggested by the Soviet scientist A.M. Prokhorov, the LLL researchers find that there is a conflict between the entropy conditions (isentropic compression) and obtaining ignition temperatures.

For the very thin shelled targets the LLL report points out that the Rayleigh-Taylor instability is unavoidable. A diagram of the computer output of the LLL laser fusion computer program, LASNEX, shows a Basov-designed target breaking up from the Rayleigh-Taylor instability (Figure 2).

Dr. John H. Nuckolls, head of the LLL laser program, points out that targets with a high strength of materials may be able to improve the situation, but all other approaches to stabilize thin-shelled targets are unlikely to work. For example, Nuckolls notes the laser fusion team at the Naval Research Laboratory in Washington, D.C. proposed dynamic stabilization of the Rayleigh-Taylor instability. Specifically, the NRL team, lead by J. Boris, proposed to oscillate the input of laser energy driving the implosion to damp out the instability.[5] The LLL report comments that although this may work for some Rayleigh-Taylor modes, it may enhance others.

According the LLL, all other approaches to stabilizing thin shells — turbulence stabilization, for example — also fail, because they depend on setting up a density gradient of which the thin shells are inherently incapable.

Nonablative Acceleration

In inertial confinement the key question is obtaining efficient implosion of the fusion fuel. This can be obtained in two ways: (1) *ablative implosion* in which material on the surface of the pellet is "burned" off and the hot gases produced act like the exhaust of a rocket to drive an implosion inward; and (2) *nonablative implosion* in which pressure is directly applied (for example, when two or more objects collide).

In ablative implosion only about 10 percent of the input energy of the laser beam is used effectively to obtain implosion. The rest is lost in the "blow-off."

With nonablative acceleration, the requirements for high-gain fusion targets can be greatly relaxed.

Much the same effect can be obtained with a practical approach of electrostatically or magnetically accelerating from 10 to 10,000 small pellets or superconducting coils to velocities of 20 million centimeters per second over a distance of about 1 kilometer. If directed onto a spherical target pellet symmetrically, the small pellets will be vaporized by impact. This deposition of impact energy on the surface of the target creates temperatures of more than 1 million degrees Celsius, generating pressures equal to about 10 million atmospheres. Electron heat conduction strongly smooths any irregularities caused by the finite number of accelerated pellets shot onto the target.

An alternative to electrostatic or magnetic acceleration is to use laser ablative acceleration. Since the distance that the small pellets can be accelerated over is on the order of 1 kilometer—instead of just several hundred microns as in the case where ablative acceleration is used to directly implode a target—the power requirements of the laser are significantly reduced from 100 trillion watts to less than 100 billion watts. But, medium wavelength to short wavelength lasers must be used to obtain ablative acceleration efficiencies of greater than 10 percent.

Efficient lasers of this type have not yet been developed.

Systems and Applications Studies

This section of the LLL annual report gives some of the most important results of the laser program, although, ironically, it is a research area that is not receiving the necessary funding for detailed work.

The four areas of major significance are a detailed design for the lithium "jet" reactor, a detailed design of a laser-driven fusion-fission energy system, alternative applica-

Table 2
COMPARISON OF TWO FUSION-FISSION HYBRID DESIGNS

Aspect	LLL/Bechtel	LLL/Westinghouse
Fuel	Depleted uranium	Enriched fuel
Blanket energy multiplication	$M \leq 10$	$M \geq 10$
Required fusion energy gain	≥ 2	≥ 1
Principal product	Fission fuel	Electricity
Fuel production	6-7 LWR's*	3-4 LWR's
First wall	Graphite cylindrical liner	Spherical wet wall
Wall loading	~1 MW/m^2	~10 MW/m^2
Power density	~40 W/cm^3	~250 W/cm^3
Reactor configuration	Single cylindrical cavity	Multiple spherical cavities
Capital cost	3 x LWR	~2 x LWR

LWR = Light water reactor.

In this comparison between the design parameters of two fusion-fission hybrid laser fusion reactors, M is a measure of the fission energy generated in the blanket surrounding the fusion chamber. For M equal to 10, the blanket fission energy produced is 10 times that of the fusion energy generated.

