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ABSTRACT

Presented in this quarterly publication are reviews, highlights, and 391 annotated bibliographic references from current and international literature in the area of science and public policy. The term "science" is used here to denote both engineering and technology as well as science. The literature reviewed includes books, reports, and periodical articles and focuses on matters of broad public policy; that of a highly technical and narrowly specialized nature is not covered. In addition to the bibliographic entries, this issue includes four articles: (1) "Federal R&D Programs: Who Picks 'Em?" a description of how a proposal filters through departments and agencies of the Executive Branch and the U. S. Congress to wind up as a national program or in the wastebasket; (2) "Technology Assessment," its history, significance, and potential; (3) "Straight from the Top," text of the first Presidential message on science and technology calling for new actions to enhance R&D in all sectors--government, universities, and industry; and (4) "Soviet Science Policy," how the USSR is struggling with its science policy problems. A current booklist recaps books that appeared during the previous year, and the list of publications screened includes publisher name and address and subscription information. (BL)

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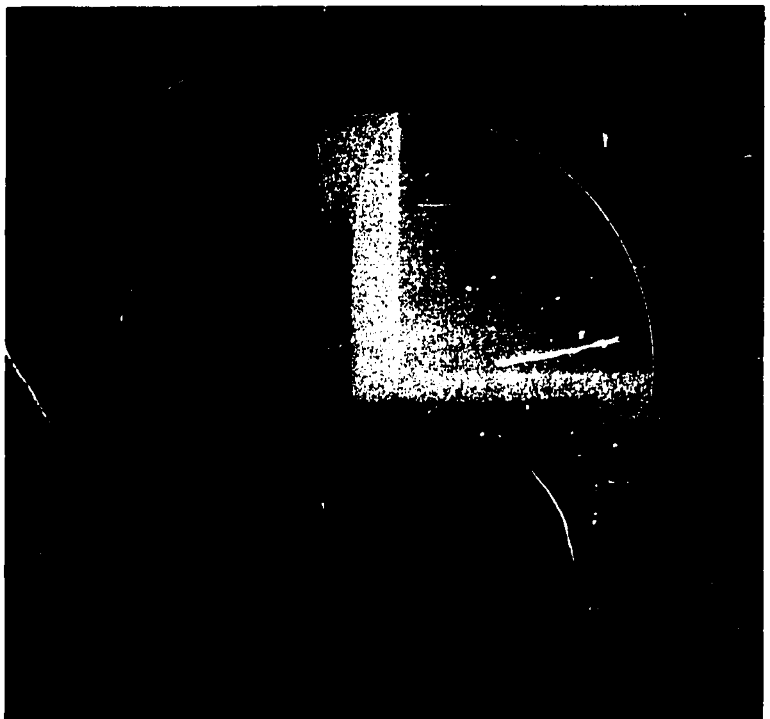

Battelle

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About This Issue

Yes, this is *Science Policy Reviews* – I hope you are pleasantly surprised by our new cover design. It reflects the fact that Battelle recently adopted a new service mark (corporate symbol and lettering style), and we have now brought the *Reviews* into the official "family" of publications. We did, of course, attempt to retain a bit of our previous graphics style in the new cover.

For those of you who may wonder, the mark does have a meaning. It represents the heterogeneous character of Battelle by depicting it as a forum of individuals working in common purpose. Further, the outward orientation of the individual elements of the mark expresses Battelle's concern for the public benefit. The lettering style is derived from early Greek forms in recognition of Greece as the first known center of scientific knowledge and thought. It suggests the high levels of skill and dedication that are manifest in the work of Battelle.

With this issue, we begin a new feature, "Current Book List", which will appear in the first issue of each volume. The list will recap books in our subject area that appeared during the previous year.

In response to numerous requests, we have expanded the information contained in "Publications Screened" to include the publisher and his address, as well as subscription information. Because the list is significantly longer, it will appear as the last two pages of each issue rather than on the inside of the back cover.

You will recall that we supplied, in our last issue, an address verification card and requested you to complete and return it to us no later than April 1, 1972. Most of our readers have responded; however, some have not. If you have not returned the card, please do so. If we do not receive your card shortly, we will assume that you no longer desire to receive the *Reviews*. That being the case, we will, reluctantly, remove your name from our mailing list – only because we have a list of individuals waiting to be added./CRT

Federal R&D Programs: Who Picks 'Em?

"A very large number of scientists and engineers must be convinced that an idea is valid, and an even larger number of laymen must be persuaded that it should be funded. The coordination of the persuasion process -- the distillation of a consensus of opinion into a succession of group actions -- is the essence of making what we call National Science Policy."

Just how this process works was told most graphically by Dr. Carl M. York, Jr., Technical Assistant to President Nixon's Science Adviser, at the March session of the Battelle Science Policy Colloquium. Here are his words.

THE NUTS AND BOLTS OF SCIENCE POLICY

by Carl M. York

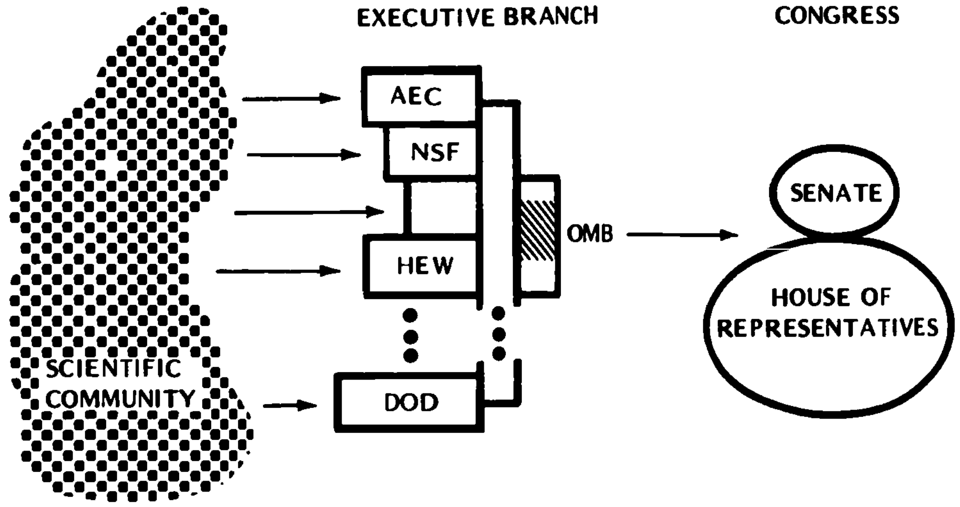
The Machine

Today I am here as a mechanic. There are a number of us in the Federal Government and we work in an area known as National Science Policy. We are there to make a rather unwieldly machine run, to repair and modify its parts and connecting links when they break down, and to train new operators in the complexities of the mechanism.

I'll start by describing the most important parts of the machine which is schematically represented in the figure below. First, there is a large amorphous body which is known as the "scientific community". Then there is a rather rigid and much better defined set of structures which are known collectively as the Executive Branch of government. Finally, there is a third, and very important, two-part group called the Congress. These three entities are the key features of the machine.

Let's see how this machine works. Ideas generated by the scientific community are fed into the appropriate agency of the Government's Executive Branch. As you probably know, this happens when a scientist writes a "proposal" and submits it to an agency such as the Atomic Energy Commission or the National Science Foundation. The agency either absorbs the idea contained in the proposal into one of its current programs or creates a new program around it.

Annually each agency summarizes its programs and its estimated costs in the form of a budget. These documents are collected by the Office of Management and Budget (OMB) and compiled into a single volume called the President's Budget Message. The President then submits this Message to Congress at the end of January each year. Because the OMB has the responsibility of "balancing" the nation's budget for the



TIMES REQUIRED TO FUND PROJECTS

a. "Big Science"

1. Consensus in the Scientific Community	1 to 5 years
2. Preliminary Designs and Cost Estimates (with agency progr. m funds)	1 to 2 years
3. Acceptance into the Budget	1 to 3 years
4. Congressional Action (authorization and appropriation)	3/4 to 2 years
5. Agency Acts to Begin Construction	0 to 1 year
Totals	3-3/4 to 13 years

b. "Little Science"

1. Idea → Proposal by Principal Investigator	1 month to ?
2. Response Time of the Agency	9 months to 2 years
Totals	5/6 to 2 + years

President, some agency programs must be excluded from the final document. The budget examiners on the OMB staff carefully assess the agency programs, which include the ideas of the scientific community. Although these examiners seldom have had any scientific or technical background, their influence on the selection procedure is very great.

After transmittal to the Congress, the budget is dealt with in a rather complex way by the committee system which they have.

There are many Congressional hurdles each budget must overcome. An Authorization Bill must be passed by both the House and Senate, followed by an Appropriations Bill which also must be passed by both bodies. Thus, each program receives Congressional scrutiny four times through full committee hearings, amended versions of the programs and budgets, and finally conference versions of the law. The final law, containing the money for the program as an appropriation, is then sent back to the President (who could veto it). If the law is signed by the President, OMB notifies the requesting agency that funds are available and the program can start. It is then that the agency can make a grant to the scientific community and the work of implementing the idea can finally begin.

Slow Process

I have gone through this discussion in detail to demonstrate two main points: first, that the process takes a long time, and second, that the idea must be accepted by many people, any one of whom could stop its progress for different reasons. Furthermore, these reasons may have no direct bearing on the validity of the idea itself.

Consider the time scale of the process. In the table, I have estimated the amount of time required for each major step. An idea's full circuit through the machine as shown in the upper part of the table is only applicable to what Derek Price* would call "Big Science" projects. The 200 Bev proton accelerator at Batavia, Illinois, or the Very Large Array (VLA) radio telescope in the NSF's new budget for FY'73 are typical of multi-million dollar projects subjected to this process. The time lapse between conception of an idea and the approved funding for construction of a major project is from four to thirteen years. When this is added to the construction time for the facilities, it is easy to see why such projects have been compared to the cathedrals of the Middle Ages.

Fortunately, "Little Science"* projects

Price, D. J. De S.,* **Little Science, Big Science, *Columbia University Press, New York, 1963.*

short circuit the longest delays as seen in the lower half of the table. If a program is already funded in one of the agencies supporting research in a specific fielu, such as nuclear physics, then action can be taken more quickly. However, the "peer-review" system and the agency's bureaucracy can still produce delays of from nine months to two years before a proposal is funded.

Selection Mechanics

Let's turn our attention to the second point that was stressed earlier, namely that a very large number of scientists and engineers must be convinced an idea is valid, and that then an even larger number of laymen must be persuaded that it should be funded. The coordination of the persuasion process -- the distillation of a consensus of opinion into a succession of group actions -- is the essence of making what we call National Science Policy.

Since we are confronted with a system as involved as that described above, obviously not every idea should be fed through it. The idea selection process is a central feature of Science Policy. The initial evaluation of ideas must take place within the scientific community. A member of that community might think that it would be difficult to transmit his opinions to the Federal bureaucracy. However, the program officers in each agency pride themselves on knowing the latest ideas in their professional fields. They stay in close contact with the latest developments by telephone and site visits, through reading technical articles, and by attending the meetings of professional societies. If an exciting new idea comes from the scientific community, it spreads throughout the Federal agencies with a speed matched only by the transmission of political gossip. The program officers in t. e agencies follow the technical discussions about a new idea and carefully note whether or not its originator will submit a proposal for funding to one of the agencies. If more than one agency funds work in this area, members of the appropriate inter-agency committee are immediately informed as to which agency received the proposal and how much money was requested. One member of the inter-agency group may even volunteer to fund the proposal because it bears special "relevance" to his agency's mission. An agency may decide to give a grant or contract for a detailed preliminary design study. The report of this study will then be sent through the entire funding process if the project is "Big Science" and requires the construction of facilities.

When Federal agencies submit their budgets to the OMB for inclusion in the President's budget message to Cc.ngress, a somewhat different kind of selection process begins. "Little Science" projects are dealt with as part of an overall agency program whose budget figure is fixed. Thus the NSF's Chemistry program might be given an allocation without anyone stopping to discuss the content or quality of the work they are supporting. That is considered to be an internal agency matter and not an "issue". The "issues" center around projects like the multi-million dollar accelerators, radio telescopes, or orbiting observatories. There are enormous difficulties in establishing priorities among the multitude of projects submitted every year.

The primary basis for choosing a few projects to support out of the numerous applicants is based on a simple "appeal to authority". It is imperative, for example, that a major project receive approval and support from the scientific community. Usually this is provided by the National Academy of Sciences, which issues a report to publicize the agreement of a substantial segment of the community. For example, no major facilities in Radio Astronomy had been undertaken for 4 or 5 years. A group, who had been working on an Academy report, were invited to determine which of several projects, should be built next. The Very Large Array (VLA) Antenna was given top priority and later included in the NSF budget.

There is another way to demonstrate the consensus of scientific opinion. A Federal agency or private foundation can commission a study which will focus discussion on a specific issue. The subsequent reports can then be used as the authoritative expression of judgment in the community. The recent

report on higher education, organized by Frank Newman of Stanford, is a typical example of a Federal agency (HEW) stirring up the idea pot. Ten years ago a Ford Foundation Study by John Goodlad of UCLA was used as the primer for setting up programs under the Elementary and Secondary Education Acts.

Role of OST

How does the Office of Science and Technology fit into this process? As part of the Executive Office of the President, the staff at OST are the maintenance men, who identify ideas in the community and translate them into layman's language. Then they carefully tutor their colleagues in the OMB about the importance of these ideas to national scientific programs. In some cases the OST staff may lead the way and start the process well before the agencies submit their budgets. In others, OST may supply an independent technical evaluation to aid OMB and the President in making a final decision.

OST has a wide range of techniques which can be used to formulate its case. First is the Presidentially appointed advisory group, PSAC, the President's Scientific Advisory Committee. These twenty-four nationally known and respected individuals cannot do everything themselves, and so a second mechanism exists, the PSAC Panel. Each Panel is headed by a member of PSAC, who brings together six to ten other experts in a field. The Environmental Panel, which urged the establishment of the Environmental Protection Agency, is an example of such a panel and shows the kind of impact it can have. This panel proposed ways to organize the new agency, and the budget needed to support it.

A third way to determine scientific opinion is the use of outside consultants or firms to provide needed analyses of problems of concern.

The impact of these activities on the country's research and development establishment is not measured by the number of papers or documents that are published, but by how well the system as a whole responds to innovative opportunities. Generally, the most important papers go unpublished. They are inter-office memoranda which are not in the public domain and which simply inform one or two persons about a single problem or part of a problem.

Because it is impossible to give equal treatment to all problems simultaneously, the OST staff must select a small number of important issues or projects. These can be carefully and patiently "sold" to all of the individuals linking the decision-making chain. If a project gets started in the wrong agency, only the President's Office has the persuasive clout to get it moved to the appropriate place. One example some of you may recall was the case of the "IDL's", or material sciences laboratories on twelve campuses. The support for these laboratories was transferred from the Department of Defense to NSF not so long ago.

The key role for an OST staff man is that of the interpreter and teacher. Although the first non-scientist to review a given program may be the OMB budget examiner, he will certainly not be the last. It is essential for passage of the program in the Congress that the supporting evidence be presented in a convincing way to the non-technically trained person. Although the original presentations are considered from this point of view within the agency during the period of budget preparation, the OMB provides the first crucial test for a new program. If there are weak points, these can be strengthened before making a more public presentation to the Congress.

The OST man is somewhat like the old-fashioned railroad mechanic who leaped off the caboose when the train stopped, dashed up and down checking for damage, poured oil into the smoking bearings, and made other minor repairs. Each idea or new program requires a track to guide it through the system and a maintenance crew to keep it moving on its way. The challenge to the mechanics is great. It is the satisfaction of helping a single idea become reality that makes it so rewarding.

Technology Assessment

The subject of technology assessment has become increasingly popular in the last few years, with articles appearing recently in the Wall Street Journal, Newsweek, *and practically every periodical that has anything to do with public policy. It is also receiving international attention, as evidenced by the lively 10-country Organization for Economic Cooperation and Development (OCED) Conference on Technology Assessment in Paris last January. Also, an International Society for Technology Assessment is in the process of being organized.*

In February, the U. S. House of Representatives passed H. R. 10243 to establish an Office of Technology Assessment (OTA) in the Legislative Branch. As of this writing (late March), a companion bill has received sufficiently favorable hearings by the Senate Rules Committee to indicate that Congress will probably have its OTA before the year is out.

When Battelle's Director of Planning, Gabe Strasser, was in the White House Office of Science and Technology, he spearheaded the technology assessment activities of that Office. He has probably been more deeply involved in policy angles of technology assessment than any other individual. In the following article, he tells us how technology assessment got started, what it is, what its shortcomings are, and what we ought to be doing about them.

TECHNOLOGY ASSESSMENT – A FAD OR A NEW WAY OF LIFE?

by Gabor Strasser

Origin and Meaning

In recent years, we have become increasingly concerned about the deterioration of certain aspects in the quality of human life. Due to unforeseen, deleterious side-effects, certain innovations like DDT, which have done a great deal of good in some ways, have degraded or endangered our lives in others. The pollution of our lakes and streams assaults our senses. Rapid population growth and the concentration of people in urban regions have created severe disharmonies.

Since technology plays a highly significant as well as visible role in the solution of many of our problems, there has arisen a desire to better "pre-plan" the use of technology. The objective of this pre-planning is to minimize the potential deleterious side effects of our actions. This has given rise to the technology assessment concept.

But what we do or don't do is really up to our socio-political system, not to our scientific-technical establishment, however extensively many of our industrial products and government programs may depend on science and technology. Furthermore, science and technology represent only one set of the many "enabling mechanisms" that help us attain our objectives. Others lie in such areas as economics, management, labor, political science, institutional arrangements, etc. It is the integrated use of these enabling mechanisms, under the direction of our socio-political system, that can make the difference between success and failure. It is a mistake to look primarily at technology when something has gone wrong. It is also wrong to search primarily for technological solutions, since the best solutions generally involve a combination of technology and other means, or even a combination of non-technological means without any new technology.

For this reason, most authorities broaden the concept of technology assessment to include a great deal more than what ordinarily comes to mind when we use the term technology assessment, namely: *A systematic planning and forecasting process that delineates options and costs, encompassing economic as well as environmental and social considerations, that are both external and internal to the program or product in question, with special focus on technology-related "bad" as well as "good" effects.*

I have somewhat facetiously suggested a "more appropriate" acronym: PAYOFF (Plans and Assessments to Yield Options for the Future) as a simple,

more accurate, and less confusing label for the process [SPR 4(4):1687].