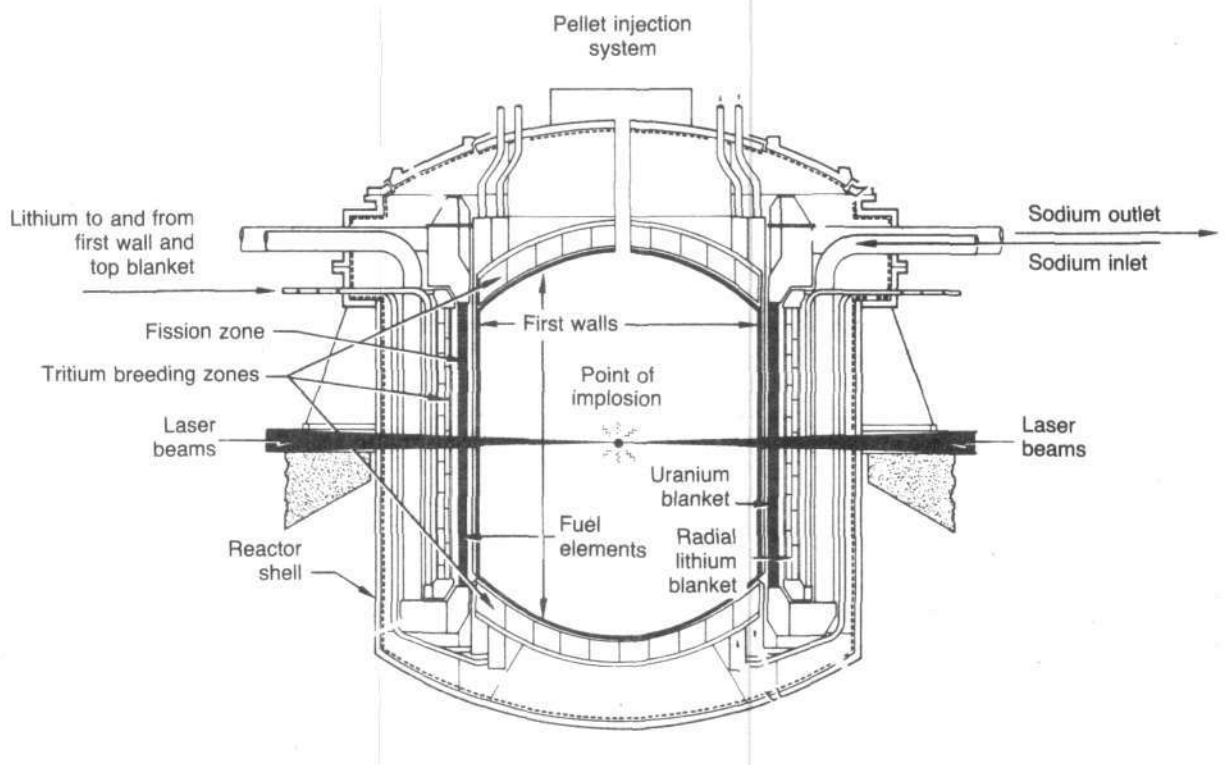
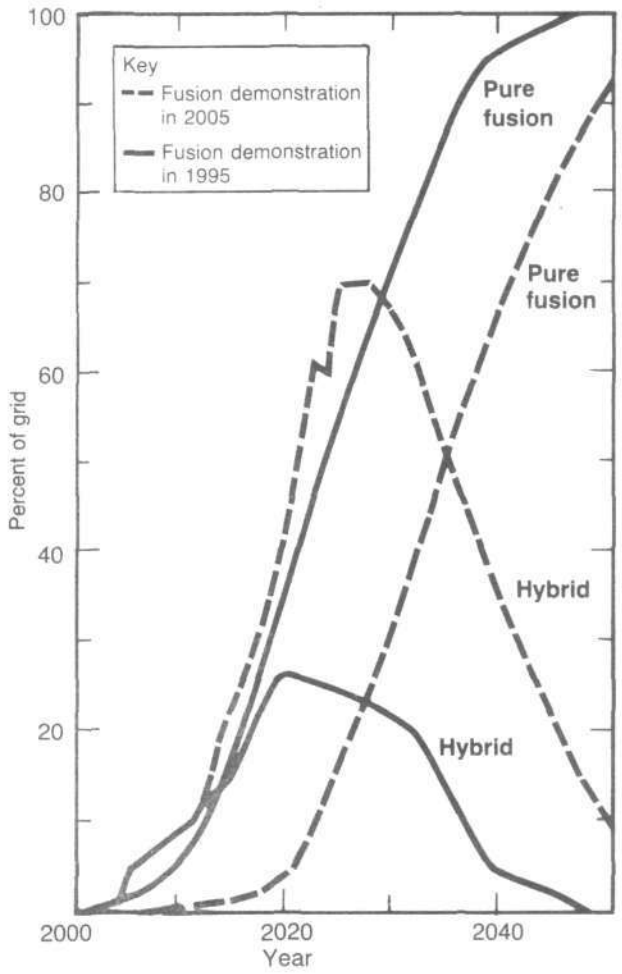


Figure 4
THE BECHTEL MODEL FOR A FUSION-FISSION HYBRID REACTOR

This concept calls for neutron production via laser-induced fusion reactions. The cylindrical walls shown at the sides contain the fissile fuel breeding blanket and part of the tritium breeding capacity. But most of the tritium to fuel the fusion reactor is bred in the end-cap assemblies at the top and bottom of the chamber. Taking advantage of the energy production from fission reactions in the cylindrical blanket, this device is designed to produce net electrical power of 400 electrical megawatts at the same time that it produces 1,300 kilograms of plutonium each year.



Assumptions

- 2% grid growth rate
- Medium small fusion, hybrid, and fission growth rates
- Conservative introduction
- Hybrid demonstration on line in 1995
- 6 fission plants fueled by each hybrid

Figure 5

THE EFFECT OF A 10-YEAR DELAY IN PURE FUSION DEVELOPMENT ON PEAK HYBRID PENETRATION

With a 2 percent grid growth rate per year, a medium construction growth rate for small fusion reactors, hybrid reactors, and fission reactors, and a conservative initial introduction of fusion, the hybrid quickly becomes a significant input to the power grid. But the small fusion system rapidly overtakes the hybrid.

The figure shows two cases: first, with the fusion demonstration in 2005, and second, with the fusion demonstration in 1995. As can be seen, the later introduction of pure fusion dramatically alters the total to which the hybrid (and the LWRs it fuels) grows.

tions, and long-range planning for the development of a fusion economy.

Detailed Reactor Design

Figure 3 shows the initial lithium waterfall LLL laser fusion reactor design. The wall of the reactor is protected from the debris and neutron output of the fusion pellet microexplosion by a "waterfall" of liquid lithium metal. The lithium serves two other functions—breeding tritium fusion fuel and heat-transfer fluid.

In later analyses, LLL found that a solid waterfall might suffer from hydro instabilities and not be able to recover after each shot.

The 1977 annual report shows how this problem can be addressed by arranging the waterfall as a series of jets. Complex hydrodynamic calculations and experimental work are now underway to fully explore this area. The report also covers the optics for transport of the laser beam into the waterfall reactor.

Hybrid Fusion-Fission Reactors

Figure 4 is a diagram of a laser fusion hybrid fusion-fission reactor designed by Bechtel Corporation for LLL. In the hybrid, fusion neutrons carry out four functions: They breed tritium, induce fission in fertile material in the wall, generate fissile material, and generate heat. As a result of this neutron activity, the total fusion energy output is multiplied severalfold, both in terms of immediate fission energy input and production of fission fuel.

What the projected performance for the fusion-fission hybrid design will look like is shown in Table 2, which compares the LLL Bechtel design to an LLL-Westinghouse design.

The LLL report also explores the use of laser fusion reactors for space propulsion, synthetic hydrocarbon fuel production, and disposal of fission radioactive waste materials.

Long-Range Planning

One of the most interesting parts of the Applications Studies examined the effect of different rates of fusion, fission, and hybrid fusion-fission development on the future U.S. electric grid.

LLL projected that the electric grid in 2000 would consist of 1,390 gigawatts electric (GWe) and 380 GWe fission. Five types of power plants were used in the study: large pure fusion plants (greater than 1 GWe), small pure fusion (sub GWe), hybrid fusion-fission, fission, and fossil; and for the purposes of the study, all plants are retired after 50 years.

The variables examined were pure fusion and hybrid introduction dates of 1985, 2005, and 2105; different numbers of fission plants fueled by one hybrid plant; and the total grid growth after the year 2000.

The LLL study concluded the following:

- Pure fusion will take considerable time to have an impact on the grid (~10% in 20 years, ~25% in 25 years).
- Hybrid-plus-hybrid-fueled fission plants deploy faster (~10% in 10 years, ~25% in 20 years).
- Small units deploy faster than large units.
- Deployment is sensitive to the early introduction

rate and the industrial capability growth rate, and it is relatively insensitive to the overall demand growth rate.

- Delay in completing a demonstration plant is not regained later.
- In a combination hybrid-fusion scenario, peak hybrid penetration is minimized for early fusion demonstration and high industrial growth capacity.

The effect of a 10-year delay in pure fusion demonstration on peak hybrid growth is shown in Figure 5.

Some Fundamental Questions

In a paper on dynamic stabilization of thin-shelled targets, Dr. J. Boris of the Naval Research Laboratory pointed out that the scientific analysis of the important Rayleigh-Taylor hydrodynamic instability is still at a preliminary stage.[5] This is certainly true in the case of the LLL examination of the problem, where nonlinear interactions are still viewed as a "mystery."

A first approximation of what is involved in getting to the basic issue can be seen by looking at a related question.

In the mid-19th century geologists were able to prove that the earth had been around for at least several millions of years and that the sun had to be putting out the same flux of energy the entire period of time. Although nuclear reactions were unknown, scientists sufficiently understood chemical reactions to know that it was impossible for chemical reactions to fuel the sun for more than a few thousand years. Therefore, a most perplexing question was where did the sun get its energy.

In 1854, Herman von Helmholtz suggested that simple adiabatic compression was the answer.[6] (Adiabatic compression—that is, without heat transfer—can be quite similar to "isentropic" compression, depending on the "equation of state" of a material.) According to Helmholtz, simple hydrodynamic energy, given the sun's mass, could produce the required energy output for several million years. This would occur through the heating of the solar mass by adiabatic compression. However, most geologists pointed out at the time that this was still not long enough.

It is likely that Bernhard Riemann was concerned with this question when he began his studies of the hydrodynamic structure of stars and made his discovery of shock waves.[7]

First, Riemann was looking at more sophisticated and complex geometries than the simple spherical one used by Helmholtz. This could lead to a greater compression or compression without obvious change in the star's overall radius. Even more significant, after his discovery of shock waves, Riemann immediately launched an investigation of isentropic compression with the implicit assumption of "changes of the equation of state" during the shock compression process. This change of the equation of state could lead to significantly larger energy outputs, over longer periods of time.

It is ironic that today, with the failure to measure solar neutrino outputs of sufficient magnitude predicted by theory and with the measurement of anomalous sun oscillations, the Helmholtz hypothesis is coming back into currency—although in a modified form that can account for the "missing energy."

The point for laser fusion is that in terms of the open literature, LLL does not even take into account the Riemannian approach of looking for changes in the equation of state. In general, the LLL criticism of the alternative approaches is based on the failure of achieving ignition or burn-wave conditions. Changes in the equation of state directly affect both ignition and the Rayleigh-Taylor instability conditions.

Magnetic insulation targets are a case in point. In Riemann's time, magnetic confinement of plasmas was not investigated. LLL, which took the lead in helping to develop magnetic insulated targets for the Sandia electron-beam pellet fusion program, sees as the key problem with this target the failure to ignite the outer fusion fuel. But the LLL analysis is based on what is actually a linear picture of magnetic plasmas, instead of the required Riemannian view.

Charles B. Stevens is the director of fusion engineering for the Fusion Energy Foundation.

Notes

1. The Lawrence Livermore Laboratory *Laser Program Annual Report—1977* was published in spring 1979 with a final manuscript date of July 1978 (UCRL-50021-77).
2. For a review of the constraints of classification policy on laser fusion science, see "The Secret of Laser Fusion," *Fusion*, March-April 1979, pp. 38-46.
3. Ripin, B.H. et al. 1977. "Enhanced Backscatter with a Structured Laser Pulse," *Phys. Rev. Lett.* 39:611.
4. B.H. Ripin and E.A. McLean. 1979. "Brillouin Backscatter Dependence upon Pulse Amplitudes, Timing, Target Material, and Geometry." *Appl. Phys. Lett.* 34:809.
5. J. Boris. 1977. "Dynamic Stabilization of the Imploding Shell Rayleigh-Taylor Instability." *Comments on Plasma Physics and Controlled Fusion* 31.
6. Leo Koenigsberger describes Helmholtz's work in this area in his book *Hermann von Helmholtz*, (New York: Dover, 1965), p. 123.

   "But there remains the great mystery of the origin of the sun's heat, which keeps up the circulation of water on the earth by means of cloud and rain and streams, which governs all inorganic movement, and preserves the cycle of life by the metabolism of plant and animal. The actual heat of the sun, and the number of calories it gives out incessantly could be computed, but there was no valid hypothesis as to the origin of this heat. Helmholtz set out from the Kant-Laplace hypothesis, that the materials now distributed in the sun and planets had originally occupied space in the form of a circulating nebula, which acquired the multiform aspect of the planetary system in virtue of its centrifugal and gravitational forces. He assumed that the density of the nebulous mass was at first a vanishing quantity in comparison with the present density of sun and planets, and then calculated how much work had been expended on this condensation, and how much of this work still exists in the form of mechanical energy, as the attraction of the planets towards the sun, and the vis viva of their motions, after which he estimated by means of the mechanical heat-equivalent, how much of that work has been converted into heat.

   "Helmholtz found that only some 454th part of the original mechanical energy remains as such, while the re-mainder transformed into heat suffices to heat a mass of water equal to the mass of the sun and planets taken together to 28,611,000 degrees of the centigrade thermometer."
7. Bernhard Riemann. 1876 (1859). "On the Propagation of Plane Air Waves of Finite Amplitude." In *Gesammelte Mathematische Werke*, ed. H. Weber, pp. 145-164. For a discussion of Riemann's concept of shock waves, see "Riemann Declassified" by Uwe Parpart in *Fusion*, March-April 1979.

Viewing the Human Species from the Mind

Evidence obtained from scanning electron microscope examination of fine-detail wear patterns on fossil tooth surfaces by Dr. Alan Walker, an anthropologist at Johns Hopkins University, indicates that the Australopithecines subsisted mainly on fruit.