Why Needed Now?

The fundamental concept of technology assessment is not new, even in its broader interpretation. What is new, however, is that today's problems that need technology assessment have become more numerous, more severe, and more complex. Also, public awareness of these problems has become more acute, and insistence that something be done about them has become more vocal.

Scientists and engineers are often surprised when they find that problems of urban blight, social unrest, environmental pollution, inadequate educational opportunities, and health care deficiencies do not respond neatly to scientific and technological initiatives. Even the systems approach, which worked so well in the 1950s and 1960s for developing complex weapons systems and for putting men on the moon, remains wanting when used here for several important reasons:

(1) The objectives are much more diffuse, relating less to quantifiable economics and "hard" science and engineering.
(2) The disciplines involved are much more heterogeneous, and we have not yet learned how to orchestrate them for coordinated assaults on the problems.

The apparent need for technology assessment as an integral step in planning, organizing, and implementing our activities today is an outgrowth of changes that have been taking place over the past several decades, some of which are:

(1) Technology and management techniques are providing more and more leverage, often with more severe consequences, shorter lead times, and greater impacts.
(2) Mistakes made are becoming more and more costly; there is an increase in the irreversibility of many of our actions.
(3) There is less damping; our environment is becoming less and less forgiving of abuses.
(4) Our goals are becoming more and more complex and call for increasingly complex, interdisciplinary approaches.

Methodology Lacking

Most of the existing literature related to technology assessment deals with

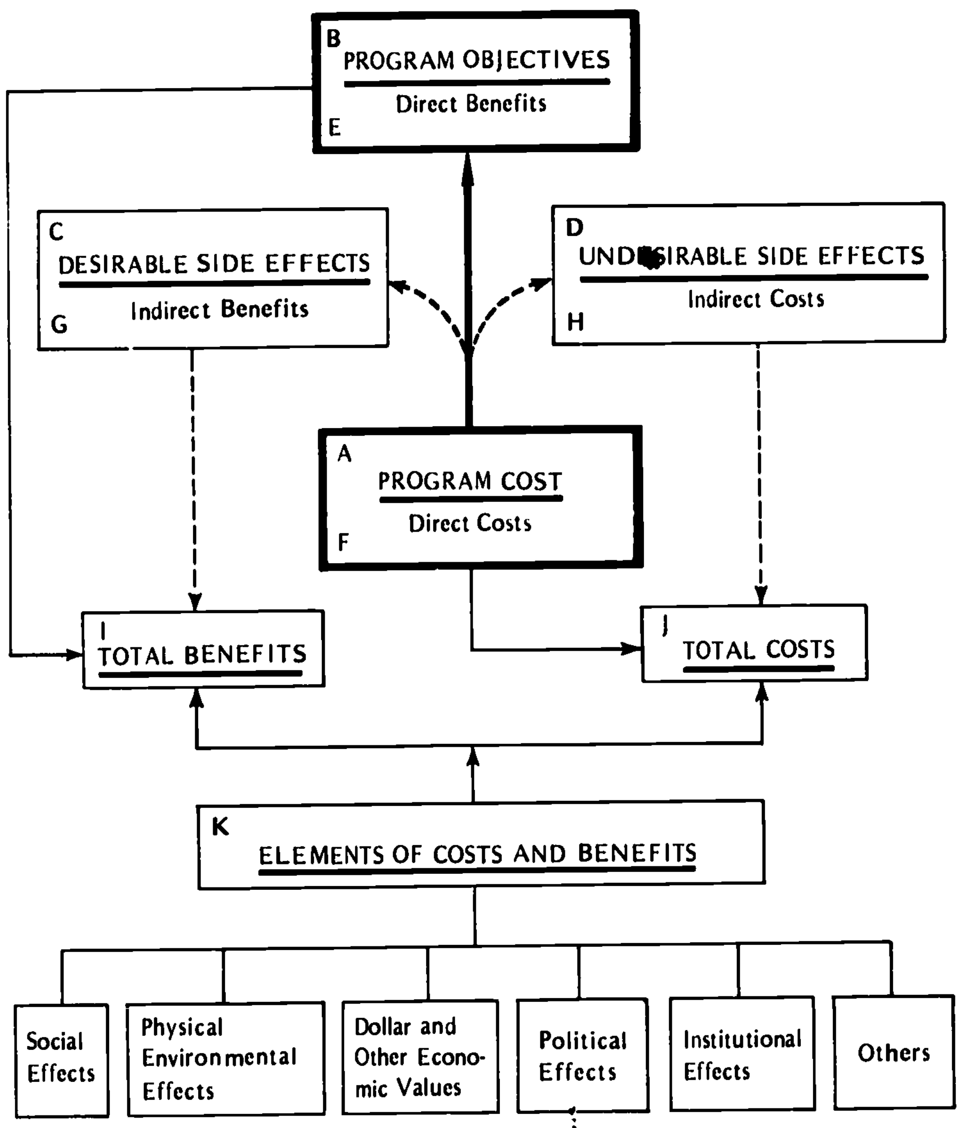
(1) The proliferation and increasing severity of undesirable side effects of many actions
(2) The difficulties associated with eliminating or ameliorating these effects, recognizing that current techniques are generally inadequate
(3) The needed and possible organizational arrangements for the appropriate assignment of the technology assessment function.

At the same time, actual techniques for technology assessment have received very little attention. Without methodology, the dialogue could continue, but not much progress would be made. Recognizing this, in 1970 the White House Office of Science and Technology (OST) with the help of the MITRE Corporation undertook a series of studies toward narrowing the gap between needed and existing methodologies.

Framework for Methodology Development

Before discussing the OST studies, it is instructive to look at a framework that illustrates cost-benefit interactions connected with a proposed program or resource. We are used to talking about a resource or a Program Cost (A) being committed to the achievement of Program Objectives (B) (see figure). These may be called Direct Costs (F) and Direct Benefits (E), in that they represent the intended causes and effects.

In the process we can have two kinds of side effects – Desirable (C) and Undesirable (D). Since these are unintentional effects, they may be termed Indirect (G) and (H). The Desirable Side Effects (C) together with Program Objectives (B) add up to the Total Benefits (I), whereas Program Cost (A) and Undesirable Side Effects (D)



A FRAMEWORK FOR TECHNOLOGY ASSESSMENT

add up to the Total Costs (J). What is defined here as Indirect, an economist might call external costs and benefits.

Total Benefits (I) and Total Costs (J) really consist of a combination (K) of Social Effects, Physical Environmental Effects, Dollar and Other Economic Values, Political Effects, Institutional Effects, and various Others. However, these terms are incommensurable; therefore we need some sort of integrated social, environmental, or urban yardsticks that have all three of the following qualities simultaneously: relevance, utility, and acceptability to the public. We do not have such yardsticks today.

Since there is also a time scale involved, we cannot talk only about what is happening now, but must include in our deliberations discounted future costs and benefits. When we do this, the problem of uncertainty comes into sharp focus, calling for some popularized treatment of risks and expected values, which is difficult enough when only dollar "costs" are involved.

In the past, enterprises have forged from Program Cost (A) to Program Objectives

(B) while spilling their "external" costs into the social and physical environments. Now, both the "social sink" and the "physical environmental sink" are becoming saturated, and there are demands to turn off the "faucet" that permits the spillover from (A) to (D). But such faucets cannot be turned off. The spillover cost can only be rerouted back to the original Program Cost (A).

For example, if a paper pulp manufacturer who has been polluting a river (his "physical environmental sink") is forced to stop, he must install devices to eliminate or at least reduce to some acceptable level the harmful effects of his pollutants. This adds to his production cost (A). Since many such companies are only marginally profitable, it would not be surprising if a massive effort to force industries to internalize their external costs would turn the ink on their profit-and-loss statements from black to red. In fact, many of our industrial products are profitable only because some of their costs have never been absorbed by the producers themselves. Now, the real challenge is to achieve an equitable balance among internal and external costs and benefits without causing unacceptable disruptions in our economic, social, and political systems.

Our old, reliable models of the free market economy have been giving us some surprises lately, perhaps because they do not adequately consider external costs, about which an increasingly vocal public is becoming more and more concerned. Traditional methods, concentrating on ingeniously maximizing narrow special interests, often at huge costs to other interests, worked as long as the available resources substantially exceeded the demands placed upon them. Now that our demands are approaching (or in some cases have already outpaced) the supply, better planning, management, efficiency, and understanding are imperative.

The OST Studies

The OST program represents one of the pioneering efforts in the development of a technology-assessment methodology.

Earlier, the National Academy of Engineering had reported on similar studies attempting to normalize the results of a number of different assessments using systems analysis techniques. The variables turned out to include too many judgmental factors to be quantifiable, and there emerged no generalized ground rules from the individual case studies.

For this reason, a combination of two approaches was used in the OST study. One, the "case history" approach, analyzes and assesses *real* problems and focuses on how to resolve specific related issues. [The five case histories, (pilot studies) deal with (1) the impact of computers on society, (2) ocean farming, (3) automobile emissions, (4) water recycling, and (5) industrial enzymes.] The second approach concerns the extension of existing methodologies to encompass technology assessment in a generic sense. When the two approaches are used in combination, in an iterative fashion, the first provides practicality and relevance, while the second provides generality and transferability of the resulting methods.

The results of this study are described in detail in a six-volume series [see SPR 4(4): 1691]. In-depth analysis of assessment procedures for the five widely differing cases revealed seven major steps that were common to all: (1) definition of the assessment task, (2) description of relevant technologies, (3) development of state-of-society assumptions, (4) identification of impact areas, (5) performance of preliminary impact analysis, (6) identification of possible action options, and (7) completion of impact analysis. Detailed checklists are presented showing how each of these seven steps was carried out for each of the five pilot studies. Assessments in any other area should now be facilitated simply by transferring the applicable reasoning used in each step of the five pilot studies to the new case.

This is still far from a comprehensive "cookbook" for making technology assessments; but it is a beginning. It gives a knowledgeable individual needed guidelines for making a first stab at an assessment in his area of interest. Hopefully, each such experience

will contribute further to the state of the art of technology assessment.

Where Do We Go From Here?

It is clear that countries as well as individuals must have a better appreciation for what can reasonably be sought and for what can reasonably be achieved. It is also clear that the declining rate of increased productivity in the United States calls for better integration of planning, management, and resource utilization. The difficulties associated with the ordering of priorities in a pluralistic society must be fully appreciated and then somehow coped with. Potentials and limitations must be better understood.

More specifically, we must:

- Articulate qualitatively and quantitatively (wherever possible) the nature of our societal problems and the resulting goals, and then translate these goals into implementable products and services.
- Establish parameters that incorporate all of the relevant variables from all of the relevant disciplines to which end objectives are sensitive. We do not know how to establish such parameters today. The solutions to most of the current problems depend on a host of disciplines in addition to technology. Superposition does not work. The social, political, economic, and scientific elements must be integrated. Further, the integration must take place throughout the continuum of objective setting, approach formulation, and implementation.
- Trade off the benefits and consequences of the qualitative versus the quantitative, the deferred versus the immediate, and the direct versus the indirect.
- Define and trade off various benefits against one another. The output of a program can manifest itself in a host of widely differing noncommensurable impacts – for example, cleaner air and better education, housing, health, and transportation. As a start, we need relevant *and* usable social, urban, and environmental indexes that the public can and will accept.
- Relate sets of value judgments to different alternatives.
- Consider the potential good as well as bad side effects or impacts on other programs. Although probabilistic in nature, these considerations could be critical. Hence, our deliberations and proposed alternatives heavily depend on notions of uncertainty, on risks, and on expected values. We don't quite know how to popularize these notions as we must, such that they may be included in the deliberation of decision makers and made understandable to their constituencies.
- Provide viable alternatives based not only on dollar costs but on social, political, institutional, and other costs.
- Develop standards that are broader in scope than those we have today, and which are performance- rather than design-oriented.
- Include in our current plans more rational and realistic ways to treat discounted future social costs and benefits when these are interpreted in the broadest sense.
- Utilize our resources more efficiently so that the disparity will be reduced between what we want and what we can have.
- Modernize institutional frameworks. Our existing institutions must be reorganized so they become more responsive to the achievement of the goals and aspirations that we as a nation, through our government, have set for ourselves. There is difficulty in articulating many of these aspirations in an implementable fashion. And, even where we can do so, institutional inertia all too often makes the change impossible.
- Set individual priorities with full cognizance of overall resource limitations.

It is clear that what is needed today is a capability to better orchestrate what we have – natural resources and human talents – in order to maximize those products and services that we desire most and to minimize the possibility that other important services or products will fall below an unacceptable threshold level. Only in this man-

ner can we hope to keep the disparity between what we would like to have and what we can have in some acceptable balance.

What we need today is a capability that is much broader, much more complex and much more elusive than what the scientist, the technologist, and the systems engineer dealt with in the 50s and 60s.

Some have said that technology assessment is that part of this needed capability which says, "Watch out for untoward, undesirable side effects that can be traced to actions having highly visible scientific technological components". Obviously, this addresses only a small part of our problem.

What is really needed is more akin to, and even more general than, the definition of technology assessment as given earlier in this article: some systematic planning and forecasting process that delineates options and costs, encompassing economic as well as environmental and social considerations, that are both external and internal to the program or product in question. No area should be singled out for special focus such as technology-related "bad" as well as "good" effects. However, we should consciously search for, identify, and deal with "bad" as well as "good" effects irrespective of what their sources may be.

Science and technology represent one such source. Others with likely negative effects include obsolete institutional frameworks; incompetent management; inappropriate regulatory practices; sterile or counter-productive standards; unimaginative use or even misuses of resources; ill-defined requirements and problems; ill-defined approaches to, and solutions of, problems; using the right approach on the wrong problem or vice versa; impractical or even unfeasible implementations; and many, many others.

If this is, in fact, what we need, then, as implied before, "technology assessment" as a label is far too narrow.

An Application

Section 102 of Public Law 91-190, which established the Council on Environmental Quality (CEQ) in the U. S., calls for all Federal Agencies and Departments to perform analyses and prepare environmental impact statements on all of their proposed actions which might impinge in any manner on the environment. CEQ, in the Executive Office of the President, is charged with reviewing such documents.

Methodologies for carrying out these environmental impact analyses are far from clear cut. Technology-assessment-type guidelines for the implementation of Section 102 are sorely needed by the Agencies and Departments in order to prepare meaningful statements, and by the CEQ and the Environmental Protection Agency (EPA) in order to review them competently. With the methodology available today, neither preparing nor reviewing the host of impact statements pouring into the CEQ and the EPA is an enviable task.

Office of Technology Assessment (OTA)

Within the U. S. Congress, a House Bill (H.R. 10243) to establish an Office of Technology Assessment (OTA) was passed (256-118) in February, and a similar bill received favorable Senate committee hearings in March. This suggests that the work begun five years ago by the House Subcommittee on Science, Research, and Development under Congressman E. Q. Daddario and picked up by his successor, Rep. John Davis, may be ready to bear fruit in the form of a new information aid for Congress.

The House bill as passed calls for a Technology Assessment Board of five Senators and five Representatives appointed by Congress. The Board would then hire a Director to supervise the staff (up to 100) and operate the Office. The actual "assessing" would be done under contract to the OTA by suitable outside groups (industrial, non-profit, academic, *ad hoc*).

The OTA would supplement advice provided by existing committee staffs, the GAO, and the Congressional Research Service. This could cause considerable stir within the Executive Branch, since we are talking about nothing short of Congress, the "questioner", becoming better informed on a host of issues than many of the "expert testifiers" would be from the Departments

and Agencies of the Executive Branch. In fact, nothing would give greater impetus to the practice of the principle of "Technology Assessment" in the Executive Branch than the establishment of an Office of Technology Assessment (OTA) in Congress.

Concluding Thoughts

The history of mankind is full of sporadic, isolated efforts undertaken in the name of progress or to redress past wrongs. In retrospect, these efforts often turned out to be counterproductive. At times they were downright disastrous. After all, for centuries war has been man's primary instrument to "fix things". What has been lacking throughout the ages, and what is still lacking today, is some integrated, "surprise-free" approach to our affairs as individuals, as groups, as nations, and even as the world. Myriad efforts have come and gone; few have taken root. Is technology assessment going to be just another passing fad? It could be, and in all likelihood it will be, unless we broaden it and better understand its potentials as well as its limitations.

First, if it is to work at all, we need a more encompassing process than what we have labeled "Technology Assessment". Second, this new process cannot be superimposed on our current way of doing things as if by afterthought; it must be woven into the very fabric of our system. It must become an integral part of our lives, our way of planning, our way of doing business.

All too often, when we want to get something done but lack faith in the existing institutional mechanisms, we set up new mechanisms rather than investigate and repair the faults in the existing system This procedure diminishes the effectiveness of the organizations that have been bypassed; but the old organizations continue to exist and add to the overhead. The newly created mechanisms may be superbly efficient (until they themselves get bypassed), but the overall efficiency of such a system must progressively decline.

I do not believe that the present system can cope with existing and emerging problems. We must therefore re-examine our institutions to insure that they help rather than hinder us in the pursuit of our objectives. If they don't help, we should take the necessary evolutionary steps to change them. (Incidentally, "evolutionary" does not mean "lethargic".) All too often, progress is stifled because many of our institutions, established to cater to past needs, cannot cope with the challenges of today and of tomorrow. Our system must be nudged to evolve, to remain current and effective *vis-à-vis* the ever-changing nature of the problems to which it must respond. Technology assessment represents one such necessary nudge.

While our system may indeed be in need of an evolutionary overhaul, anyone who believes that the future power center of our policy and decision-making process can be anywhere but in the socio-political system is fooling himself. We must think of the concept of technology assessment not as something in lieu of, or separate from, the political system, but as a well-integrated part of it — as one of the means to help the political system be more responsive to the people and become more efficient. Only in this manner will the socio-political system accept the technology assessment concept; only in this manner can the technology assessment concept contribute to the upgrading of our socio-political system; only in this manner can the concept of technology assessment take root and make badly needed contributions to our way of life.

Straight from the Top

On March 16, President Nixon sent to the U.S. Congress a special message on science and technology. It calls for "a strong new effort to marshal science and technology in the work of strengthening our economy and improving the quality of our life", and spells out in some detail how this should be done.

What are the implications of this change in Federal attitude toward science and technology? Who will be calling the signals and who will foot the bill? What will be the roles of traditional R&D agencies such as the National Science Foundation, the National Aeronautics and Space Administration, the Atomic Energy Commission, and the Department of Defense? Will there be any funding for basic research?

Here is the complete text of the President's message. Judge for yourself.

by Richard M. Nixon

The ability of the American people to harness the discoveries of science in the service of man has always been an important element in our national progress. As I noted in my most recent message on the State of the Union, Americans have long been known all over the world for their technological ingenuity — for being able to "build a better mousetrap" — and this capacity has undergirded both our domestic prosperity and our international strength.

We owe a great deal to the researchers and engineers, the managers and entrepreneurs who have made this record possible. Again and again they have met what seemed like impossible challenges. Again and again they have achieved success. They have found a way of preventing polio, placed men on the moon, and sent television pictures across the oceans. They have contributed much to our standard of living and our military strength.

But the accomplishments of the past are not something we can rest on. They are something we must build on. I am therefore calling today for a strong new effort to marshal science and technology in the work of strengthening our economy and improving the quality of our life. And I am outlining ways in which the Federal Government can work as a more effective partner in this great task.

The importance of technological innovation has become dramatically evident in the past few years. For one thing, we have come to recognize that such innovation is essential to improving our economic productivity — to producing more and better goods and services at lower costs. And improved productivity, in turn, is essential if we are to achieve a full and durable prosperity — without inflation and without war. By fostering greater productivity, technological innovation can help us to expand our markets at home and abroad, strengthening old industries, creating new ones, and generally providing more jobs for the millions who will soon be entering the labor market.

This work is particularly important at a time when other countries are rapidly moving upward on the scientific and technological ladder, challenging us both in intellectual and in economic terms. Our international position in fields such as electronics, aircraft, steel, automobiles and shipbuilding is not as strong as it once was. A better performance is essential to both the health of our domestic economy and our leadership position abroad.

At the same time, the impact of new technology can do much to enrich the quality of our lives. The forces which threaten that quality will be growing at a dramatic pace in the years ahead. One of the great questions of our time is whether our capacity to deal with these forces will grow at a similar rate. The answer to that question lies in our scientific and technological progress.

As we face the new challenges of the 1970's, we can draw upon a great reservoir of scientific and technological information and skill — the result of the enormous investments which both the Federal Government and private enterprise made in research

and development in recent years. In addition, this Nation's historic commitment to scientific excellence, its determination to take the lead in exploring the unknown, have given us a great tradition, a rich legacy on which to draw. Now it is for us to extend that tradition by applying that legacy in new situations.

In pursuing this goal, it is important to remember several things. In the first place, we must always be aware that the mere act of scientific discovery alone is not enough. Even the most important breakthrough will have little impact on our lives unless it is put to use – and putting an idea to use is a far more complex process than has often been appreciated. To accomplish this transformation, we must combine the genius of invention with the skills of entrepreneurship, management, marketing and finance.

Secondly, we must see that the environment for technological innovation is a favorable one. In some cases, excessive regulation, inadequate incentives and other barriers to innovation have worked to discourage and even to impede the entrepreneurial spirit. We need to do a better job of determining the extent to which such conditions exist, their underlying causes, and the best ways of dealing with them.

Thirdly, we must realize that the mere development of a new idea does not necessarily mean that it can or should be put into immediate use. In some cases, laws or regulations may inhibit its implementation. In other cases, the costs of the process may not be worth the benefits it produces. The introduction of some new technologies may produce undesirable side effects. Patterns of living and human behavior must also be taken into account. By realistically appreciating the limits of technological innovation, we will be in a better position fully to marshal its amazing strengths.

A fourth consideration concerns the need for scientific and technological manpower. Creative, inventive, dedicated scientists and engineers will surely be in demand in the years ahead; young people who believe they would find satisfaction in such careers should not hesitate to undertake them. I am convinced they will find ample opportunity to serve their communities and their country in important and exciting ways.

The fifth basic point I would make concerning our overall approach to science and technology in the 1970's concerns the importance of maintaining that spirit of curiosity and adventure which has always driven us to explore the unknown. This means that we must continue to give an important place to basic research and to exploratory experiments which provide the new ideas on which our edifice of technological accomplishment rests. Basic research in both the public and private sectors today is essential to our continuing progress tomorrow. All departments and agencies of the Federal Government will continue to support basic research which can help provide a broader range of future development options.

Finally, we must appreciate that the progress we seek requires a new partnership in science and technology – one which brings together the Federal Government, private enterprise, State and local governments, and our universities and research centers in a coordinated, cooperative effort to serve the national interest. Each member of that partnership must play the role it can play best; each must respect and reinforce the unique capacities of the other members. Only if this happens, only if our new partnership thrives, can we be sure that our scientific and technological resources will be used as effectively as possible in meeting our priority national needs.

With a new sense of purpose and a new sense of partnership, we can make the 1970's a great new era for American science and technology. Let us look now at some of the specific elements in this process.

Strengthening the Federal Role

The role of the Federal Government in shaping American science and technology is pivotal. Of all our Nation's expenditures on research and development, 55 percent are presently funded by the Federal Government directly or indirectly, the Federal Government supports the employment of nearly

half of all research and development personnel in the United States.

A good part of our Federal effort in this field has been directed in the past toward our national security needs. Because a strong national defense is essential to the maintenance of world peace, our research and development in support of national security must always be sufficient to our needs. We must ensure our strategic deterrent capability, continue the modernization of our Armed Forces, and strengthen the overall technological base that underlies future military systems. For these reasons, I have proposed a substantial increase for defense research and development for fiscal year 1973.

In this message, however, I would like to focus on how we can better apply our scientific resources in meeting civilian needs. Since the beginning of this Administration, I have felt that we should be doing more to focus our scientific and technological resources on the problems of the environment, health, energy, transportation and other pressing domestic concerns. If my new budget proposals are accepted, Federal funds for research and development concerning domestic problems will be 65 percent greater in the coming fiscal year than they were in 1969.

But increased funding is not the only prerequisite for progress in this field. We also need to spend our scarce resources more effectively. Accordingly, I have moved to develop an overall strategic approach in the allocation of Federal scientific and technological resources. As a part of this effort, I directed the Domestic Council last year to examine new technology opportunities in relation to domestic problems. In all of our planning, we have been concentrating not only on *how much* we spend but also on *how* we spend it.

My recommendations for strengthening the Federal role in science and technology have been presented to the Congress in my State of the Union message, in my budget for fiscal year 1973, and in individual agency presentations. I urge the Congress to support the various elements of this new Federal strategy.

1) We are reorienting our space program to focus on domestic needs — such as communications, weather forecasting and natural resource exploration. One important way of doing this is by designing and developing a reusable space shuttle, a step which would allow us to seize new opportunities in space with higher reliability at lower costs.

2) We are moving to set and meet certain civilian research and development targets. In my State of the Union Message, my Budget Message and in other communications with the Congress, I have identified a number of areas where new efforts are most likely to produce significant progress and help us meet pressing domestic needs. They include:

- Providing new sources of energy without pollution. My proposed budget for fiscal year 1973 would increase energy-related research and development expenditures by 22 percent.
- Developing fast, safe, pollution-free transportation. I have proposed spending 46 percent more in the coming fiscal year on a variety of transportation projects.
- Working to reduce the loss of life and property from natural disasters. I have asked, for example, that our earthquake research program be doubled and that our hurricane research efforts be increased.
- Improving drug abuse rehabilitation programs and efforts to curb drug trafficking. Our budget requests in this critical area are four times the level of 1971.
- Increasing biomedical research efforts, especially those concerning cancer and heart disease, and generally providing more efficient and effective health care, including better emergency health care systems.

3) We will also draw more directly on the capabilities of our high technology agencies — the Atomic Energy Commission, the National Aeronautics and Space Administration and the National Bureau of Standards in the Department of Commerce — in applying research and development to domestic problems.

4) We are making strong efforts to improve the scientific and technological basis for

setting Federal standards and regulations. For example, by learning to measure more precisely the level of air pollution and its effects on our health, we can do a more effective job of setting pollution standards and of enforcing those standards once they are established.

5) I am also providing in my 1973 budget for a 12 percent increase for research and development conducted at universities and colleges. This increase reflects the effort of the past 2 years to encourage educational institutions to undertake research related to important national problems.

6) Finally, I believe that the National Science Foundation should draw on all sectors of the scientific and technological community in working to meet significant domestic challenges. To this end, I am taking action to permit the Foundation to support applied research in industry when the use of industrial capabilities would be advantageous in accomplishing the Foundation's objectives.

Supporting Research and Development in the Private Sector

The direction of private scientific and technological activities is determined in large measure by thousands of private decisions – and this should always be the case. But we cannot ignore the fact that Federal policy also has a great impact on what happens in the private sector. This influence is exerted in many ways – including direct Federal support for such research and development.

In general, I believe it is appropriate for the Federal Government to encourage private research and development to the extent that the market mechanism is not effective in bringing needed innovations into use. This can happen in a number of circumstances. For example, the sheer size of some developmental projects is beyond the reach of private firms particularly in industries which are fragmented into many small companies. In other cases, the benefits of projects cannot be captured by private institutions, even though they may be very significant for the whole of society. In still other cases, the risks of certain projects, while acceptable to society as a whole, are excessive for individual companies.

In all these cases, Federal support of private research and development is necessary and desirable. We must see that such support is made available – through cost-sharing agreements, procurement policies, or other arrangements.

One example of the benefits of such a partnership between the Federal Government and private enterprise is the program I presented last June to meet our growing need for clean energy. As I outlined the Federal role in this effort, I also indicated that industry's response to these initiatives would be crucial. That response has been most encouraging to date. For example, the electric utilities have already pledged some $25 million a year for a period of 10 years for developing a liquid metal fast breeder reactor demonstration plant. These pledges have come through the Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association. This effort is one part of a larger effort by the electrical utilities to raise $150 million annually for research and development to meet the growing demand for clean electric power.

At the same time, the gas companies, through the American Gas Association, have raised $10 million to accelerate the effort to convert coal into gas. This sum represents industry's first-year share in a pilot plant program which will be financed one-third by industry and two-thirds by the Federal Government. When it proves feasible to proceed to the demonstration stage, industrial contributions to this project will be expected to increase.

Applying Government-Sponsored Technologies

An asset unused is an asset wasted. Federal research and development activities generate a great deal of new technology which could be applied in ways which go well beyond the immediate mission of the supporting agency. In such cases, I believe the Government has a responsibility to transfer the results of its research and development

activities to wider use in the private sector.

It was to further this objective that we created in 1970 the new National Technical Information Service in the Department of Commerce. In addition, the new incentives programs of the National Science Foundation and the National Bureau of Standards will seek effective means of improving and accelerating the transfer of research and development results from Federal programs to a wider range of potential users.

One important barrier to the private development and commercial application of Government-sponsored technologies is the lack of incentive which results from the fact that such technologies are generally available to all competitors. To help remedy this situation, I approved last August a change in the Government patent policy which liberalized the private use of Government-owned patents. I directed that such patents may be made available to private firms through exclusive licenses where needed to encourage commercial application.

As a further step in this same direction, I am today directing my Science Adviser and the Secretary of Commerce to develop plans for a new, systematic effort to promote actively the licensing of Government-owned patents and to obtain domestic and foreign patent protection for technology owned by the United States Government in order to promote its transfer into the civilian economy.

Improving the Climate for Innovation

There are many ways in which the Federal Government influences the level and the quality of private research and development. Its direct supportive efforts are important, but other policies — such as tax, patent, procurement, regulation, and antitrust policies — also can have a significant effect on the climate for innovation.

We know, for instance, that a strong and reliable patent system is important to technological progress and industrial strength. The process of applying technology to achieve our national goals calls for a tremendous investment of money, energy, and talent by our private enterprise system. If we expect industry to support this investment, we must make the most effective possible use of the incentives which are provided by our patent system.

The way we apply our antitrust laws can also do much to shape research and development. Uncertain reward and high risks can be significant barriers to progress when a firm is small in relation to the scale of effort required for successful projects. In such cases, formal or informal combinations of firms provide one means for hurdling these barriers, especially in highly fragmented industries. On the other hand, joint efforts among leading firms in highly concentrated industries would normally be considered undesirable. In general, combinations which lead to an improved allocation of the resources of the Nation are normally permissible, but actions which lead to excessive market power for any single group are not. Any joint program for research and development must be approached in a way that does not detract from the normal competitive incentives of our free enterprise economy.

I believe we need to be better informed about the full consequences of all such policies for scientific and technological progress. For this reason, I have included in my budget for the coming fiscal year a program whereby the National Science Foundation would support assessments and studies focused specifically on barriers to technological innovation and on the consequences of adopting alternative Federal policies which would reduce or eliminate these barriers. These studies would be undertaken in close consultation with the Executive Office of the President, the Department of Commerce and other concerned departments and agencies, so that the results can be most expeditiously considered as further Government decisions are made.

There are a number of additional steps which can also do much to enhance the climate for innovation.

1) I shall submit legislation to encourage the development of the small, high tech-

nology firms which have had such a distinguished pioneering record. Because the combination of high technology and small size makes such firms exceptionally risky from an investment standpoint, my proposal would provide additional means for the Small Business Investment Companies (SBICs) to improve the availability of venture capital to such firms.

a. I propose that the ratio of Government support to SBICs be increased. This increased assistance would be channeled to small business concerns which are principally engaged in the development or exploitation of inventions or of technological improvements and new products.

b. I propose that the current limit on Small Business Administration loans to each SBIC be increased to $20 million to allow for growth in SBIC funds devoted to technology investments.

c. I propose that federally regulated commercial banks again be permitted to achieve up to 100 percent ownership of an SBIC, rather than the limited 50 percent ownership which is allowed at present.

d. To enhance risk-taking and entrepreneurial ventures, I again urge passage of the small business tax bill, which would provide for extending the eligibility period for the exercise of qualified stock options from 5 to 8 or 10 years, reducing the holding period for non-registered stock from 3 years to 1 year, and extending the tax-loss carry-forward from 5 to 10 years. These provisions would apply to small firms, as defined in the proposed legislation.

2) I have requested in my proposed budget for fiscal year 1973 that new programs be set up by the National Science Foundation and the National Bureau of Standards to determine effective ways of stimulating non-Federal investment in research and development and of improving the application of research and development results. The experiments to be set up under this program are designed to test a variety of partnership arrangements among the various levels of government, private firms and universities. They would include the exploration of new arrangements for cost-sharing patent licensing, and research support, as well as the testing of incentives for industrial research associations.

3) To provide a focal point within the executive branch for policies concerning industrial research and development, the Department of Commerce will appraise, on a continuing basis, the technological strengths and weaknesses of American industry. It will propose measures to assure a vigorous state of industrial progress. The Department will work with other agencies in identifying barriers to such progress and will draw on the studies and assessments prepared through the National Science Foundation and the National Bureau of Standards.

4) To foster useful innovation, I also plan to establish a new program of research and development prizes. These prizes will be awarded by the President for outstanding achievements by individuals and institutions and will be used especially to encourage needed innovation in key areas of public concern. I believe these prizes will be an important symbol of the Nation's concern for our scientific and technological challenges.

5) An important step which could be of great significance in fostering technological innovations and enhancing our position in world trade is that of changing to the metric system of measurement. The Secretary of Commerce has submitted to the Congress legislation which would allow us to begin to develop a carefully coordinated national plan to bring about this change. The proposed legislation would bring together a broadly representative board of private citizens who would work with all sectors of our society in planning for such a transition. Should such a change be decided on, it would be implemented on a cooperative, voluntary basis.

Stronger Federal, State and Local Partnerships

A consistent theme which runs throughout my program for making government more responsive to public needs is the idea that each level of government should do what it can do best. This same theme characterizes my approach to the challenges of re-

search and development. The Federal Government, for example, can usually do a good job of massing research and development resources. But State and local governments usually have a much better "feel" for the specific public challenges to which those resources can be applied. If we are to use science and technology effectively in meeting these challenges, then State and local governments should have a central role in the application process. That process is a difficult one at best; it will be even more complex and frustrating if the States and localities are not adequately involved.

To help build a greater sense of partnership among the three levels of the Federal system, I am directing my Science Adviser, in cooperation with the Office of Intergovernmental Relations, to serve as a focal point for discussions among various Federal agencies and the representatives of State and local governments. These discussions should lay the basis for developing a better means for collaboration and consultation on scientific and technological questions in the future. They should focus on the following specific subjects:

(1) Systematic ways for communicating to the appropriate Federal agencies the priority needs of State and local governments, along with information concerning locally-generated solutions to such problems In this way, such information can be incorporated into the Federal research and development planning process.

(2) Ways of assuring State and local governments adequate access to the technical resources of major Federal research and development centers, such as those which are concerned with transportation, the environment, and the development of new sources of energy.

(3) Methods whereby the Federal Government can encourage the aggregation of State and local markets for certain products so that industries can give Government purchasers the benefits of innovation and economies of scale.

The discussions which take place between Federal, State and local representatives can also help to guide the experimental programs I have proposed for the National Science Foundation and the National Bureau of Standards. These programs, in turn, can explore the possibilities for creating better ties between State and local governments on the one hand and local industries and universities on the other, thus stimulating the use of research and development in improving the efficiency and effectiveness of public services at the State and local level.

World Partnership in Science and Technology

The laws of nature transcend national boundaries. Increasingly, the peoples of the world are irrevocably linked in a complex web of global interdependence – and increasingly the strands of that web are woven by science and technology.

The cause of scientific and technological progress has always been advanced when men have been able to reach across international boundaries in common pursuits. Toward this end, we must now work to facilitate the flow of people and the exchange of ideas, and to recognize that the basic problems faced in each nation are shared by every nation.

I believe this country can benefit substantially from the experience of other countries, even as we help other countries by sharing our information and facilities and specialists with them. To promote this goal, I am directing the Federal agencies, under the leadership of the Department of State, to identify new opportunities for international cooperation in research and development. At the same time, I am inviting other countries to join in research efforts in the United States, including:

- the effort to conquer cancer at the unique research facilities of our National Institutes of Health and at Fort Detrick, Maryland; and
- the effort to understand the adverse health effects of chemicals, drugs and pollutants at the new National Center for Toxicological Research at Pine Bluff, Arkansas.

These two projects concern priority problems which now challenge the whole world's research community. But they are only a part of the larger fabric of cooperative international efforts in which we are now engaged.

Science and technology can also provide important links with countries which have different political systems from ours. For example, we have recently concluded an agreement with the Soviet Union in the field of health, an agreement which provides for joint research on cancer, heart disease and environmental health problems. We are also cooperating with the Soviet Union in the space field; we will continue to exchange lunar samples and we are exploring prospects for closer cooperation in satellite meteorology, in remote sensing of the environment, and in space medicine. Beyond this, joint working groups have verified the technical feasibility of a docking mission between a SALYUT Station and an Apollo spacecraft.