The Australopithecines, up-right, small-brained hominids flourishing some one to six million years ago and thought to be ancestors of modern man, supposedly existed in two species. One was a strict vegetarian with a diet of seeds, roots, and other tough plant parts. The other, man's purported ancestor, was thought to be omniverous, gradually eating larger quantities of meat and developing human-like hunting activity as it evolved. Dr. Walker's research now indicates that both Australopithecines were strict vegetarians.

Although the publication of these findings could serve as an excellent platform for discussing the "hunting hypothesis" of human evolution—that man's intelligence originated through the demands of hunting early in the species development—the May 15 report in the *New York Times* science section[1] chose instead to draw moral conclusions for modern man. A companion article by science reporter Jane Brody, titled, "Studies Suggest a Harmful Shift in Today's Menu," stated that, "heavy meat-eating by modern affluent societies may be exceeding the biological capacities evolution built into the human body."[2]

Bushmen Model

Brody proposed as the proper dietary model the Bushmen of the Kalahari desert. If infections or accidents do not kill them first, they can live to ripe old ages. In fact, the proportion of individuals over 60 in these hunting-gathering tribes is about 10 percent, similar to that in the United States, despite their lack of medical care." Furthermore, "their cholesterol levels are as low as newborn Americans all their lives, they do not develop hypertension and their blood pressures do not rise with age, as do ours."

And who are the overindulgent meat-eaters? According to Brody, "The damage caused . . . in a land of plenty can be seen in peoples only recently exposed to abundance, including the Pima Indians, who developed widespread diabetes, and American blacks, many of whom became obese and hypertensive."

The unspoken conclusion is that supplying the malnourished billions in the developing world with high-protein, meat diets will only cause a spread of obesity and other diseases peculiar to protein-adequate diets.

The Broader Issues

But beyond the *Times*'s "science-chic" condemnation of these populations to malnutrition and starvation, there are broader issues of scientific method. Ultimately, the scientific question and the moral question are identical. These articles are but particularly transparent chapters in a 150-year history of shaping the science of anthropology around preexisting political and economic conceptions tions.[3] One aspect of this manipulation of science is the significance of hunting in human history—and the role of such media as the *Times* in legitimizing the idea that man is merely a clever beast, too clever indeed for his own bestial "good."

Dr. Walker's determination of the diet from wear patterns on fossil teeth is refreshingly innovative in a field known for its wild speculations based on scanty, ambiguous data. Differentiation among various diets is made possible by the differing amounts of *phytoliths*—microscopic silicate crystals—present in various plant parts and their absence in meat. These phytolith particles scratch tooth enamel, revealing whether the eater ate mainly stems (grasses and the like), which are high in phytolith content; fruits, with very few; or leaves, which are intermediate. Meat produces no such fine scratching, although bone fragments ingested with meat create a distinctive coarser-grain scratching and chipping. The technique has been tested on living species with known diets with great success.

The Darwin-inspired "African Genesis" and "Territorial Imperative" pop-theory of Robert Ardrey and Konrad Lorenz that a "genetic" propensity to hunting acquired by Australopithecines is the root of violent behavior and war[4] is competely discredited by Walker's evidence that Australopithecines were vegetarians. The *Times* cooperates in ostensibly disposing of the "inherited aggression" theory, substituting the notion of man as a gentle, sharing, meek and altogether insignificant creature. But in substituting "Man the Savage" with "Man the Meek," the *Times* deliberately ignores the appropriate importance of hunting in man's history: thermodynamic efficiency.

Energy and Mind

In *later* stages of human evolution—man as such and his immediate forebears—hunting was a critical means for obtaining a protein-rich, that is, energy-rich food source. The thermodynamic efficiency of eating meat made possible the expansion of protohuman and human populations over far wider areas of the earth. More important, it made possible the increase in population density, leisure time, and division of labor that culminated most dramatically in the big game hunters of the Ice Age period, the cultures responsible for the magnificent cave paintings of France, Spain, and elsewhere.

It is these populations and their Neanderthaloid and *Homo erectus* forebears that are most closely allied to modern man genetically. With half a million years of continued evolution intervening between Australopithecines and modern man, it is nothing but the most blatant fallacy of composition, the crudest sophistry, to argue

that since Australopithecines ate no meat we must not. Because our ancestors further back were fish, should we perhaps drown ourselves?

The growth of human intelligence, the power of reason, coincided with increasing mastery of the environment through technical practice and innovation. Reason has superseded genetic evolution as an evolved species-characteristic. For the development of the human mind and the mediation of the historical development of that mind through the capture of increasingly dense energy throughput by human societies, hunting was in fact a subsistence technology of incalculable importance! Its importance was of the exact same nature as later large-scale agriculture. The results of both have been the production of modern societies that have advanced beyond the limitations of earlier limited forms of technology.

A Real Anthropology

Counterposed to the sick parlor-chatter the *Times* passes off as "anthropology," a real anthropology would occupy the central, critical place among the sciences that is now falsely ascribed to mathematics. Viewed from the mind rather than from the stomach, the emergence of the human species makes sense only as a crucial singularity in the self-development of the universe as a whole, whose impact on that development has superseded that of any known previous agent. More broadly, the universe itself makes sense only if one takes that emerence into account as demonstrating the universe's own most fundamental laws.

The proper questions for such a scientific anthropology are essentially of two forms: First, what have been the negentropic changes of the biosphere correlative with the emergence of man (in terms of density of energy throughput and related features such as species diversity and biomass), and what are the causal relations between those changes and human activity; and second, how has the human mind itself developed in relation to those changes?

Subsumed aspects of such an investigation would include identification of the *lapses* from development as well as the fundamental moves forward

(moves such as large-game hunting, agriculture, and other means of capturing and utilizing larger portions of energy throughput). In either case the only adequate methodology is to extend our knowledge of historical (and reasonably understood prehistorical) processes back in time as far as possible, to the point of identifying how those processes emerged lawfully from preceding, less advanced stages of biospheric development.

The *Times* articles sadly reflect the general attempt of most contemporary anthropology to take the reverse approach: to accord equal ontological and evolutionary significance to each and every stray "cultural" or "biological" manifestation that comes to attention, and in the process to deny that any evolution in fact ever occurred.