One result of my recent visit to the People's Republic of China was an agreement to facilitate the development of contacts and exchanges in many fields, including science and technology. I expect to see further progress in this area.

The United Nations and a number of its specialized agencies are also involved in a wide range of scientific and technological activities. The importance of these tasks – and the clear need for an international approach to technical problems with global implications – argues for the most effective possible organization and coordination of various international agencies concerned. As a step in this direction, I proposed in a recent message to the Congress the creation of a United Nations Fund for the Environment to foster an international attack on environmental problems. Also, I believe the American scientific community should participate more fully in the science activities of international agencies.

To further these objectives, I am taking steps to initiate a broad review of United States involvement in the scientific and technological programs of international organizations and of steps that might be taken to make United States participation in these activities more effective, with even stronger ties to our domestic programs.

Finally, I would emphasize that United States science and technology can and must play an important role in the progress of developing nations. We are committed to bring the best of our science and technology to bear on the critical problems of development through our reorganized foreign assistance programs.

A New Sense of Purpose and a New Sense of Partnership

The years ahead will require a new sense of purpose and a new sense of partnership in science and technology. We must define our goals clearly, so that we know where we are going. And then we must develop careful strategies for pursuing those goals, strategies which bring together the Federal Government, the private sector, the universities, and the States and local communities in a cooperative pursuit of progress. Only then can we be confident that our public and private resources for science and technology will be spent as effectively as possible.

In all these efforts, it will be essential that the American people be better equipped to make wise judgments concerning public issues which involve science and technology. As our national life is increasingly permeated by science and technology, it is important that public understanding grow apace.

The investment we make today in science and technology and in the development of our future scientific and technical talent is an investment in tomorrow – an investment which can have a tremendous impact on the basic quality of our lives. We must be sure that we invest wisely and well.

Soviet Science Policy

In the March 1971 issue of the Soviet Journal, Nauka i Zhizn *(Science and Life), there appeared an article that spells out in forthright fashion the Communist Party's current science policies and problems. Its author is the Deputy Chairman of the State Committee for Science and Technology under the USSR Council of Ministers.*

A translation of the complete text is presented below. Readers may find it revealing to look for similarities and differences between this and President Nixon's science and technology message to Congress, which appears elsewhere in this issue.

Following the translation is a brief interpretive commentary prepared for SPR *by Dr. Louis Nemzer, Professor of Political Science at The Ohio State University and a recognized authority on Soviet politics.*

THE SCIENTIFIC-TECHNOLOGICAL REVOLUTION AND THE PROBLEMS OF SCIENCE

By Djermen Gvishiani

A most important milestone in our country's historical development will be the 24th CPSU Congress. This Congress will not only sum up the country's activities during the recent past, but will also determine concrete tasks for the future. In increasing the rate of our progress, a particularly important role is played by Soviet science, which is becoming a direct productive force of society and the workshop that initiates scientific and technical progress.

Revolutions, Past and Present

The development of society is characterized by continuous improvements in implements of production, by extension of man's knowledge of his environment, and by steady advances in science and technology. However, at certain stages in history, progress in the development of science has been characterized by revolutionary changes — genuine upheavals in science and technology. The first such revolution began in the 15th century and continued until the 18th. This revolution, as F. Engels pointed out, led to the rise of modern natural science by freeing science from scholasticism. There have been revolutions in individual sciences also — in physics, chemistry, biology, etc. In the late 18th and early 19th centuries, the industrial revolution brought about radical changes in the means of production. In the words of Karl Marx, this revolution replaced "not some kind of a special tool, but the human hand itself" and made it possible "to produce machines by means of machines." The keynote of the current scientific and technological revolution is the mechanization and automation of not only the physical, but also the mental activities of man. This revolution brings about a profound change in all sectors of production and affects all aspects of society's life.

Another feature of today's revolution is the increased role of science and its transformation into a direct productive force.

The effect of science on society is manifested through the expansion of the sphere of scientific activity and by the increase in manpower and material resources devoted to it. In the USSR today there are about 930,000 scientific workers. If we include all engineers and service personnel, then the number of people occupied in the field of science exceeds 3 million, which is approximately 4 percent of our total working force. National expenditures on scientific research will total 13 billion rubles in 1971 (an increase of 8.3 percent over 1970), while the national income will increase by 6.1 percent.

However, the growing role of science is not purely quantitative; profound qualitative changes also are taking place. Economic, social, and cultural progess is increasingly dependent on scientific and technical achievements. The haphazard and limited application of scientific knowledge in pro-

duction is giving way to permanent ties between science and production. The economic and technical potential of any country, its power and defense capability, are at present, as never before, closely related to the state and progress of its science and technology. Hence we are faced with the difficult and complex task of learning how to control the development of science and technology in the interests of social progress.

Farsighted Plan Needed

We are concerned not simply with the rational planning of expenditures on science, the number and training of people employed in the field of science, the rational distribution and utilization of the available resources, obtaining maximum returns for investments in science, providing facilities for research, and the like. The issue is much broader and more fundamental; it concerns the future, the prospects for further development of human society, the leadership in scientific and technological progress, and the utilization of the latter for the benefit of mankind.

However, this goal can be achieved only with the help of the most advanced science. The socialist system has provided the objective prerequisites for an overall increase and improvement of social production, for the steady development of science, and for utilizing its results in production. To utilize these objective possibilities that are inherent in the socialist system it is necessary to organize the subjective activities of people. It is essential to learn how to control scientific technological advance in a planned fashion, foreseeing at each stage its perspectives and societal consequences.

If this is not done, further increasing investments in scientific activities, developing the network of scientific institutions, creating new research centers, increasing the production of special-purpose scientific equipment. and more widespread and even advanced training of scientific personnel cannot produce the necessary result. The scope and complexity of these issues are such that under present conditions they can be dealt with only on the level of government policy. The system of government measures aimed at directing scientific activities is called science policy.

Socialist Science Policy

The development of science, which is a complex social phenomenon and a special social institution, is subject to specific laws. Unless these laws are understood, it is impossible to organize, plan, and direct scientific activity correctly.

An integrated study of science as a complex system must be more than a mosaic of separate investigations of the economics, sociology, psychology, history, and logic of science.

So far, not one of the existing sciences has made it possible to carry out such an integrated study. This was the reason for establishing the science of science [naukovedeniye] as a special branch of research.

The science of science deals with the general laws governing the development of science and technology and the interaction of the economic, social, historical-logical, psychological, and structural and organizational aspects of the development of science and technology. Its purpose is to work out both the theoretical foundations for organizing, planning, and directing scientific activity and a concrete set of measures dictated by the objective logic of the development of science and technology. Thus, it ensures the optimum rate of scientific and technological progress and the increased effectiveness of scientific investigations and developments, forming a theoretical foundation for working out science policy principles.

At present it can be said without any exaggeration that developing and implementing a unified national policy for science is a new, but fully defined function of the state.

Obviously, the nature of a country's governmental structure will have a profound effect on its national science policy.

Policy is dictated by the tasks facing the country in a given period and also by the needs of science itself. Science is not a passive subject of policy. It actively affects

policy. Policy in the field of science changes as science develops and as the social functions of science change.

In the socialist state, science is expected to serve society.

Several issues of current importance in science policy can be noted in the socialist countries:

(1) the matter of improving the management of scientific activity in conjunction with the economic reforms being carried out in the socialist countries, and increasing the moral and material interestedness of scientists in doing scientific research and in applying their findings to practice;

(2) the matter of improving the system of managing science to keep pace with the rapid increase in the number of scientific institutions, the increased complexity of their structure, the increased level of competence of scientific personnel, and the accelerated rate of development of science;

(3) the specialization and cooperation of scientific research activities that ensure acceleration of the rate of development of science; and a rational utilization of the possibilities of specializing and dividing labor and, on the basis of this, the organization of overall cooperation;

(4) the rational distribution of scientific centers, taking into account the needs of economic, political, and cultural development.

Under the conditions of a planned socialist economy, science policy acts as an effective instrument for directing the development of productive forces both in the immediate and in the distant future. The corresponding areas of science policy can be called the tactics and the strategy of scientific activity.

Role of the State

Regardless of the social and economic structure of the country, there are several functions that can best be carried out only on the national level. These include such things as determining the amount of financial appropriations for scientific research; planning the development of science; planning current and future capital investments in science; coordination of scientific research plans with the plans for national development; coordination of the work plans of the scientific research organizations; systematic study of factors affecting the effectiveness of the work of the scientific research institutions; and working out the necessary measures to ensure the effectiveness of scientific activity, on the one hand, and organizing the introduction of the results of scientific investigations into practice, on the other.

The socialist state has great experience in running the various sectors of the economy and the entire national economy. This provides a good basis for working out the right forms of activity to develop science. However, on the whole, the state's forms of activity in the field of science are still in a formative stage. Some of these forms have been applied for dozens of years, while others have arisen relatively recently.

The system of financing scientific research is of paramount importance. There are two sources of funds: the first is from the state budget; the second is from the private funds of the enterprises and organizations; these sums must be included in the cost of industrial products and of building and installation, as well as in estimates of operational and distribution costs.

It must be pointed out that the state plans for the most important scientific research and experimental design activities include only the major complex projects that determine the future direction of development. Approximately 30 percent of the total expenditures on science is allocated to these projects. The remaining 70 percent is distributed among the ministries and the USSR Academy of Sciences, the agencies responsible for determining which research problems should receive attention. Research institutions are given the opportunity, in addition to the topics approved from above by the state and the industries, to decide what scientific problems need elaboration.

Information Management

An important part of state activity in de-

veloping science is the state system of scientific and technical information.

At present there are 82 branch information agencies in the scientific and technical information network. These include union republic institutes of information and more than 60 territorial centers. In addition, there are more than 8,000 bureaus and departments of scientific and technical information attached to the larger plants, factories, and scientific research, planning, and design organizations. In all, more than 130,000 people are employed in the system of scientific and technical information. There are seven all-union scientific research institutes of information in operation. The largest of them is the All-Union Institute of Scientific and Technical Information (VINITI). In addition to the basic permanent staff, more than 23,000 scientists and specialists participate in information work as non-staff consultants here.

The Problems of Forecasting

In recent years a great deal of attention has been paid to technological forecasting in the activities of the state agencies concerned with scientific development. Forecasts represent the first stage of all work done in managing scientific activity. First, forecasts for the most important independent branches of science and technology are worked out. These provide the basis for a unified forecast for the entire national economy. The scientific and technical forecasts are constantly corrected to take into account new data and new factors.

Technological forecasting involves the following aspects and functions of science:

(1) the problems – estimation of the amount of time needed to solve the problems already on the agenda and determination of the range of new problems; questions regarding the structure of science and the interrelations among its various areas;

(2) the social role of science – an issue that has many aspects, including the place of science in the social system, in technology, and in culture;

(3) the expanding sphere of science – not simply the extrapolation of existing growth rates into the future, but the development of criteria and the selection of a corresponding policy which contributes to the development of science and to the prevention of the negative consequences of inadequately assessed actions.

It should be pointed out that increased attention to the problems of forecasting has stimulated the development of well-founded methods of forecasting, over 100 of which are currently being applied in practice.

Obviously, forecasting cannot be applied to all problems in science and technology, especially in fundamental research. However, analysis of the trends of development of science and technology is essential for valid programming and planning of scientific and technological progress.

Long-Range and Current Planning

The most important state activity with regard to developing science is long-range and current planning, which determines both the main trends in scientific activity and the specific activities to be undertaken by scientific organizations and individual scientists.

Overall planning of scientific activity in the USSR is incorporated in the state 5-Year plans, which specify the basic scientific tasks to be undertaken and their expected results.

The main goal of the long-range plans is to stimulate scientific investigations and research on problems recognized as the most timely and in line with future developments. The most important task of the long-range plans is to create a sector for scientific work needing further processing, to eliminate excessive parallelism, and to ensure proper specialization of the scientific institutions.

Guided by the long-range plans, current planning in the field of science becomes increasingly specific and flexible. Current planning is done, as a rule, by the scientific research organizations. Current plans may include, in addition to the items spelled out by the long-range plan, topics

proposed by the researchers themselves, or topics proposed to them by industry or other customers.

Planning such a sphere of activity as science is difficult due to the fact that it is impossible to predict beforehand what the result of major fundamental research projects will be. This indeterminateness, which is greatest in fundamental research, decreases in applied research, and especially at the stage of development work. In the case of fundamental, or so-called "pure" research, planned regulation can be restricted to selecting the most promising (mainly related) trends and to creating favorable conditions for the activities of competent scientists and specialists.

At the applied stage, where expenditures noticeably increase, planning becomes more concrete. In the stage of development work, where expenditures are yet an order of magnitude larger, indeterminateness is reduced to a minimum and planning closely approaches that in production areas.

The starting point for planning scientific activity is not the immediate but the long-range goal. Therefore current planning is always combined with long-range planning. However, no matter how important planning is, it is but a stage of management. The flexible activity of all government organs in carrying out the plans is of great importance.

Management of science, besides planning, includes the following functions: organizing, coordinating, motivating (material and moral incentives), and control. The fact that there are a great many organizations participating in work on complex projects makes it necessary to set up coordinating plans and constant supervision over each project. The methods of network planning and management are widely used here. The experience of the Soviet Union convincingly demonstrates the possibility of and necessity for government control of the development of science, a control combined with broad initiative and extensive independent action by the scientific collectives and the individual scientists.

Advantages of Centralized Control

One of the key problems in the present development of science and technology is that of harmoniously combining centralized control of scientific activity with freedom of the creative potential of research collectives and individual researchers.

The notion that scientific activity does not need management is gradually becoming a thing of the past. The concept that present-day science needs certain organizational forms of centralized administration becomes more and more definitely established. At present, this organization is not limited to technological applications of science, but increasingly encompasses the area of fundamental theoretical research.

The necessity for centralizing the management of scientific activity in our times stems from several objective conditions:

(1) Contemporary science makes an integrated approach to the study of any phenomenon in nature or in society.

In the investigation of all basic problems of contemporary science, it is necessary to combine the efforts of scientists belonging to different fields of science, who approach the subject of research from different angles, apply different investigation methods, different equipment, a different conceptual framework, and so on. Work in any field of science requires division of labor and a harmonious combination of the activities of theoreticians and experimenters, scientists and technologists, etc. This gives rise to the need for proper organization of a given complex research project or overall program.

(2) Modern research requires expensive equipment and instruments in many fields. Frequently, when these implements are owned by one scientists' collective, they are a long way from being fully utilized. At the same time, we know that the scientific apparatus nowadays becomes obsolete very soon. Therefore the funds invested in it are only partially utilized.

Consequently, supplying scientific institutions with technical apparatus and organizing joint use of equipment appear to be logical central activities. For instance, there

is no need for each scientific institution to own its own computer. Setting up stations serving several institutions working in related fields will doubtless prove more suitable and economical.

(3) Centralization of the management of scientific activity is necessary also to achieve rational planning of research projects, personnel, means, and research equipment to ensure harmonious development of science, to establish a proper balance between theoretical and applied research, etc.

(4) The necessity for centralizing the organization of scientific activity under the conditions of a tremendously increased flow of information is tied in with the urgent task of organizing exchange of scientific information. In this connection, the role of the institutes of information increases, and a need arises for developing new, more efficient methods of accumulating and transmitting information (use of teletype, radio, and television for intercity and international effective scientific communication). An important task which also requires centralized efforts is the standardization of the statistics of science and developing a unique language for science – the unification of the conceptual framework, terminology, system of measurement units, etc.

(5) Arranging for the pooling of experience among countries and the cooperation of several countries in solving expensive, labor-consuming problems also call for centralized management of scientific activity.

(6) Safeguarding the priority of scientists and engineers, protection of authors' rights, patenting scientific achievements, etc., also require centralized management of scientific activity.

Centralized management of scientific activities is required, therefore, both by the internal needs of science itself and by the necessity of ensuring its contacts with the other areas of society's vital activities (industry, agriculture, culture, education, etc.).

Disadvantages of Centralized Control

Although centralized management of scientific activity is, in this manner, fully necessary in our times, it would be incorrect not to notice several negative trends that arise when the centralization of the management of scientific collectives is one-sided and excessive.

In industrial production, the drive for standardization and unification of units, parts, technology, and production processes is a sign of progress, of eliminating backward methods and the isolation of the handicraftsman.

The situation is different with regard to science. Rigid unification of the structure of scientific collectives reduces their mobility and productivity. Unification of opinions under centralized control is totally undesirable for science. The attempts to monopolize the right to truth, as we know, have brought nothing but trouble for science.

It is advisable in some cases to provide for a certain parallelism and rivalry in the activities of scientists – healthy competition between different research units. In order to ensure freedom of ideas, the development of different scientific schools of thought and creative competition should be encouraged.

Combining Flexibility and Stability

Combining flexibility and stability in the organization of scientific institutions presents special difficulties.

The structure of a given scientific institution that has developed in the course of decades does not easily yield itself to reorganization. It is usually much simpler to set up a new scientific research institute than to reorganize an old one – to change its field, and to set up new departments, sectors, and groups in it. The difficulty here lies, of course, not only in the conservatism of the organization as such, but in the complications inherent in any kind of organizational restructuring and the retraining of scientific personnel (whose average age is frequently well over 40 years). As a result, new departments, sectors, project groups and even entire institutes are set up, as a rule, not by retraining some of the workers, but by hiring new associates who have recently graduated from the higher educational institutions. As a result, the

number of scientific workers involved in old, traditional scientific trends is disproportionately large in comparison with the number of workers engaged in the newer and latest fields of science.

Consequently, the need arises for improving the organizational structure of the scientific institutions; for searching for new, less conservative, and most flexible organizational forms; and for creating more extensive opportunities for the scientific workers to transfer from work on one set of problems to another.

The new, more flexible and adaptable organizational forms of scientific research work cannot be designed a priori. In this area, the same as in several others, a carefully thought out, theoretically justified social experiment, taking into account past (both positive and negative) experience, is necessary. This is why, in particular, it is most essential to intensify serious research on the history of science.

The project principle, which permits combining the efforts of scientists with differing specialties for the sake of solving a general complex problem (and such is the majority of the contemporary scientific problems), apparently still remains at present the optimum principle on which to base the structuring of scientific institutions. It is apparently more expedient that the internal structure of the institutes should be governed by the project principle as well, by setting up groups and departments for performing a given task. This procedure would significantly contribute to unfolding the initiative of the more gifted workers and to creating a greater freedom for scientific investigation.

One of the possible wa''s of working out more flexible and more adaptable organizational structures would be, most likely, setting up for definite periods (3-5 years) inter-institute associations for undertaking a given complex problem that is of great theoretical and practical importance. Such an association could work on the basis of a single plan under the administration of the board of directors of a leading institute or a united authority set up by the corresponding ministry, department, or academy of sciences. Upon completion of the planned work and achievement of the goal set for the association, the latter would be disbanded, and its members would switch over to solving other problems of the institute or would join a new association.

Setting up such relatively short-lived associations for solving complex problems would, presumably, make it possible to solve complex problems much faster and cheaper. At the same time, these associations would doubtless help stimulate new ideas and renewed creativity in the laboratories. The era of the scientific and technical revolution is also a time of rapidly expanding differentiation and integration of scientific disciplines and of more extensive development of complex research. One of the main demands made on science is that it should become more flexible and adaptable and should become capable of being reorganized more easily and rapidly in a given manner, and in case of necessity, of being completely transformed. At the present rapid rate of development, science has too much stability and (in certain cases) conservatism.

Personnel — The Most Important Facet of Science Policy

During the years 1961-1969 the number of scientific workers in the USSR increased by more than 150%. However, the proportion of these with advanced degrees (doctor and candidate of science) decreased from 30.8% to 25.8%. In other words, the rate of increase of the total number of scientific workers exceeded the rate of increase of the number of people who had obtained advanced degrees.

Rational utilization of scientific personnel poses an especially difficult problem. As has been pointed out before, one of the serious obstacles to reorganizing the existing structure of scientific institutions is the difficulty, and in several instances, the impossibility of retraining scientific workers, of transferring them from one field of research to another. Actually, as science develops more rapidly and new branches and trends grow rapidly, the need for such a transfer of a certain number of workers in-

creases correspondingly. Within the span of the average creative period in the life of the scientific worker (25-30 years), all branches of science will progress so far, and so many new branches will appear, that an at least partial, and in many instances a complete, retraining of scientific workers, their changing from the solving of old problems to new ones, even if related, becomes essential.

The scientific worker's ability to be periodically retrained, and to change over from the solving of one set of problems under investigation to another, depends to a significant extent on the preparation that he has received. Therefore this issue is inseparably linked to how well the educational system meets the demands of the contemporary development of science and technology, and what provisions are made for improving the training, retraining, and utilization of scientific personnel.

All socialist countries pay great attention to the development and improvement of the system of higher education, and to the training of scientific personnel in particular. In the socialist countries, government expenditures on education (including elementary and secondary) are as a rule significantly higher than in the capitalist countries: in the USSR they constitute more than 8% of the national income; in Bulgaria, Hungary, Romania, Poland, the GDR, and Czechoslovakia, they constitute 5-6% of the national income.

From 1961 through 1968, the Soviet "vuzes" (special institutions of higher learning) trained 3.7 million specialists. During this period, the majority of the positions of scientific workers in the USSR were filled by the graduates of the natural science departments of the universities and technical vuzes.

It must be pointed out that the training of young scientists and highly qualified specialists could be significantly speeded up and improved if the educational system of the vuzes were improved. In the opinion of many specialists, the most suitable method for improving the vuz training of engineers is to strengthen the general science courses; this will enable the students to study special subjects on a higher theoretical level. Certain engineers, especially those working at scientific research institutes, keep pointing to the inadequacy of mathematics training at the vuzes — a gap which tremendously affects the effectiveness of their work.

The existing programs do not answer to the needs of training specialists in the fields needed by modern industry and the scientific research, planning, and design organizations. Therefore it becomes urgently necessary to work out scientifically based programs and curricula that correspond to the professional divisions of labor (researchers, designers, production managers, and such).

The necessity for an integrated and systematic approach to the question of training scientific personnel becomes increasingly evident. A system is needed under which the vuzes, industry, and the scientific institutions would be responsible for making the training of specialists correspond to the main trends of scientific and technical progress.

Traditionally, the training of personnel for scientific institutions in our country and in the other socialist countries has been carried out predominantly at the universities. However, a substantial number of university graduates is being sent to work in various branches of industry, to perform administrative or educational work and the like. All these specialists are trained for activities in essentially different fields, yet they are trained according to the same programs and follow the same curriculum. It would probably be advisable to consider increasing specialization in higher educational institutions not only by fields of knowledge, but also by those spheres of activity which their graduates will have to work on.

In the USSR, such forms of training and retraining scientific workers have developed as graduate study [aspirantura] (with leave from work, at evening courses, or correspondence courses), on-the-job training in research institutions, transfer to the position of junior or senior scientific associates, leave for creative activities, and others.

A significant number of scientific workers

are being trained through the graduate courses of the vuzes and of the scientific research organizations. In 1969, 25,800 received graduate degrees. This is 2.5 times the number of 1961 graduates and 12 times the 1940 number. In the course of 9 years (1961-1969), 158,000 people took graduate courses.

Of course, the role of the scientific research institutions in training personnel with advanced degrees is especially important. In the USSR during the postwar years, the number of graduate students [aspiranty] at the scientific institutions increased much more rapidly (almost twice as fast) than that at the higher educational institutions. The training of scientific personnel will continue to expand here.

Increasing the Effectiveness of Scientific Research

In 1968, the CPSU Central Committee and the USSR Council of Ministers adopted a resolution "Regarding Measures to Increase the Effectiveness of Scientific Organizations and Accelerate the Utilization in the National Economy of the Achievements of Science and Technology," which has played a significant role in the further progress of Soviet science and technology. The resolution envisages working out long-range, five-year, and yearly national economic plans, extensive utilization of the latest achievements of domestic and foreign science and technology and advanced experience. With reference to the most important problems of developing the national economy (production and equipment), it provides for long-range scientific and technological forecasting (for 10-15 and more years); it envisages expanding cooperation between scientific research, planning and design, and technological organizations and industrial enterprises both within the country and with the countries that are members of the Council for Mutual Economic Assistance.

Conclusion

These are only a few problems that the present scientific and technological revolution raises. The socialist system opens up tremendous possibilities for organizing scientifically all activities aimed at developing scien^ce and at technical progress. The task consists of making maximum use of these possibilities.

In 1971, the Soviet Union entered the Ninth Five-Year Plan. A most important landmark on the historical road of our development is the 24th CPSU Congress, which will sum up the results of the country's activities during the last period and will define the specific tasks of the present stage of communist construction. Soviet science and technology, which will continue to occupy an honored position in the vanguard of worldwide scientific and technical progress, play an especially great role in accelerating the rate of our progress toward communism.

A BRIEF COMMENTARY

by Louis Nemzer

Gvishiani's article was one of a series of policy statements issued at the time of the 24th Congress of the Communist Party in 1971, and it provides some significant clues about the scope and nature of the Soviet national science program. An important element in that program is a master list of 240 "most important problems," approved at the highest government levels. Several thousand research projects are devoted to these priority problems. Approval of the specific R&D plans, funding directly from the State Budget, and implementation of the projects are supervised by the State Committee for Science and Technology, a staff agency of the USSR Council of Ministers. Gvishiani, son-in-law of Premier Alexei Kosygin, is a First Deputy Chairman of that State Committee. Gvishiani reports that total R&D funding continues to rise in the Soviet Union, but the division of allocations is changing. This is shown by the table below. Note that in

R&D Funding in the USSR, billion rubles

Year	Total Amount	Amount Under State Committee	(Percent of Total)
1964	6.4	4.6	(72)
1968	~9.0	~5.4	(60)
1971	~13.0	~3.9	(30)

1964 Gvishiani's Committee was responsible for 72% of the total R&D budget. Most of this went for basic research and for long-scale applied research. A much smaller share was spent for development (especially industrial development). However, by 1971, the State Committee was supervising only 30% of the total R&D funding, which means that a far greater share than ever before is going to industrial development under the direction of the industrial ministries and enterprises. Incidentally, the 13 billion-ruble 1971 total would buy the equivalent of around $19 billion to $26 billion, depending on which estimate is used for the exchange value of the R&D ruble.

Has there been (as many Western writers claim) an erosion of ideology and Party control in the field of science? Gvishiani uses a variety of symbols which are tied to the traditional functions of the Party bureaucracy. He calls for more "efficiency" in pursuance of the kind of social progress tied to the Soviet type of society, and declares that there are "great objective possibilities available in the socialist system." He insists, however, that proper utilization of these "objective" possibilities requires the organization of "subjective activities of people." This usually refers to the broad area of attitudes, ideas, and relationships of citizens which the Communist Party agencies claim to mold and manipulate. It implies the process of continuing socialization and propaganda which the Party has long maintained, and against which Soviet scientists and engineers have apparently reacted with increasing resistance – although only a few of the signs of this resistance have come into the Western press.

Another of several clues pointing in the same direction is Gvishiani's emphasis on "increasing the moral (as well as material) interestedness of scientists" in their work, and the need for control of the efforts of scientific collectives and individuals. These clues presumably mean that the Party is seeking again to intensify the work of its agencies within the scientific and technological institutions.

Finally, we must comment on a major theme of Gvishiani's writings and speeches, reappearing in this article. He is one of the leading spokesmen for greater central control of science and technological development, and for utilization of modern (and, normally, western) ideas and processes of management in socialist society. Elsewhere he argues that the application of Marxism-Leninism in contemporary problems can succeed only if these new concepts are imported from western Europe and the United States and developed far beyond their present state.

In this article he insists on the necessity for the Soviets "to learn how to control scientific-technological advance in a planned fashion, foreseeing at each stage its perspectives and societal consequences." He sees such planned control as absolutely indispensible; without it the vast investment of resources, expansion of facilities, improvement of training processes for personnel "cannot produce the required result." This requires a science policy of very broad scope and great complexity, using authority available only to the central agencies of the State.

Gvishiani repeats here his support of those who are seeking to establish a "science of science," not merely trying to piece together in an incremental fashion a mosaic of clues about the nature of science, but seeking to learn through formal investigation the laws of scientific development, and then apply them in the organization, planning and direction of national science, research, and development. He calls for scientifically planned programs, closely monitored and tightly run, with ever-advancing techniques of management and control, which alone will "assure the optimum rate of . . . progress and the increased effectiveness of scientific investigation and development."

Current Literature

AFRICA

1754. *Survey on the Scientific and Technical Potential of the Countries of Africa* (In English and French), Unesco Field Science Office for Africa, Nairobi (Kenya), 1970, 296 pp. (Available from Unesco Publications Center, P.O. Box 433, New York, N.Y. 10016. Price: $6.00.)

Presents a country-by-country inventory of the 722 centres, stations, and offices that contribute to basic and applied research in 40 African countries, listing location, function, size of laboratory, size of staff, size of library, and brief history of each; gives numbers of research personnel available in all institutions, arranged according to disciplines; Appendixes define abbreviations, outline functional classifications, and list references.

ALASKA PIPELINE

1755. Banfield, A.W.F., "Anticipating the Effects of a Buried Gas Pipeline on the Northern Ecosystem", *Science Forum*, v. 5, no. 1, February 1972, pp. 15-17.

Describes extensive wildlife and vegetation studies performed as part of the overall feasibility study conducted by the Northwest Project Study Group (a consortium of oil and pipeline companies) to evaluate the possible impact of a buried gas pipeline in Alaska and Northern Canada; a survey on a major herd revealed that the herd's winter range is well south of the proposed alternative pipeline routes, and the bulk of the movements in the other seasons lay in a broad region between the routes; studies are continuing on winter carry-over of grass, the time required to form an insulating mat over the permafrost layer, and the effect of fertilizers; also planned are studies of the possible effects of noise produced by gas turbines on caribou and of possible excavation sites and their danger to fishes.

1756. "Interior Agency's Paper on Alaska Pipeline Takes No Stand, but Nixon Backing Likely", *Wall Street Journal*, 21 March 1972.

Describes the actions which could delay the start of the trans-Alaska pipeline construction until 1973; points out that the final draft environmental impact statement by the Interior Department offers arguments for and against the project but makes no recommendation.

1757. "The Big Pipeline: Focus on Impact", *Science News*, v. 101, no. 13, 25 March 1972, p. 199.

Describes some of the findings published in the Department of Interior's nine-volume study of the proposed Alaska pipeline, and reports that the study is not, as some conservationists had feared, a sellout to the oil companies; mentions the problems of shipping the oil by tanker across the treacherous Prince William Sound, permafrost melting, and erosion caused by extracting large amounts of gravel to be used as a base for the pipeline.

1758. "Dilemmas in Oil", *Toronto Globe*, 11 February 1972; reprinted in *Congressional Record*, v. 118, no. 38, 14 March 1972, pp. E2497-2498.

Describes Canada's strong opposition to the proposed trans-Alaska Pipeline System (TAPS); expresses concern over the safety of the proposed alternative, a trans-Canada pipeline; questions

Canada's lack of a requirement for environmental studies to be made and published before projects such as these are launched.

ANTARCTICA

1759. *Report on United States Antarctic Research Activities, 1970-71, and United States Antarctic Research Activities Planned for 1971-72,* Report No. 13 to SCAR, Committee on Polar Research, National Academy of Sciences, National Research Council, July 1971, 80 pp. (Available from Committee on Polar Research, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)

    Lists the past and planned activities of U.S. Antarctic research stations in the atmospheric sciences, earth sciences, biology, and vessel operations, by station, experiment, schedule, and personnel; presents an extensive bibliography of selected publications on U.S. Antarctic Research.

1760. *Earth Science Investigations in the United States Antarctic Research Program (USARP),* for the period July 1, 1970-June 30, 1971, A summary report prepared for the Working Group on Geology, Scientific Committee on Antarctic Research (SCAR), International Council of Scientific Unions, National Academy of Sciences-National Research Council, Washington, D.C. 1971, 44 pp. (Available from the Committee on Polar Research, NAS, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)

    Describes and lists by institution the activities of all active U.S. Antarctic geologists and solid earth geophysicists, along with a number of other earth scientists, giving field work, laboratory work, publications issued and in press, and future programs.

1761. *Biomedical and Behavioral Science Research in Antarctica,* Proceedings of the Colloquium held at Oklahoma Medical Research Foundation, Oklahoma University Medical Center, Oklahoma City, 18-19 March 1971, Review and Recommendations, by the Panel on Biological and Medical Sciences, 1971, 35 pp. (Available from the Committee on Polar Research, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.)

    Includes a statement by C. M. Pierce which discusses the relevance of Antarctic biomedical research to society in the 70's; summarizes the Colloquium and presents 4 recommendations agreed upon by the Panel in regard to biomedical, behavioral science, and human ecologic research in the Antarctic; presents abstracts of statements given by participants in the Colloquium and by Panel members.

ATMOSPHERIC SCIENCES

1762. "Pell Urges Ban on Military Weather Control", *Science & Government Report,* v. 1, no. 22, 12 January 1972, p. 4.

    Discusses the classified but generally acknowledged efforts by the U.S. Department of Defense to manipulate the weather for military purposes, referring to Project "Nile Blue", with a $2 million budget for FY 1971 and $3 million for FY 1972, for "Climate Modification Research" under DoD's Advanced Research Projects Agency Auspices.

AUSTRIA

1763. *Reviews of National Science Policy: Austria,* Organization for Economic Co-operation and Development, October 1971, 246 pp. (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Price: $7.00.)

Describes the development of science policy in Austria, calling special attention to the Country's historical and geographical situation; in 4 parts: (1) The R&D Effort, (2) Economic Structures and R&D Activities, (3) Training of Research Personnel and Research in Higher Education and Academic Sector, and (4) Resources and Prospects for Government Action; numerous tables and charts.

BIOLOGICAL SCIENCES

1764. *Research Programs Constituting U.S. Participation in the International Biological Program*, Report No. 4 of the U.S. National Committee for the International Biological Program, National Academy of Sciences, 1971, 121 pp. (Available from U.S. Committee for the International Biological Program, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418.)

Summarizes progress in organizing the research programs constituting U.S. participation and describes the status of research within these multidisciplinary studies, designed to provide a clearer understanding of the interrelationships within and among ecosystems; two types of research programs have been organized – coordinated and integrated – both having an environmental component and a human adaptability component.

1765. Kennedy, T. J., Jr., Sherman, J. F., and Lamont-Havers, R. W., "Factors Contributing to Current Distress in the Academic Community", *Science*, v. 175, no. 4022, 11 February 1972, pp. 599-607.

Identifies and discusses in detail the bases for the concerns that have been aroused in the biomedical research community: (1) sudden decline of NIH program growth, (2) inflation, and (3) marked variations in the funding of NIH components.

1766. "Ethics: Biomedical Advances Confront Public, Politicians, as Well as Professionals with New Issues", *Science*, v. 175, no. 4017, 7 January 1972, pp. 40-41.

Describes efforts to deal with the rapidly mounting number of ethical, social, and legal implications of advances in biomedical research, particularly in the areas of genetics, behavior modification, and abortion.

BRAZIL

1767. "U.S. and Brazil Sign Agreement on Scientific Cooperation", *U.S. Department of State Bulletin*, v. 65, no. 1696, 27 December 1971, p. 747.

Announces the signing on December 1 of a 5-year agreement aimed at intensifying the cooperation between U.S. and Brazilian scientists "and to provide additional opportunities to exchange ideas, information skills, and techniques to collaborate on problems of mutual interest, to work together in special environments, and to utilize special facilities".

BUDGET FOR SCIENCE AND TECHNOLOGY

1768. "Special Report: Fiscal 1973 R&D Budget", *Washington Science Trends*, v. 27, nos. 16-17, 24-31 January 1972, pp. 91-102. (Available from Trends Publishing, Inc., National Press Bldg., Washington, D.C. 20004. Price: $4.00.)

Reviews the "record-high" R&D portions of Nixon's FY 1973 budget, asking the greatest increase ($838 million) for Defense R&D to $8.5 billion, only $40 million for the new technological

opportunities program, and increases for virtually all agencies except space, making the total R&D obligations $17.8 billion ($1.4 billion above the FY 1972 sum); discusses the division among research, development, facilities, and academic R&D, as well as allocations for specific national goals and individual departments, agencies, and programs.

1769. Holmfeld, J. D., "New Budget Emphasizes Science and Technology", *SPPSG Newsletter*, v. 3, no. 2, February 1972, pp. 4-10.
Discusses the increase in Federal funding for R&D in 1973, which will be equally divided between defense and civilian R&D; discusses how the funds will be handled so as to focus R&D toward national needs and objectives; presents a brief description of budget outlays and planned activities for 1973 of the National Science Foundation, and of defense, space, atomic energy, environmental, and health R&D.