Not accidentally, it is the present evolved state of human existence achieved not by centuries but by millennia of reason that the *Times* and its cothinkers would destroy. Added to the liberal and environmentalist litany that the world's energy is running out, that a deep recession is inevitable, that nuclear fission is defunct, and nuclear fusion "is for the next generation, not this one,"[5] is a new excuse for a return to the Dark Ages: "In our 'current luxury diet circumstances,' the opportunities [to eat meat] are omnipresent and 'preference betrays best interest,'" the *Times* notes.

But just because the *Times* has gone to seed is no reason for anyone else to follow suit.

—*Richard Welsh*

Notes

1. Boyce Rensberger, "Teeth Show Fruit Was the Staple," *New York Times*, May 15, 1979.
2. Jane E. Brody, "Studies Suggest a Harmful Shift in Today's Menu," *New York Times*, May 15, 1979.
3. Future articles in *Fusion* will document this history in detail.
4. On Konrad Lorenz's 1966 book, *On Aggression*, the *Times* wrote: "One of the most important works of our time." On Desmond Morris's 1967 book, *The Naked Ape*: "There is much here to intrigue, educate, and certainly entertain any reader. Mr. Morris draws a fascinating picture of man . . . in eye-popping detail."
5. This quote is from an article by veteran science writer Walter Sullivan in an article called "Fusion: The Answer to Fission?" that appeared in the same *New York Times* science section as the Rensberger and Brody pieces.

Books

Science Made Mindless

Mind and Nature—A Necessary Unity
Gregory Bateson
New York: E.P. Dutton, 1979
238 pp., $11.95

Godel, Escher, Bach: An Eternal Golden Braid
Douglas R. Hofstadter
New York: Basic Books, Inc., 1979
777 pp., $18.50

The Dancing Wu Li Masters—An Overview of the New Physics
Gary Zukav
New York: William Morrow and Co., 1979
352 pp., $12.95

The spate of popular books on science and the epistemological concepts that determine the course of scientific and technological development parallels the emergence of several new popular science magazines like *Omni* and the *New York Times* weekly "science section."

Their intent cannot be mistaken. There is no question of broadening the layman's understanding of the frontiers of scientific developments, new theoretical conceptions, or their relationship to the larger questions concerning the nature of mind and the self-expanding, self-organizing quality of the universe as a whole. In each case advanced scientific conceptions are tailored to fit into the framework of one or another empiricist belief structure, designed to explain away the existence and significance of the human mind.

In the three books reviewed here, the careers of the authors are the most useful clues as to why their books were written.

An Ugly Career

Let's start with Gregory Bateson, author of *Mind and Nature—A Necessary Unity*.

Bateson has had a long and ugly career in the zero-growth, antitechnology movement. In his early years, he was married to the late Margaret Mead, and the two of them helped to popularize the notion of cultural relativism. In short, they argued that primitive peoples deserve to be left alone to enjoy their cultures unmolested by the intrusions of modern technology, life-prolonging medical care, and the kind of education that would bring their children into modern industrial society.

Later in his career, Bateson joined forces with Aldous Huxley running MK-Ultra, a CIA operation linked to British intelligence that aimed to test the effects of LSD on American youth.

Still later, Bateson set out to prove that porpoises are as intelligent as man. More recently, his work has been followed up with research demonstrating, according to Piaget's criteria, that up to the age of 24 months, there is nothing to distinguish the learning achievements of an ape from those of a human infant. In other words, man is just a smart monkey; the transfinite quality of the mind—the human soul—does not exist.

Among Bateson's most recent activities, along with Stewart Brand of the *Whole Earth Catalogue*, is the publication of the *Coevolution Quarterly*, essentially a comic book geared to the short attention span of Bateson's counterculture readership. Bateson's *Quarterly* advocates everything from group sex and "natural" foods to off-planet space colonies operated by solar power.

This last Bateson item has coalesced into an institution known as the L-5 Society run by Carolyn and Keith Henson, LSD enthusiasts who claim to have weapons stashed away in the Arizona desert to carry out their dream of VOAG—Violent Overthrow of All Governments. Timothy Leary, the former Harvard professor who popu-

larized LSD, is another principal in L-5.

Not incidentally, *Omni* magazine gives regular prominent coverage to L-5 and to Gerard K. O'Neill, the so-called legitimate scientist from Princeton University who has pushed for the establishment of utopian colonies in space.

Artificial Intelligence and Mysticism

Douglas Hofstadter, author of *Godel, Escher, Bach,* has not had such a varied experience with the antiscience movement as Bateson, but his brief career, nevertheless, is a clue to the message of his book.

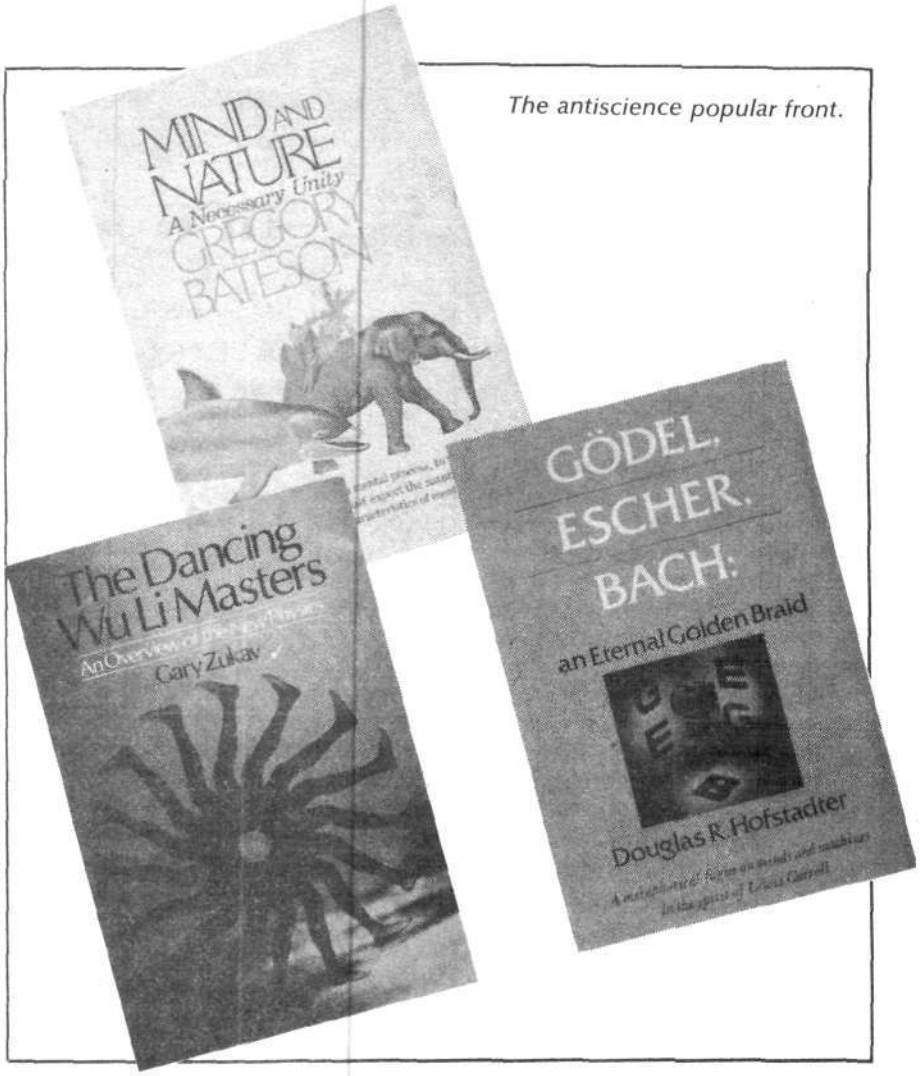
Hofstadter is a computer expert in the field of artificial intelligence. This dismal discipline, which emanates from the Bertrand Russell-Karl Korsch networks, has been used primarily to develop brainwashing programs. Hofstadter claims to be part of this network through his close association with Marvin Minsky who, in turn, works closely with linguistician Noam Chomsky at the Massachusetts Institute of Technology. Politically these "artifical intelligence" academics link up to the Bateson circles through the various radical groups they mutually support.