1770. *Statement of FY 1973 Budget and Program Summary*, National Science Foundation News Release NSF 72-106, 24 January 1972, 16 pp. (Available from National Science Foundation, Washington, D.C. 20550.)
Presents a breakdown of the Administration's $674.7 million NSF budget request for FY 1973 ($73.6 million more than for FY 1972), with a broad description of plans in each category; tables show (1) FY 1973 allocations in each of 15 categories along with corresponding allocations for FY 1971 and 1972, (2) major increases, (3) major decreases, and (4) 3-year comparisons of allocations for major activities within each category.

1771. "Whitehouse Seeks Backing for Technology", *Aviation Week & Space Technology*, v. 96, no. 11, 13 March 1972, p. 20.
Describes the new technology opportunities program of the U.S. Government, aimed at keeping U.S. industry competitive with overseas industry; lists the benefits which will accrue to the private sector of the economy – if Congress approves the budget for the program – including the generation of 65,000 immediate jobs for scientists, engineers, and technicians and 675,000 jobs of all types over 5 years; about 80% of the funds requested for FY 1973 are expected to be channeled to private industry R&D, universities, or nonprofit groups.

1772. Greenberg, D., "Causes of Budgetary Caution", *New Scientist*, v. 53, no. 784, 24 February 1972, p. 440.
Describes the Experimental Technology Incentives Program which is intended chiefly to prod industry into expanding its research activities, either on its own or in collaboration with government and academic laboratories; cites the reasons behind its low budget ($40 million) as lack of money for big new ventures and lack of understanding of how knowledge is transformed into goods and services; suggests that "whatever successes it [the program] achieves are likely to serve as models for a new, high-spending era in government relations with research".

1773. Ruckelshaus, W. D., "Statement on 1973 Budget", *Environmental News*, Environmental Protection Agency, Washington, D.C. 20460, 24 January 1972, 13 pp.
Describes qualitatively the Environmental Protection Agency's budget for FY 1973 which will be supporting larger efforts, for example, in research on air pollution control, on eutrophication problems, and on development of safer pesticides and better effluent guidelines; $2 billion of the $2.5 billion is earmarked for Federal matching grants to local governments for construction of sewage treatment facilities; presents highlights of the EPA's FY 1973 budget, for operations, research, and facilities, for construction grants, and for scientific activities overseas.

1774. "Prototypes: The Fight to Switch", *Astronautics & Aeronautics*, v. 10, no. 1, January 1972, pp. 9-10.

Discusses the desirability of changeover from paper studies to prototypes for U.S. aircraft and missiles and the difficulties in obtaining Government financial support despite the recognized benefits of prototyping (cutting waste, maintaining design teams, leading to more production hardware, demonstrating technology as a basis for selection of programs for engineering development, increasing the number of options and product reliability).

CANADA

1775. *A Science Policy for Canada*, Report of the Senate Special Committee on Science Policy, Volume 2, "Targets and Strategies for the Seventies", 1972, 608 pp. (Available from Information Canada, Ottawa, Canada. Price: $3.00.)

This is the promised sequel to Volume 1, "A Critical Review: Past and Present" [SPR 4(1):27]; reviews the background and framework of an overall science policy for Canada in the 1970's and makes specific recommendations for a "first generation of science policy" centered around basic research and industrial R&D and innovations; proposes a 1980 target of 2.5% of GNP for aggregate R&D expenditures; Volume 3 will deal with the "second generation of science policy" — social R&D and social innovations to improve the quality of life for Canadians.

1776. Forman, S. A., "Where all the Money Goes: Federal Expenditures on Science and Technology", *Science Forum*, v. 5, no. 1, February 1972, pp. 11-14.

Discusses a portion of the mandate for Canada's Ministry of State for Science and Technology which requires that it assist departments and agencies of Canada's government in supplying advice to the Governor of Canada with regard to the allocation of financial, personnel, and other resources to Canadian scientific endeavors; describes the procedures of Statistics Canada, a Federal mechanism for acquiring expenditure data; presents graphs showing the total costs of scientific activities by performer, by department or agency, by scientific activity, and of the Canadian Government overall.

1777. Goldak, J., "Innovation in a Cold Climate: What is really Wrong with Industrial R&D in Canada", *Science Forum*, v. 5, no. 1, February 1972, pp. 3-5.

Reviews the Canadian Science Council's report No. 15, *Innovation in a Cold Climate*, which analyzes Canada's faltering manufacturing industry and its implications for scientists; the Council concludes that future growth and stability of Canada's economy depends on a profitable manufacturing base and that the main impediment is the poor relationship which exists between government and industry; presents an excerpt from the report emphasizing the importance of technology transfer between government and industry, the need for government exploration of the possibility of creating new mechanisms for supplying capital to new and small companies, and the need for action by Federal and Provincial governments to remove the barriers that now prevent participation of financial institutions in enterprises based on technology.

1778. Sinclair, G., "Perpetuating Fallacies about Innovation in Canadian Industry", *Science Forum*, v. 5, no. 1, February 1972, pp. 5-10.

Charges that the Canadian Science Council's report, *Innovation in a Cold Climate*, continues the fallacy that lack of innovation is primarily due to a lack of R&D in industry, contending that the

real need is for policies to encourage the launching and development of small ventures; comments on various Council's findings, e.g., that Canadian industry has (1) an inadequate technological base, (2) limited market size and access, (3) poor climate for investment, and (4) inadequate management skills; believes that the importance of Items (1) and (2) can be overemphasized, that the real reason for Item (3) has been overlooked, and that it is questionable whether Item (4) is an important factor in the lack of innovation.

1779. Aspin, L., "Canada's Opposition to the Trans-Alaska Pipeline", *Congressional Record*, v. 118, no. 25, 23 February 1972, pp. H1405-1407.
Reprints an address by C. M. Drury, president of the Canadian Treasury Board, concerning Canada's need to conserve natural resources and to develop a national resource policy; Drury also describes the purposes and activities of the Canadian Task Force on Northern Oil Development and emphasizes that the Canadian Government favors the construction of a pipeline from Alaska, through Canada, into the continental U.S.

CHILE

1780. Hawkes, N., "Chile: Trying to Cultivate Small Base of Technical Excellence", *Science*, v. 174, no. 4016, 24 December 1971, pp. 1311-1313.
Describes efforts by Chilean scientific organizations and international organizations to bring technology to Chile; discusses the progress being made by Chile's major technical institute (INTECH) and by technical institutes dealing with problems in the fishing and copper industries.

CHINA

1781. Benn, A. W., "China — Land of Struggle, Criticism and Transformation", *New Scientist*, v. 53, no. 777, 6 January 1972, pp. 10-12.
Discusses the organization of Chinese science and technology, China's radical educational policy, and the concept of "struggle-criticism-transformation" — complete reexamination of policies and structures of all State institutions; describes some of the resulting changes, and concludes that this "radical" system, which is trying to make knowledge work more directly for it, has parallels in Western science and education.

1782. Esposito, B. J., "Science in Mainland China", *Bulletin of the Atomic Scientists*, v. 28, no. 1, January 1972, pp. 36-40.
Discusses the severe retardation of China's scientific advancement brought about by the Cultural Revolution with its high emphasis on production-related research; its policies of demanding increased political awareness, political activity, and attention to ideology on the part of scientists; its suspension or termination of scientific journals; and its policy of letting cadres untrained in science set the direction of research activities.

1783. "China: Science on a Swinging Pendulum", *Science*, v. 50, no. 10, 6 March 1971, pp. 17-21.
Presents a general view of the status of science and technology in China today; notes that while scientists and engineers have a central role in China's development plans, their work is politically dominated, almost all being applied to specific needs of industrial and agricultural production or medical care; also notes the emphasis on self-reliance and the prevailing belief that China, to meet national goals, must rely on both the traditional

and the modern; contends that basic research will be needed to ensure China's scientific capabilities.

1784. Galston, A. W., and Signer, E., "Education and Science in China", *Science*, v. 175, no. 4017, 7 January 1972, pp. 15-23.
Discusses the development and profound transformation of education (primarily University organization and curricula) and scientific research brought about by the Cultural Revolution; notable changes include control of universities and research institutes by political cadres, policies which involve universities and scientists working closely with factories or agricultural communes, integration of curricula with production, and change in emphasis from basic to applied research.

1785. Murphy, C. H., "Mainland China's Evolving Nuclear Deterrent", *Bulletin of the Atomic Scientists*, v. 28, no. 1, January 1972, pp. 28-35.
Describes in detail China's development of atomic and thermonuclear materials and warheads, various systems and testing capabilities, submarine fleet, and space program, all designed to provide China with a nuclear deterrent to attack by the superpowers (the U.S. and the Soviet Union); examines the effect of such development on future U.S.-China relations.

COMPUTERS

1786. Gassmann, H. P., "Computer Utilization in OECD Countries", *OECD Observer*, no. 54, October 1971, pp. 33-35.
Describes a programme developed by the OECD's Science Policy Committee to assist governments by providing information relevant to the policy issues in the field of computer utilization, namely those issues centering around development of data banks, creation of special networks for data transmission, and fixing responsibility for the training of computer specialists.

CUBA

1787. Ryder, W. D., "Lessons of Castro's Cuba", *New Scientist*, v. 52, no. 776, 30 December 1971, pp. 262, 264-265.
Examines the scientific and technological developments in Castro's Cuba, which have been possible only as a result of the material and human resources which the social revolution has made available; suggests that other Third World countries in the course of asserting and assuring their independence might learn from Cuba's blunders and successes in the application of science.

DEVELOPING COUNTRIES

1788. Odhiambo, T. R., "Emerging Lands Need Research", *New York Times*, 31 January 1972, reprinted in *Congressional Record*, v. 118, no. 13, 3 February 1972, pp. E767-768.
Describes the role of technology in bringing about the "green revolution"; states that "scientific research must become a part of national development plans of the developing countries"; cites the three ingredients vital to a successful science-based breakthrough in development: acquisition of new and relevant knowledge, availability of first-class managerial skills, and the existence of a well-defined and critical market.

1789. Sabato, J., "Ideas – Not Money – Are Lacking", *New Scientist*, v. 52, no. 776, 30 December 1971, pp. 250-252.
Discusses the lack of understanding in developing countries on

the part of both the public sector and the scientific and technical community of their mutual role in the development process; contends that science and technology must be recognized as development tools and that the "professional" role of scientist and technologist — to produce good research and development — must be transformed into the "social role of active participants in the development process".

1790. Bauer, P., "Foreign Aid: Necessary? Useful? Damaging?", *New Scientist*, v. 52, no. 776, 30 December 1971, pp. 252-258.
Challenges widely held views regarding foreign aid; maintains that foreign aid is not indispensable for material progress and cites eight ways in which its advocacy and flow induce many repercussions which offset its beneficial effects, e.g., foreign aid promotes centralization of power and thus increases political tension and struggle, and programs supported by foreign aid often have negative productivity.

1791. Prentice, R., "280 Million More Jobs to Find", *New Scientist*, v. 52, no. 776, 30 December 1971, pp. 258-259.
Urges drastic changes in development programs by developing countries and aid donors to cope with their critical unemployment situation: shifts in emphasis from prestige projects to labor-intensive projects, from the urban to the rural sector of the economy, and from professional-level training to middle-level vocational training; untying of aid programs to purchase of goods from donor countries; and radical improvement in both the quality and quantity of aid.

1792. Jones, G., "The Manager's Role is Vital", *New Scientist*, v. 52, no. 776, 30 December 1971, pp. 260-262.
Emphasizes the importance of good management at both the government and industry levels to economic development in Third World countries; describes the shortage of management skills and the constraints imposed on management education and training efforts, particularly lack of experienced teachers and socio-cultural attitudes which differ from those in developed countries.

1793. Baranson, J., "An Economic Lesson from Developing Countries", *Chemical Technology*, v. 2, no. 1, January 1972, pp. 10-13.
Submits that industries in developing countries need "product selection policies that limit industrialization to a cost-efficient range, avoid chauvinistic import substitution, and aggressively pursue external markets"; explores cost-efficient industrialization and the need for technical adjustments in product design, product mix, and production techniques in, for example, the chemical and automotive industries.

EAST GERMANY

1794. "German Democratic Republic: Attack on Pollution", *Science Policy*, v. 1, no. 1, January/February 1972, p. 2-3.
Enumerates measures to protect the environment in the GDR: the 1970 Environment Protection Law, recultivation of strip-mined land, construction of dams and reservoirs, and water-treatment activities; outlines the administrative setup, wherein local authorities have direct responsibility, overall management is under the GDR Council of Ministers, and there is a coordinating committee of agency heads, environmentalists, and private citizens.

ECONOMICS AND SCIENCE

1795. *Selected Readings on Science, Technology, and the Economy*, Prepared for the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, 1 October 1971, 95 pp. (Available from the Committee on Science and Astronautics, U.S. House of Representatives, Washington, D.C. 20515.)

Presents 47 excerpts from books, articles, reports, and other writings that touch upon the relationship of science and technology to the economy, as viewed by economists, government officials and bodies, and leaders of the academic and industrial communities.

1796. Johnson, H. G., "Some Economic Aspects of Science", *Minerva*, v. 10, no. 1, January 1972, pp. 10-18.

Discusses problems facing science as a result of being supported largely by the taxpayer – principally, the need to prove science's value to a public which often sees science as the source of unexpected and sometimes uncomfortable change, hampered by lack of standards to judge performance or promise and means to measure economic benefits of scientific research.

1797. Jones, P.M.S., "Lessons from the Objective Appraisal of Programmes at the National Level – Implications of Criteria and Policy", *Research Policy*, v. 1, no. 1, November 1971, pp. 10-26.

Explores the problem of formulating objective, coherent science policies on the basis of the numerical methods of investment appraisal and cost-benefit analysis; considers the place of R&D in the economy, using a model linking production, consumption, and the quality of life with resource utilization; discusses methods of developing an overall R&D strategy; explains the application of decision analysis to justifiable R&D investment levels; concludes that no overall coherent objective approach to national R&D resource allocations is yet possible.

1798. "Economists Link R&D to Economy", *Washington Science Trends*, v. 27, no. 18, 7 February 1972, pp. 103-104.

Summarizes analyses by 2 groups, the President's Council of Economic Advisers and a White House Conference Board, leading to the conclusion that every effort should be made to restore R&D funding to at least the same fraction of the GNP as it was in the 1960's in order to sustain the advance of scientific knowledge and the pace of technological innovation required for healthy growth of the U.S. economy in the 1970's and 1980's; discusses incentives for industry to carry out its own R&D and the need for direct Government support in particular circumstances.

1799. Anderson, E. V., "Trade Deficit Puts New Emphasis on Technology", *Chemical & Engineering News*, v. 50, no. 6, 7 February 1972, pp. 11-13.

Notes the emphasis on technology, innovation, and investment as the routes to overcoming the trade deficit in the U.S.; contends that the Government must exert greater effort to improve the climate for R&D; discusses the extent of investment in R&D as well as in new plant and equipment in West Germany and Japan; urges exploitation of new technology regardless of where it is developed.

1800. Harr, K. G., Jr., "Technology and Trade: Essential Economic Partners", *Vital Speeches of the Day*, v. 38, no. 9, 15 February 1972, pp. 267-270.

Notes the present weakened position of the U.S. in international trade; emphasizes that: (1) "only through technological advance can we hope to achieve continued economic and social progress",

(2) "the solution to many of the problems confronting the nation will require new forms of government/industry cooperation", (3) "we must have the same kind of dedication from industry that has brought us to our present preeminence in high-technology development", and (4) "we must have an entirely new approach by labor to the world we now live in".

1801. Jones, R., "Innovation is More Than R&D", *New Scientist*, v. 53, no. 780, 27 January 1972, pp. 200-202.
Examines the relationships between R&D, innovation, and economic growth on both company and national level; describes the anti-growth movement occasioned by environmental concerns, which are already viewed as exaggerated in some cases; contends that the economic importance of technology cannot be overridden by its side effects, and that economic growth must remain a social goal for some time.

1802. "Technology and National Growth", *Astronautics & Aeronautics*, v. 10, no. 3, March 1972, pp. 35-43.
Presents statements by members of the AIAA's Forum panel: B. Fox, from the Harvard Business School, describes the changes that have brought about economic growth and increased technological development, and stresses the need for continued growth; E. Cole, President of General Motors Corp., emphasizes the need for an accelerated pace of technological development; H. Uchida, Consul General of Japan, discusses the implications of technology for Japan; M. McCormak, U.S. Congressman, discusses Congress' increasing willingness to support R&D; W. Magruder, Special Assistant to President Nixon, describes the savings and benefits that would accrue to society from new applications of technology.

1803. Gregory, W. H., "New Technology Program, Election Year Fiscal Stimuli May Spur Aerospace", *Aviation Week & Space Technology*, v. 96, no. 11, 13 March 1972, pp. 12-13.
Describes the improved economic outlook for 1972 which is expected to result from increased Federal spending: aerospace sales will rise from \$22.6 billion in 1971 to \$23.1, military aircraft spending will increase from \$7.7 billion to \$8.1, business flying sales will increase from \$130 million to \$400 million, and avionics, the most active aerospace segment, will have sales of about \$9 million.

1804. Curtis, C. T., "American Technology Spurred by the Space Shuttle", *Congressional Record*, v. 118, no. 37, 13 March 1972, pp. S3832-3835.
Describes the U.S.'s weakening position in international trade and emphasizes the importance of the space shuttle as a stimulant to advanced technological development; reprints an article from *Business Week*, January 15, 1972, which discusses the urgent need for a national policy on technoiogy, the increasing international competition in the aircraft industry, the extent of Federal control, and possible means of regaining our trade lead.

EDUCATION

1805. *Engineering and Technology Graduates – 1971*, Report compiled by the Engineering Manpower Commission of the Engineers Joint Council, 76 pp. (Available from Engineers Joint Council, Department P, 345 East 47th Street, New York, N.Y. 10017. Price: \$5.00.)
Presents results of a survey of colleges, junior colleges, and technical schools granting 2-year degrees in technology and bachelor of technology degrees; indicates that a record number of technical degrees were awarded in 1971 (over 28,000 2-year

degrees and 5000 bachelor degrees); presents degree statistics broken down by school, curriculum, and degree level, with the greatest number in electrical engineering.

1806. "Trends in Graduate Education in Science and Engineering, 1960-70", *Reviews of Data on Science Resources*, no. 20, National Science Foundation Report NSF 71-15, November 1971, 8 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 15 cents.)

Analyzes U.S. Office of Education data which indicate that increases in graduate enrollments and number of advanced degrees in science and engineering granted between 1960 and 1970, while substantial, lagged behind those in other fields (science and engineering enrollment declined from 38% of total graduate-school enrollment in 1960 to 31% in 1970); shows breakdowns by fields of science and type of degree (master's or doctor's).

1807. *Graduate Student Support and Manpower Resources in Graduate Science Education*, Fall 1970, Surveys of Science Series, National Science Foundation Report, NSF 71-27, 1971, 105 pp. (Available from the U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.25.)

Presents statistics for 1967-70, showing a decline in graduate student enrollment in the physical and mathematical sciences and engineering, an increase in the social and life sciences, and a substantial increase in the enrollment of foreign graduate students; classifies the types of financial support of full-time graduate students, and notes the decline in Federal support and the growth of self-support; describes the distribution of full-time faculty members and of postdoctoral appointments by field, with the heaviest concentration in the physical and life sciences.

1808. *Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1970*, A Report to the President and Congress, National Science Foundation, Report NSF 71-28, July 1971, 105 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402, Price: $1.25.)

Discusses the distribution and pattern of Federal obligations for R&D among U.S. universities, colleges, associated Federally funded R&D centers, and selected other nonprofit institutions; analyzes support by geographic locality and institution, including comparisons of the relationship between the distribution of Federal R&D support and such variables as the types of science degrees awarded; includes numerous graphs and tables.

1809. "Undergraduate Enrollments in Science and Engineering", *Science Resources Studies Highlights*, NSF 71-42, 5 January 1972, 6 pp. (Available from National Science Foundation, Washington, D.C. 20550.)

Summarizes findings from 80,000 completed questionnaires obtained through an NSF-sponsored survey conducted by the American Council on Education to examine resource requirements for science and engineering education of all students, whether or not they are science majors; notes that 86% of over 6 million undergraduates were enrolled in one or more science or engineering courses in 1969, and over half were enrolled in 3 or more such courses; shows breakdowns by major field, course type, male vs. female students, white vs. black students, public vs. private institutions, university vs. 4-year colleges vs. 2-year colleges.

1810. *Advanced Science Education Program*, National Science Foundation Brochure, 1972, 11 pp. (Available from Advanced Science Education Program, Division of Graduate Education in Science, National Science Foundation, Washington, D.C. 20550.)

Announces a new education program instituted by the National Science Foundation which is designed to foster the planning and implementation of experimental instructional approaches to graduate sciences education; describes the types of proposals to be given primary consideration, and presents guidelines for the preparation of proposals.

1811. "Big Enrollments Worry Chem Departments", *Chemical & Engineering News*, v. 50, no. 11, 13 March 1972, pp. 22-23.

Discusses reasons for the vast increases in enrollment in chemistry courses: interest in medical, dental, and public health professions prompted by belief that they offer financial security and are worthy occupations, and the poor employment picture in other areas; describes concerns over sufficiency of funds, faculty, and space to meet the demand.

1812. *The Conversion Research and Education Act of 1971, H.R. 34*, Hearings before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, no. 11, 22-24 June, 13-15 July, 5-6 August 1971, 732 pp. (Available from the Committee on Science and Astronautics, U.S. House of Representatives, Washington, D.C. 20515.)

Presents prepared statements of 33 Representatives and testimony by 23 "civilian" witnesses relevant to H.R. 34, a bill to authorize the National Science Foundation to conduct research, educational, and assistance programs to prepare the U.S. for conversion from defense to civilian, socially oriented R&D activities; reprints the text of the bill, including the roles of the NSF, the Economic Development Administration and the Small Business Administration; calls for $100 million through FY 1972 for the conversion loan fund.

1813. *National Institute of Education: Preliminary Plan for the Proposed Institute*, a report prepared for the Department of Health, Education, and Welfare, February 1971, 199 pp. (Available from Communications Department, The Rand Corporation, 1700 Main St., Santa Monica, California 90406. Price: $4.00.)

Presents a detailed preliminary plan for the National Institute of Education (NIE), its primary objective being "to improve and reform education through research and development", discusses its organization, its major program areas (alleviating major educational problems, advancing educational practice, strengthening education's foundations, and strengthening the R&D systems), and its functions in terms of these program areas; presents a tentative program listing, emphasizing that the next planning step for the NIE should be the development of an improved *Agenda for Education R&D.*

1814. Grayson, L. P., "Costs, Benefits, Effectiveness: Challenge to Educational Technology", *Science*, v. 175, no. 4027, 17 March 1972, pp. 1216-1222.

Defines educational technology as "a systems approach to instruction, incorporating specific measurable instructional objectives, diagnostic testing criteria for student performance . . ., and the repeated redesign of the curriculum materials . . ."; observes that technology has great potential for improving education and extending educational services to all; emphasizes that proper planning for educational technology is essential to keep costs from becoming prohibitive and stresses several practices to ensure this.

1815. "Opening the Way for Innovation in Education", *OECD Observer*, no. 54, October 1971, pp. 17-26.

States the objectives of the Centre for Educational Research and

Innovation (CERI): briefly, to provide and support the development of research activities in education as well as pilot experiments to introduce and test innovations in educational systems, and to provide the development of cooperation between member countries in the field of educational research and innovation.

1816. **"Technology and Society, A New Curriculum at Stevens Institute of Technology", 6 pp.** (Available from the Director of Admissions, Stevens Institute of Technology, Castle Point Station, Hoboken, New Jersey 07030.)
Describes the new Technology and Society curriculum at Stevens, created to bridge the gap between advanced technology and the requirements of society; the undergraduate program is divided into two, 2-year segments: (1) a fo ndation in science and mathematics similar to that giver o traditional engineering curricula, plus economic, political, and social analysis; and (2) a sequence of courses in the humanities.

1817. **Hiles, D. A., and Heywood, J., "Teacher Attitudes to Projects in A-Level Engineering Science",** *Nature*, **v. 236, no. 5341, 10 March 1972, pp. 61-63.**
Presents the results of a survey revealing that teachers favor project work over conventional teaching methods; reasons cited include: projects engendered enthusiasm, encouraged initiative and independence, and generated confidence; compares the objectives of coursework in A-level engineering science, as published by the U.K. Joint Matriculation Board, with those considered important by the teachers directly involved.

ENERGY – CRISIS

1818. **McLean, J. G., "New Year's Resolutions: The Energy Crisis",** *Vital Speeches of the Day*, **v. 38, no. 9, 15 February 1972, pp. 277-280.**
Summarizes briefly the essential facts of the U.S. energy situation, and offers 3 specifications which must be initiated in 1972 as a prelude to the development of a comprehensive, carefully integrated national energy policy: (1) decontrol of natural gas prices, (2) diversification in the energy industries, and (3) lifting from the national to the international level our concern with energy matters.

1819. *Changed Underlying Factors Influencing Electric Load Growth*, **A Report to the Federal Power Commission prepared by the Technical Advisory Committee on Load Forecasting Methodology for the National Power Survey, 1971, 46 pp.** (Available from Federal Power Commission, Office of Public Information, 441 G Street, N.W., Washington, D.C. 20426.)
Discusses major factors influencing electric load forecasts which are new or have changed since the 1970 National Power Survey: control of effluents into air and water, effect of population growth, conservation of resources, degree of inflation, capital requirements for industry, and fuel availability; considers the increasing concern for environmental protection as the most momentous change; concludes that there will be an increase in electric loads over those forecast in the 1970 survey.

1820. **McClure, J. A., "The End of Cheap Energy",** *Congressional Record*, **v. 118, no. 17, 9 February 1972, pp. E1035-1037.**
Reprints a speech by C. A. Robinson, Jr., staff counsel for the National Rural Electric Cooperative Association, which explains the rising cost of generating electricity and gives projections for future energy and fuel supply shortages which underscore the seriousness of the problem; stresses the need for a massive energy research program to uncover new energy sources or develop those now available but deemed unworkable.

1821. "Coal Gasification Technology at Center Stage", *Chemical & Engineering News*, v. 50, no. 2, 10 January 1972, pp. 36, 38.

Describes the importance of coal gasification as a means of offsetting diminishing natural-gas supplies; states that foreign gasification technology is ahead of that in the U.S.; describes research on the four possibly competitive processes in the U.S.: the Bi-gas, Synthane, Hygas, and molten-salt processes.

ENERGY – ENVIRONMENT

1822. *Engineering for Resolution of the Energy-Environment Dilemma*, Committee on Power Plant Siting, National Academy of Engineering, 1972, 340 pp. (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $10.50. A 49-page summary is available from the Committee on Power Plant Siting, NAE, same address.)

Examines power plant siting requirements in relation to potential adverse impacts on the environment, and engineering approaches to their mitigation; presents pertinent recommendations and supporting technical information; deals with such topics as the nature and sources of air pollution from power plants, aquatic environmental zones and siting considerations, radiation protection standards and criteria, and the management of land and natural resources in relation to power plant siting.

1823. "Energy and Environment on a Collision Course", *Ecology Today*, v. 2, no. 1, March/April 1972, pp. 2-4.

Presents views of W. D. Ruckelshaus, Environmental Protection Agency Administrator, on the energy-environment question; suggests 3 guiding principles: energy and energy-invested material must be recovered whenever possible; true energy needs must be carefully calculated and weighed against potentially competing human needs; and new energy systems must be developed to make better use of our resources; weighs the cost/benefits of pollution control.

1824. Eckhardt, "Electricity and the Environment", *Congressional Record*, v. 118, no. 43, 21 March 1972, pp. H2302-2303.

Points out that the ecological effects are inadequately considered by electric utilities in planning for new generating facilities; introduces a bill calling for establishment of a Regional Planning Council in each power region designated by the Federal Power Commission, to guarantee sound long-range planning and provide for a rational siting and certification process wherein the public, Government, environmental, and utilities interests are represented.

1825. Levin, A. A., Birch, T. J., Hillman, R. E., and Raines, G. E., "Thermal Discharges: Ecological Effects", *Environmental Science & Technology*, v. 6, no. 3, March 1972, pp. 224-230.

Notes the projected increased demand for electrical power with the consequent increased thermal pollution; discusses the results of studies on effects of thermal pollution of rivers, lakes, estuaries, and oceans conducted at generating-plant sites; concludes that, with a few exceptions, there has been no major damage to the aquatic environment from waste heat discharges by existing power plants, but contends that continued study is imperative to permit predictions as to what will occur as the nation's electrical generating capacity increases.

1826. Williams, L. O., "The Cleaning of America", *Astronautics & Aeronautics*, v. 10, no. 2, February 1972, pp. 42-51.

Proposes a system of large nuclear power plants in the oceans, producing both electrical power and hydrogen, which would fuel

inland powerplants and mobile power sources and satisfy most other energy demands; examines in detail the technical realities that lead to such a system, and demonstrates its practicality; claims that this system would produce abundant energy without air or thermal pollution.

1827. **Blodgett, J. E.**, "The AEC and the Environment", *SPPSG Newsletter*, v. 3, no. 1, January 1972, pp. 4-7.
Discusses the profound implications of the D.C. Court of Appeals' Calvert Cliffs decision last July, directing the AEC to include water quality considerations in its environmental impact review [under Sec. 102(2)(C) of the National Environmental Policy Act] for the licensing of nuclear power facilities, instead of relying on an applicant's authorization by a state water quality authority under the Water Quality Act; some consequences: review and possible delay of some 90 previously licensed projects, rewriting of AEC licensing regulations – making the AEC directly responsible for evaluating total environmental impact, and several Congressional actions.

1828. **Saxbe, W. B.**, "Environmental and Consumer Advocacy", *Congressional Record*, v. 118, no. 36, 9 March 1972, pp. S3745-3746.
Reprints an editorial from the Washington Post which describes questions relating to the safety of nuclear power plants and where to locate them; calls for a long-range program of allocating sites for power plants on an area basis, and for public debate on the issues involved.

ENERGY – NATIONAL POLICY

1829. **Coughlin, L.**, "National Energy Policy – Part XII", *Congressional Record*, v. 118, no. 2, 19 January 1972, pp. E211-213.
Presents an extensive list of books, studies, reports, articles, and speeches on energy use in general, energy and the environment, energy and the economy, fuel and energy, and new sources and uses of energy, to demonstrate the need for a national energy policy; supplements previous lists in the July 1, July 13, Sept. 8, and Sept. 22, 1971 *Congressional Records*.

1830. **Hansen, O.**, "Energy and the Quality of Life", *Congressional Record*, v. 118, no. 31, 2 March 1972, pp. E1864-1865.
Presents comments by H. G. Curtis, General Manager, Northwest Public Power Association, stressing man's dependence on energy to assure quality of life; contends that man cannot survive without energy consumption and that the people, not the utilities, must determine the energy demands and the public policies affecting such demands.

1831. **Doub, W. O.**, "The Option-Policy of Energy Supply", *AEC News Releases*, v. 3, no. 11, 15 March 1972, pp. 5-8.
Stresses the need for a national energy policy; notes the options available for obtaining the great amounts of energy required to meet future demands, describing two: the fast breeder and thermonuclear fusion; calls for cooperation among the Government, industry, and the utilities.

1832. **Hottel, H. C., and Howard, J. B.**, "An Agenda for Energy", *Technology Review*, v. 74, no. 3, January 1972, pp. 38-48.
Assesses the technical and economic adequacy of existing or proposed energy- and fuel-conversion processes and their consistency with developing standards of environmental quality; suggests areas where additional federally supported effort (research, development, and demonstration projects) is most needed to accelerate changes: fuel conversion, nuclear power, central power from fossil fuel, and solar energy utilization.

1833. "Energy, Environment, and People", *Congressional Record,* v. 118, no. 35, 8 March 1972, pp. S3623-3625.

Reprints two addresses by Sen. Moss emphasizing that "one of the most critical areas of national importance today lies in balancing our requirements [for energy] and responsibilities [environmental and societal] to arrive at a sound national energy policy", cites basic needs, including: stepped-up energy research, new and more acceptable means of energy production, legislation covering surface mining, and economic incentives for investment in the development and protection of natural resources and energy supplies.

1834. Daly, H. F., "Electric Power, Employment, and Economic Growth", presented before American Association for the Advancement of Science; reprinted in the *Congressional Record,* v. 118, no. 16, 8 February 1972, pp. S1364-1370.

Examines arguments put forth by advocates of continued growth in the generation of electrical power: it is needed to increase the standard of living, clean up pollution and recycle waste, maintain an acceptable level of employment, produce devices which give us the military defense and deterrent capacity "upon which world peace depends"; discusses society's desire to continually grow, become more affluent, and increase economy and employment and the demand it creates for increased power generation; suggests that this desire must be curbed if an "energy-plateau" is ever to be reached.

ENERGY – NUCLEAR

1835. *The Nuclear Industry in '71: Never a Dull Moment,* News Release INFO, Public Affairs and Information Program, December 1971, 8 pp. (Available from C. Goldstein, Atomic Industrial Forum, Inc., 475 Park Avenue South, New York, N.Y. 10016.)

Examines the development of the nuclear power industry in the U.S. during 1971 (15% growth) and prospects for electrical generation by breeder reactors; cites problems connected with the power-generation sector of the nuclear industry such as long lead time from construction to licensing (8-9 years), siting difficulties, stricter licensing requirements, and waste disposal; lists commercial nuclear generating units in the U.S. with capacities larger than 100 mw net.

1836. Seaborg, G. T., and Carliss, W. R., *Man and the Atom: Building a New World through Nuclear Technology,* E. P. Dutton & Co., Inc., New York, N.Y., 1971, 412 pp. ($10.00)

Deals with the peaceful uses of the atom, its role in the technological revolution, and its benefits to mankind; contains 12 chapters grouped in 3 parts – Atomic Tools, Applying the Tools, and The Atom and Society – plus 2 appendixes and glossary; indexed.

1837. Packwood, B., "Nuclear Power", *Congressional Record,* v. 118, no. 10, 31 January 1972, pp. S742-750.

Reprints from *Intermountain Observer* (Boise, Idaho), a 4-part article by P. Henault, an atomic scientist and a director of the Idaho Environmental Council, which examines the safety of nuclear energy as a source of electric power, presents the pros and cons of establishing nuclear power plants, presents both sides of the issues surrounding radioactive waste disposal and thermal pollution, and describes the advantages and disadvantages of the liquid-metal fast-breeder reactor; presents an editorial describing Henault's background and an article calling for wide and intelligent public discussion on the questions posed by nuclear power generation.

1838. Feare, T. E., "Fusion Scientists Optimistic Over Progress", *Chemical & Engineering News*, v. 49, no. 52, 20 December 1971, pp. 33-34, 37.

Points out some decisions which must be made (primarily in spending rate beyond 1972) for future development of commercial fusion power; describes some recent developments in maintaining and confining plasmas (Tokamaks, magnetic mirror systems, laser-pellet fusion, and intense relativistic electron beams) and some optimistic environmental impact and safety considerations of fusion reactors.

1839. Weinberg, A., "Prophet of Nuclear Power", *New Scientist*, v. 53, no. 779, 20 January 1972, pp. 140-142.

Suggests that with nuclear energy "the whole world can enjoy a standard of living even higher than that of the present day inhabitants of the United States"; envisions a network of 24,000 nuclear reactors grouped in 3000 "nuclear parks"; claims that fusion and solar energy are too speculative, that nuclear power is the only alternative, and that it can be made safe and clean; points out that substitution of uranium for coal would reduce the amount of debris to be handled by 2 or 3 orders of magnitude.

1840. "Utilities Fall Short of AEC Breeder Goals", *Washington Science Trends*, v. 27, no. 15, 17 January 1972, p. 85.

Discusses the failure of utilities to provide their expected share of the cost for construction of the first breeder-reactor demonstration plant.

1841. Gillette, R., "Schlesinger and the AEC: New Sources of Energy", *Science*, v. 175, no. 4018, 14 January 1972, pp. 147-151.

Describes the efforts of the AEC's new chairman J. R. Schlesinger to revitalize the AEC, bolster its public image and give it new sense of purpose, reorganization, firmer management, and expansion of AEC's activities to include R&D in other, nonnuclear fields of energy.