Artificial intelligence is as nasty a discipline as its use in brainwashing implies. It is based on the premise that the operations of the human mind are essentially compatible with formal Aristotelian logic and thus can be replicated by a sufficiently complex computer.

As for the third book, *The Dancing Wu Li Masters,* author Gary Zukav is associated with the Esalen Institute in Big Sur, California, a key experimental center for the MK-Ultra drug project. And Esalen's founder, Alan Watts, whose books can be found on the occult shelves of bookstores, was a protégé of Gregory Bateson. Both Watts and Esalen are a significant source of the Zen Buddhist mysticism now rampant in the drug culture.

In his book, Zukav acknowledges his intellectual debts to Fritjof Capra, author of *The Tao of Physics,* a book that is highly recommended by the Society for Psychical Research. (For more on the involvement of "scientists" in mysticism, see "Science and Spooks" in *Fusion,* March-April, 1979.)

Zukav also notes his indebtedness to Max Jammer of Bar-Ilan University in Israel. Jammer is one of the chief academic apologists for Niels Bohr's Copenhagen Project to make quantum mechanics irreducibly irrational instead of, as Schrödinger pointed out, "incomplete." Zukav's other named mentor is David Bohm of London University who has promoted the flip side of the Bohr project. Bohm's theory of hidden variables simultaneously leads quantum mechanics directly back to reductionist classical mechanics and provides a "scientific" cover for various parapsychological theories.



The antiscience popular front.

Now to the message of the books themselves.

Bateson's book can be summed up quite simply. In the face of overwhelming evidence to the contrary, Bateson reiterates the occult British oligarchist's article of faith—irrationality is the root of mind. To Bateson, reasnn exists simply as an epiphenomenon of a fundamentally irrational universe. Of course, Bateson dresses this up in all the latest pseudoscientific jargon —stochastic processes, cybernetics, and neo-Darwinian holism— but the message remains clear.

The epistemological fundamentals are laid out for the unsuspecting reader in his first chapter, "Every Schoolboy Knows. . . ." Here Bateson treats the reader to such pearls of empiricist wisdom as "science never proves anything," "there is no objective experience," and "the division of the perceived universe into parts and wholes is convenient and may be necessary, but no necessity determines how it shall be done."

This last remark gives Bateson's game away; he denies the fundamental negetropic unity of the universe and consequently of mind.

This is again made clear on page

Continued on page 64

The Second Law And Maxwell's Demon

Plato's Academy, a new Fusion *feature, will report regularly on current Aristotelian science and the ongoing battle between the Platonists and the Aristotelians.*

In a June 2 editorial the *New York Times* expressed its deep concern that the death of the Second Law of Thermodynamics might have been prematurely reported in a May 29 article in the *Times*'s science section. What they're really worried about is something much bigger.

Several months ago the *Times* featured in its Sunday magazine a slanderous attack by I.F. Stone on Plato and the republican city-building tradition. The old muckraker was clearly a proxy for British and U.S. anglophile inner circles responding to the recent exposés by Lyndon H. LaRouche, Jr. and his associates of Aristotle as a philosophical godfather and oligarchic agent against the Platonic faction.

British intelligence and its publishing friends in the United States are more clever than to simply attack their enemies directly. They are also covering their bets with extensive interventions in scientific publishing to distort, mask, or sanitize the scientific work of LaRouche and his collaborators in the Fusion Energy Foundation. The *Times*'s new Tuesday "science section" is one facet of the operation, featuring such syntheses of "scientific" thought as the obscene idea that the harmonies of Kepler's "Music of the Spheres" have now been represented by computer-generated music.

Otherwise, the effort is marked by much greater attention to pseudo-historical and pseudoepistemological themes in existing science magazines and the spawning of numerous would-be competitors to the FEF's *Fusion* magazine. In addition, there is the intelligence operation to counter the FEF run through the Nuclear Club of Wall Street—the Society to Advance Fusion Energy, SAFE, as well as other so-called pronuclear countergangs linked to the Heritage Foundation. (See the feature section in the Sept. 1979 *Fusion* for details on SAFE.)

Zero-Growth Science

What's at stake is not simply whether science and technology—particularly nuclear power and fusion—are constrained and destroyed by the zero-growth policies of the International Monetary Fund, James Schlesinger, and the *New York Times*. More fundamentally, the issue is whether science is to be the kept domain of an antihuman oligarchy or whether it is to be practiced and conceptualized as the mediation of all humanity's process of cultural self-perfection.

The latest *Times* escapade is just such an attempt to queer science. The issue this time is the fundamental scientific conception of *negentropy*. As the *Times* expresses the issue in behalf of its oligarchic cothinkers, "Not only is Socrates mortal, but so, presumably, is the universe." The importance on the issue is underscored by the fact that a follow-up article on the same theme appeared in the June 5 *Christian Science Monitor*.

Rather than facing directly—which they are never in the habit of doing—the epistemological and empirical evidence of the actual nature of energy transformation and organization in the universe, the *Times* instead uses the standard Delphi Technique: Substitute a totally fraudulent version of the conception as the subject for "debate."

In this case, the "controversial" figure is Professor Ilya Prigogine of Brussels, a recipient of the 1977 Nobel Prize in chemistry. First the *Times* trotted out staff writer Malcolm W. Browne with a feature article on the first page of the *Times* science section, to pose the question of whether or not Prigogine had found a "loophole" in the venerable Second Law of Thermodynamics. The basic Prigogine result on which the article was based was his work in the abstract field of statistical mechanics. There he had demonstrated that in systems in which there are interactions of mechanisms that *dissipate* energy—such as viscosity in fluid—it may be *statistically favored* for unstable local regions to become highly ordered and pump their entropy (a measure of disorder) into the surrounding medium. Such a situation is termed a *dissipative structure*.

Although the name alone would doubtless recommend Prigogine's work to the science controllers of Oxford, Cambridge, and Sussex universities, the underlying concept is just what they need for Delphic warfare against real science.

Prigogine's concept turns reality on its head. The actual governing principle of the universe is its ever-increasing rate of self-organization. As LaRouche has rigorously demonstrated the matter in his writings,* the physical universe can be represented by multiply connected domains n, $n + 1$, $n + 2$, representing inorganic, biological, and human-creative-scientific characteristics, respectively. Each of these domains evidences distinct and successively transfinite ordered forms of negentropic progression, but is also connected causally to the others. These distinct but causally coupled domains are in turn subsumed by the higher-order cardinality, N, of negentropic development of the physical universe as a whole.

Against this and earlier Neoplatonic conceptions, the British have always employed whatever version of Aristotelian nominalism was convenient.

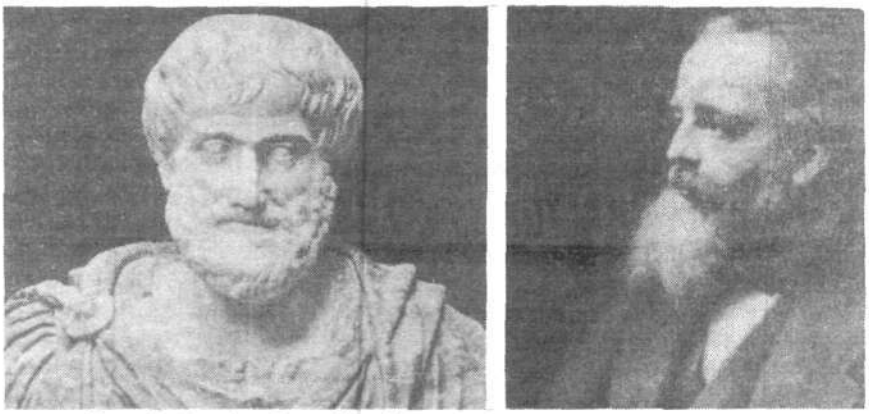
Evolution? Why, that's just a case of Darwin's natural selection. Directed evolution? Well, there can be local increases of ordering as long as entropy increases overall. The whole universe is developing? That's a mystery impenetrable by science.

Prigogine's work simply offers a technically sophisticated case of a "Maxwell's Demon," that is, a device for separating ordered regions from larger entropic ones. Just like his predecessor Maxwell, however, Prigogine recognizes no possibility of causally effected, qualitative change of physical interaction and therefore of the negentropy of phase space as a whole. In short, like the Copenhagen School to which he is historically linked, Prigogine is just another accountant of presumably irrationalist local events.

Negative Entropy

The *Times*'s contradictory use of Prigogine reflects its grave concern with the recent work of LaRouche and his scientific collaborators, which has posed a totally new problem for the Aristotelians. First, the fundamental epistemological-ontological hypothesis of negentropic science was presented in the rigorous form of the relativistic physics of Bernhard Riemann and the conception of cardinality of Cantor. Second, scientific empirics were presented to demonstrate the validity of the fundamental hypothesis in the combined areas of physics and biology.

In both areas it was demonstrated—especially for energy-dense plasmas in physics and for critical genetic and embryological transformations in biology—that energy is not a scalar quantity, but is associated with developing states of organization, representable as higher orders of cardinality in negentropic phase space. Equally clear was that a priori conceptions of particles and fields (or space-time geometry, especially in the small) are not fundamental; rather, they are determined by the negentropic (or possibly nonnegentropic for degenerate cases) evolution of energy qua organization. Further, it was demonstrated that biology and physics are mutually causally efficient, but that the former is not reducible to the latter.



Maxwell and Aristotle: Causally effected change is impossible.

To obscure the conclusive nature of these results, the *Times* presents Prigogine as the "revolutionary" scientist who has discovered dissipative structures in both physical and biological situations to "account" for order in each.

Dissipative Structures

Thus the *Times* editorial subsequent to its feature on Prigogine is a pure hoax. There is no reason to warn as they do about extending its ideas too far, too fast. There is nothing in his ideas—especially the one that the Second Law still applies to any finite region—that hasn't already contaminated thousands of acres of science libraries. There is in fact a kernel of truth in the *Times*'s editorial misgivings about Prigogine. There is nothing in his ideas, or theirs, that could provide a coherent ordering principle for the universe.

The fraud is also exposed by other scientific results that simply need wider dissemination and better focused discussion of their implications. There may still be stubborn souls, for example, who think that force-free structures or solitons in plasma are just "special, limiting" cases of ordinary electrodynamics and thermodynamics, or who hysterically block on the unique features of biological chemicals. Can they deny, however, the fact that in superfluidity and superconductivity one is dealing with nondissipative, non-Maxwellian, non-Newtonian, non-Bohrish structures? Even in the conceptual framework of ordinary physics, Professor Harold Grad of the Courant Institute of Mathematics has demonstrated recently that dissipative mechanisms are *not* required for ordered progressions of structure to emerge in plasmas.

The *Times* thus has more than a "loophole" in the Second Law to worry about. Neoplatonic science moves as shock waves even around corners; it spreads easily through tiny openings; it transforms whole manifolds with singular ideas.

Dissipative structures, like the *New York Times*, just try to hold themselves together at everybody else's expense.

—*Dr. Morris Levitt*

Notes

* For example, see "Why Poetry Must Begin to Supersede Mathematics in Physics," *Fusion* Oct. 1978, pp. 10-17.

Books

Continued from page 61

147: ". . . Both genetic change and the process called *learning* . . . are stochastic processes. . . . There is . . . a stream of events that is random in certain aspects and in each case there is a nonrandom selective process which causes certain of the random components to 'survive' longer than others. Without the random, there can be nothing new."

Of creative thought in particular Bateson says (page 183): "the genesis of new notions is almost totally . . . dependent upon reshuffling and recombining ideas that we already have."

The universe and mind, in other words, form a Newtonian paradise governed by immutable laws. The evident continuous creation *de novo* of the universe and of mind, in particular, by reflection upon itself and supersession of the limits imposed by itself in the context of ephemeral ordering of lawfulness—the Riemannian concept of n, $n+1$, $n+2$ levels of nested manifolds—is *a priori* ruled out of order.

Douglas Hofstadter's interminable driveling (777 pages) reiterates Bateson's point from the perspective of an attack on Kurt Gödel's 1931 proof that any system determined by a fixed lawfulness (axiomatic logic) is necessarily incomplete, hence incapable of solving problems that can be posed within its limits. The obvious conclusion to be reached from this proof is that there is a higher order of lawfulness (reason) that determines successive, reason-determined locally lawful systems. The British oligarchy never forgave Gödel for this insight, which negated Bertrand Russell's attempted destruction of Georg Cantor's introduction of the concept of the transfinite into mathematics.

Hofstadter simultaneously slanders Gödel and the musical genius Johann Sebastian Bach—whose recognition of the same principle in musical composition made Beethoven's subsequent breakthroughs possible—by lumping them with the psychotic Dutch draftsman M.C. Escher.

The paradoxes of formal logic, Hofstadter contends—for example, Epimenides's statement that all Cretans are liars—are really Zen *koans*. There is nothing new here that the eastern mystics and their systematized irrationality did not discover in bygone millennia. In fact, he says, the solution is to imbed simple axiomatic systems in more complex ones in regress. Once this is accomplished, presto, mind and the universe can be programmed into a computer.

Stoned

If all this is too technical for you, Gary Zukav has the answer (page 62): "The Copenhagen Interpretation of Quantum Mechanics began a monumental reunion which was all but unnoticed at the time. The rational part of our psyche, typified by science, began to merge again with that other part of us which we had ignored since the 1700s, our irrational side. . . . The left side of our brain tends to ask certain questions of its sensory input. The right side of our brain tends to accept what it is given more freely. Roughly speaking, the left hemisphere is 'rational' and the right hemisphere is 'irrational.' "

For Zukav, reason, which guides and determines the rational, does not exist.

To make the point absolutely clear, Zukav continues: "We would like to think that we are different from stones because we are living and they are not, but there is no way we can prove our position. . . . We cannot establish clearly that we are different from inorganic substances. That means that logically, we must admit that we may not be alive."

And, indeed, Zukav may be more "stoned" than alive, as he notes on page 220: ". . . The dilemma of having to talk in classical terms about phenomena which cannot be described in classical concepts is the basic paradox of quantum mechanics. . . . It is like trying to explain an LSD experience."

There is a definite need for science books written for laymen, but they must be written by people who recognize the primacy of human mind.

—John Schoonover

Fusion by 1990– Or 'Controlled Disintegration'?

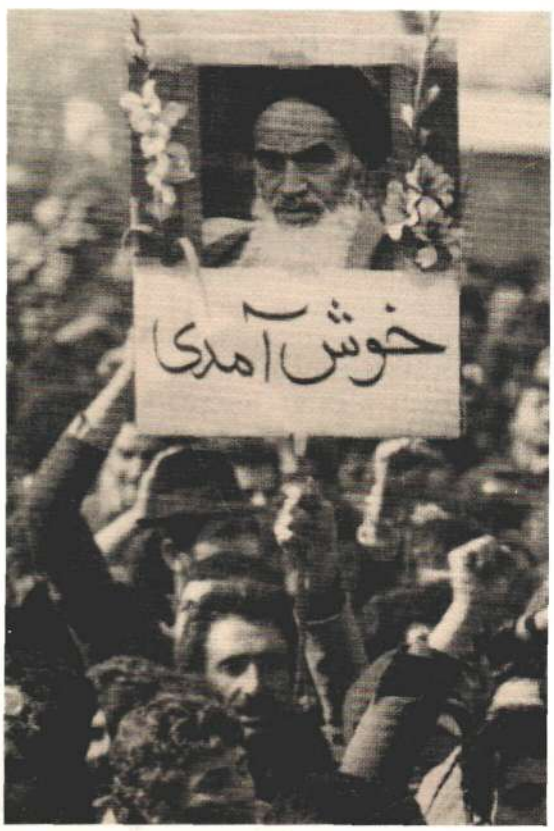
This issue's feature articles on fusion by Dr. Stephen O. Dean and Charles B. Stevens make it clear that the United States could have fusion reactors in as short a time as 10 years—if there is a crash research effort. It is also clear that whether or not this timetable is achieved, such a brute force program would result in breakthroughs on several scientific and technical frontiers and remoralize the nation.

Without an aggressive program to develop fusion, the nation is headed for another kind of crash program: the plan for "controlled disintegration in the world economy" promoted by the New York Council on Foreign Relations. Although the Council's name may not be well known to the general public, Kathleen Murphy explains in this issue how its influential members in government, industry, and academia have begun to carry out the recommendations of its *1980s Project*. In brief, this Malthusian proposal calls for a new world government to preside over the economic and social chaos expected in a zero-growth, deindustrialized world. The Ayatollah Khomeini's Iran, for example, is part of the Council's bloody *1980s Project*.

How can you ensure that the nation backs development instead of disintegration? In this issue *Fusion* inaugurates a series of articles analyzing the energy programs of the 1980 presidential candidates.

The front cover photograph is an X-ray micrograph of a target irradiated on the Shiva laser facility at the Lawrence Livermore Laboratory of the University of California. The different colors correspond to different X-ray intensities. Cover design is by Deborah Asch.

Positioning the pellet target in the Shiva laser.



Khomeini's Iran: Model for the 1980s Project.