1842. Doub, W. O., "Quality – The Name of the Game", *AEC News Releases*, v. 3, no. 6, 9 February 1972, pp. 2-7.

AEC Commissioner Doub notes the increasingly forceful expressions of concern by the public and the resultant increased emphasis on quality assurance; discusses means of achieving quality assurance, particularly in the civilian nuclear-power plants; points out that the AEC has a wide range of requirements (and means to enforce them) which constitute a formidable quality assurance program; contends that top management of utilities must become involved in quality assurance, and each company needs to develop its own disciplined approach.

1843. Lapp, R. E., "Nuclear Power Safety and Emergency Core Cooling", *Congressional Record*, v. 118, no. 35, 8 March 1972, pp. E2151-2152.

Warns that present reactors may not be employing an adequate margin of safety and points out the danger of employing siting practices that fail to consider the future population in the high-risk zone around reactors; contends that AEC safety research is inadequate and future-oriented, whereas such research is needed now, especially in the area of emergency core-cooling systems.

1844. Anderson, J. B., "Environmental Problems", *Congressional Record*, v. 118, no. 29, 29 February 1972, pp. H1568-1569.

Criticizes efforts to place a 1-year moratorium on further licensing of nuclear power plants, presenting reserve-capacity data which illustrate the adverse effects of such a moratorium; presents a table showing the emission levels of fossil fuel plants

with a megawatt capacity equivalent to that of a number of nuclear facilities scheduled for operation this year.

1845. Weinberg, A. M., and Hammond, R. P., "Global Effects of Increased Use of Energy", *Bulletin of the Atomic Scientists*, v. 28, no. 3, March 1972, pp. 5-8, 43-44.

Presents a case for two theses: (1) that mankind must have an alternate, essentially inexhaustible energy source, which must be nuclear, and (2) that there are probably no insuperable global effects even if nuclear energy from fission breeders reaches 60 times the total energy man now produces.

1846. McKnight, A., "Peaceful Nuclear Explosions – Behind the Brouhaha", *New Scientist*, v. 53, no. 781, 3 February 1972, pp. 256-258.

Criticizes Dr. E. Teller for emphasizing the prospects of peaceful nuclear explosions while ignoring the hazards and technical difficulties; describes possible applications of PNE (e.g., gas storage or mineral recovery) pointing out the further research and development needed to demonstrate feasibility and minimize hazards.

ENERGY – UNCONVENTIONAL SOURCES

1847. Heronemus, W. E., "The U.S. Energy Crisis: Some Proposed Gentle Solutions", presented before the ASME and IEEE; reprinted in *Congressional Record*, v. 118, no. 17, Part II, 9 February 1972, pp. E1043-1048.

Advocates the use of two sources of energy, windpower and sea-thermal power, which combined could satisfy all projected energy demands; contends that they could be developed with existing technology, would be economically competitive with other systems, would be pollution free, and would have minimal ecological impact.

1848. Horvath, J. C., and Chaffin, R. L., "Geothermal Energy, Its Future and Economics", *Atlanta Economic Review*, December 1971; reprinted in *Congressional Record*, v. 118, no. 34, " March 1972, pp. S3553-3560.

Describes the present status of geothermal power development and the growing worldwide interest in geothermal energy; discusses the potential of geothermal energy, its environmental implications, and its economics; describes the plowshare concept of geothermal development now under study in the U.S.

1849. Foley, Q., "They are All Getting on the Geothermal Power Bandwagon", *Sun-Telegram*, 28 February 1972, reprinted in *Congressional Record*, v. 118, no. 35, 8 March 1972, pp. E2163-2164.

Describes the overwhelming interest in geothermal power as evidenced by attendance at the Geothermal Resources Council's first national conference, attracting such people as oil men, big investors, Government officials, land owners, and geologists; notes that U.S. development of geothermal resources lags far behind that in such countries as Italy, New Zealand, Japan, Russia, and Mexico; describes increasing scale of geothermal power exploration in California.

1850. Johnsen, K., "NASA Plans Expanded Program to Exploit Space Solar Power", *Aviation Week & Space Technology*, v. 96, no. 13, 27 March 1972, p. 21.

Reports on NASA's plans to augment its programs to develop a space-deployed system to transmit limitless solar energy to the earth and to dispose of radioactive waste on the sun; mentions that the main problem with using solar energy is its price, and reports that the space shuttle can be used to dispose of the mounting supplies of radioactive wastes on the sun.

1851. **Udall, M. K., "Solving the Power Crisis",** *Congressional Record,* **v. 118, no. 39, 15 March 1972, pp. 2593-2594.**

Presents an article by A. B. Meinel which describes the concept of solar energy conversion and the technology involved; discusses the economic barriers to solar power in terms of percentage efficiency; asserts that solar energy can be helping to meet our power needs within 2 decades, and has the potential for supplying all of the nation's power needs in the future.

1852. **Cowen, R. C., "Betting on Solar Power",** *Technology Review,* **v. 74, no. 4, February 1972, pp. 5-7.**

Describes efforts to develop practical systems for converting solar energy into usable power through research on vastly superior heat-absorbing and heat-storage materials; emphasizes the large amount of research yet needed, though solar energy is considered one of the real possibilities for the long-term future.

1853. **Bostrom, K., "In My Opinion – Fusion Power, Not Nuclear Fission, is the Answer to Energy Needs",** *Milwaukee Journal,* **reprinted in** *Congressional Record,* **v. 118, no. 12, 2 February 1972, pp. S980.**

Claims that if humanity is to survive we must learn to duplicate the sun's fusion power, and calls for increased funds for such development; cites advantages of fusion power: no hazards, negligible pollution, unlimited resources from the oceans and inland seas – and, once installed, fusion power is "free" and "unlimited".

ENVIRONMENT – BIBLIOGRAPHY

1854. *Environmental Pollution: A Select Bibliography,* **Bibliography No. 5, January 1972, 7 pp.** (Requests to be put on the mailing list for this and future bibliographies should be sent to The Secretary, Science Studies Unit, Edinburgh University, 34 Buccleuch Place, Edinburgh EH8 9JT, Scotland, U.K.)

Lists 72 unannotated references through 1970 under the headings A. General Aspects, B. Air Pollution, C. Marine Pollution, D. Derelict Land, E. Noise, F. Radioactivity, G. Freshwater Pollution, H. Pesticides, I. Solid Wastes, J. Industrial Effluents, K. Sewage Disposal, and L. Built Environment.

1855. *Ecology and the Natural Environment,* **Bibliography No. 7, January 1972, 27 pp.** (Availability: same as Ref. 1854.)

Lists 412 unannotated references through 1971 under the headings 1. Values and Attitudes: Ethics and Religion, 2. Political and Legislative Aspects, 3. Economic Aspects, and 4. Educational Aspects.

ENVIRONMENT – INTERNATIONAL COOPERATION

1856. **Halpern, S., "On Worldwide Controls",** *Congressional Record,* **v. 118, no. 47, 27 March 1972, pp. E3056-3059.**

Encourages international cooperation on pollution abatement, so that the controls will protect the environment and prevent one nation from being put at an unfair trade disadvantage; presents an article which reviews the implications for international trade inherent in national environmental protection programs.

1857. **"A Watch on the World",** *Nature,* **v. 235, no. 5335, 28 January 1972, pp. 186-187.**

Reviews a report entitled *Global Environmental Monitoring,* published by the Scientific Committee on Problems of the Environment (SCOPE), which recommends establishment of a permanent global monitoring system (through international cooperation based on national efforts) and a U.N. agency to coordinate monitorings and help define international environ-

mental policy.

1858. Sterling, C., "Environmental Improvement and World Trade", *Washington Post*, 16 February 1972; reprinted in *Congressional Record*, v. 118, no. 26, 24 February 1972, pp. S2516-2517.

Points out the problems that exist today because the U.S. has not taken a multilateral approach toward achieving international accords on standards to protect the environment which will not disrupt the international trade balance.

1859. Halpern, S., "In Support of H.R. 13116, A Bill to Promote International Cooperation in United Nations Efforts to Protect the World's Oceans and Atmosphere", *Congressional Record*, v. 118, no. 37, 13 March 1972, pp. H1980-1981.

Describes the responsibility of the National Commission on International Trade and the Environment to be created by bill H.R. 13116, namely, to undertake a comprehensive investigation to determine 7 important facts; these include: what antipollution measures and recommendations relating to industrial pollution are being proposed by the U.N., whether any competitive advantage is given to foreign producers by enforcement of U.S. antipollution measures, ways in which the U.S. can avoid pricing itself out of the world market d how to enforce U.S.-proposed antipollution standards without placing any nation at an unjust trade disadvantage.

1860. *International Field Year for the Great Lakes, News Releases:* (1) "Canada, U.S. Join in Study to Provide Basis for Improved Lake Management"; (2) "United States Participation in IFYGL"; (3) "Canada's Approach to IFYGL". (Available from Public Affairs Office, NOAA, U.S. Department of Commerce, Rockville, Md. 20852.)

Describes plans for a joint U.S.-Canadian concentrated year-long study (IFYGL) of Lake Ontario for the purpose of reporting the condition of the lake, describing the lakes processes and interrelationship among the hydrological, chemical, and biological elements, and creating computer models which will enable scientists and others to predict the effects of proposed changes in the lake use or environment; the study will be of benefit in solving such lake-management problems as pollution control and control of lake levels, and will result in improved weather forecasts; delineates the extent of participation by the U.S. and Canada and their respective agencies having responsibility for the study.

ENVIRONMENT – MAN INTERACTION

1861. Meadows, D. N., Meadows, D. L., Randers, J., and Behrens, W. W., III, *The Limits to Growth*, a Potomac Associates Book, Universe Books, New York, N.Y. 10016, 1972, 205 pp. (Clothbound, $6.50; Paperback, $2.75)

Summarizes the main features of a world model built to investigate five major trends of global concern – accelerating industrialism, rapid population growth, widespread malnutrition, depletion of nonrenewable resources, and a deteriorating environment – and their causes, interrelationships, and implications, major conclusions are: that the limits to growth on this planet will be reached within 100 years if present growth trends continue unchanged, with an attendant sudden decline in population and industrial capacity; that it is possible to alter these growth trends and establish a condition of ecological and economic stability that is sustainable far into the future; and that if the peoples of the world decide to strive for a condition of stability, the sooner they begin, the greater will be their chances of success.

1862. "Another Whiff of Doomsday", *Nature*, v. 236, no. 5341, 10 March 1972, 47-49.

Presents a critique of the book *The Limits to Growth* (Ref. 1861); observes that the book is marked by oversimplification and that the predictions are based on a necessarily rudimentary model; points out weaknesses attending the calculations; claims that the global aspect is misleading, predictions being based on a single set of parameters; points out that the Club of Rome urges radical reform of institutions and political processes, and international planning on a grand scale, but has no constructive suggestions concerning either.

1863. Fedorov, E. K., "The Interaction of Man and the Environment: The Situation Today and Outlook for the Future", *Bulletin of the Atomic Scientists*, v. 28, no. 2, February 1972, pp. 5-10.

Academician Fedorov, Chief of the Hydrometeorological Service of the USSR, in his address to the July 1971 Dartmouth VI Conference in Kiev, discusses factors influencing the capacity of the earth to support human life and concludes that the finiteness of the planet does indeed impose a limit on human population – a limit that depends on the use of living space, the use of resources, and man's ability to avoid war, and hence cannot be determined now.

1864. Behan, R. W., and Weddle, R. M. (Eds.), *Ecology, Economics, Environment*, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, Mont. 59801, 1971, 198 pp. ($3.95, Paperback)

Presents nine lectures given during the course on Ecology-Economics-Environment conducted by the School of Forestry, University of Montana; in four parts – The Dimensions of the Issue, Some Facts on the Matter, Bread and Beyond, and Challenge and Response.

1865. Turk, A., Turk, J., and Wittes, J. T., *Ecology, Pollution, Environment*, W. T. Saunders Company, West Washington Square, Philadelphia, Pa. 19105, 1972, 217 pp. ($3.95, Paperback)

Deals with those aspects of biology, chemistry, physics, demography, and engineering related to interactions between man and the rest of the earth, particularly those that tend to disrupt previously established systems and processes; contains 10 chapters – Introduction to Ecology, Agricultural Environments, Pesticides, Radioactive Wastes, Air Pollution, Water Pollution, Solid Wastes, The Growth of Human Populations, Thermal Pollution, and Noise – with an annotated bibliography at the end of each chapter.

1866. "Ecology, Survival and Society, *Science News*, v. 101, no. 7, 12 February 1972, pp. 100-101.

Describes the controversy aroused by an article, "Blueprint for Survival", appearing in *The Ecologist*, January 1972; the article asserts that only adoption of a new life style can save mankind and that we must achieve a stable, community-oriented society to avert sociological and/or ecological collapse; cites articles in *Nature* taking issue with these assertions, and a *New Scientist* article which embraces them.

1867. Swift, J., "Flaws in the Blueprint", *New Scientist*, v. 53, no. 782, 10 February 1972, pp. 320-321.

Discusses an article entitled "Blueprint for Survival", appearing in *The Ecologist*, which suggests a solution to the environmental crisis: achievement of a stable society with little disruption of ecological processes, conservation of energy and materials, zero population growth, and an unconstricting social system; contends that "Blueprint" fails to deal with questions as to how wealth is to be shared more equitably between individuals and between

nations, whether a decentralized economy is compatible with rapid technological change, and whether an eco-utopia would be repressive and authoritarian.

868. Lewis, A., "Life and Politics at Home and Abroad", *New York Times*, 17 January 1972; reprinted in *Congressional Record*, v. 118, no. 1, 18 January 1972, p. E130.
Quotes from an article which stresses the need for a revolution in attitudes and abandonment of some basic human ideas (instinct for fertility, worship of economic growth); cites a book which puts the annual cost of ecological reconstruction in the U.S. at over $40 billion – a great challenge; proposes that the first step is for politicians to recognize the gravity of the ecological crisis and face the whole problem squarely.

1869. Mines, S., "Backlash", *Ecology Today*, v. 1, no. 11, January 1972, pp. 32-35.
Reviews the backlash now emerging from the enthusiastic concern for the environment; discounts the positions held by M. H. Stans (Secretary of Commerce) and H. S. Houthakker (former member of President's Council of Economic advisors) concerning pollution control, and efforts by advocates of such positions to undermine the work of the Environmental Protection Agency.

1870. Gilluly, R. H., "Man and Environment: Fighting the Backlash", *Science News*, v. 100, no. 25, 18 December 1971, pp. 410-411.
Reviews a publication, "Man in the Living Environment", issued by the Institute of Ecology, which highlights the harmful effects of phosphates, lead, and mercury on the environment as well as human practices (agricultural, aquatic) that lead to environmental destruction.

1871. Bradshaw, T. T., "Closing Circle on Environmental Economics", *Chemical & Engineering News*, v. 50, no. 8, 21 February 1972, pp. 22-29, 31-33.
Presents the views of environmentalists B. Commoner and Lawyer-economist L. O. Kelso concerning the changing nature of environmentalism and environmentalists, and points out the striking similarities in their views – both contending that environmental degradation is an inevitable consequence of the world's existing economic and political institutions, and that a new economy must be created, fitted to the dictates of both the ecological and human imperative; Commoner cites misuse of technology as the major factor influencing the environment, with population and affluence following; both men support advances in properly managed technology; Kelso suggests an economic solution which resembles universal profitsharing.

1872. Goodling, G. A., "Pollution Can Be Controlled", *Congressional Record*, v. 118, no. 17, 9 February 1972, pp. E1126-1128.
Presents the remarks of M. K. Goddard, secretary of Pennsylvania environmental resources, concerning the effects of public pressures for pollution control and the "ecology-environment crusade"; acknowledges that these forces have produced some good results, but warns that pressures based on fear and lack of complete understanding of the problems may force hasty actions without full consideration of their possible consequences.

1873. "Scientists Plumb the Unknowable Future", *Chemical & Engineering News*, v. 50, no. 2, 10 January 1972, pp. 27-28.
Discusses theories of scientists concerning how we can cope with the resource and environmental limitations of the earth now and in the future; examines the role of economics in establishing a balance: for example, concerning energy resources. states that only a pricing strategy that reflects fully internalized social costs can effect stability in the man-energy-environment system.

1874. **Packwood, B., "Need for a Global Dynamics Assessment System",** *Congressional Record,* **v. 118, no. 38, 14 March 1972, pp. S3927-3929.**

Stresses the need for periodic assessment of the major forces (population, industrialization, food supply, natural resources, and pollution) that will determine the future of mankind; presents an article by C. Sterling describing the findings of the first global computer study designed to measure those forces and predicting collapse of the world system within 100 years, if present exponential growth trends continue.

1875. **Pelly, T. M., "Remarks of Hon. John Dingell to Conference on Environmental Law",** *Congressional Record,* **v. 118, no. 28, 28 February 1972, pp. E1678-1681.**

Rep. Dingell produces a strong case for the concept that a high-quality environment is not something which stands in the way of economic prosperity; Dingell also discusses the many important consequences of the National Environmental Policy Act, and contends that "if we are to have a wholesome approach to the environment, the public must be brought fully into the decision making processes on environmental questions".

1876. *Environmental Improvement – Agriculture's Challenge in the Seventies,* **Proceedings, 19th Annual Meeting of the Agricultural Research Institute, October 13-14, 1970, Agricultural Board, National Research Council, 1971, 141 pp.** (Available from National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $4.00.)

Starts with a discussion of public understanding of agriculture; four papers under "Air" deal with agriculture's role in setting criteria and controlling air pollution; five papers under "Soil" treat land use and soil pollution in relation to agriculture; "Water" is discussed in five papers, with emphasis on the role of agriculture in establishing quality criteria and controlling water pollution.

ENVIRONMENT – U.N. CONFERENCE

1877. **Schatz, G. S., "U.N. Conference on the Environment: Recommended First Steps",** *News Report – NAS, NRC, NAE,* **v. 22, no. 1, January 1972, pp. 1, 6-7.**

Describes a report of a National Academy of Sciences panel, requested by the U.S. Department of State, recommending, among other things, the establishment of "an independent global environmental science advisory and research board to provide scientific counsel to decision makers in intergovernmental and government agencies" and support of proposals such as that for development by the U.N. of a global environmental monitoring system.

1878. **"U.S. Comments on Plans for U.N. Conference on the Human Environment",** *U.S. Department of State Bulletin,* **v. 66, no. 1701, 31 January 1972, pp. 128-134.**

Presents a statement by Rep. Moynihan in Committee 'I of the U.N. General Assembly together with the text of a resolution, sponsored by Sweden and adopted by the Committee and the Assembly; Rep. Moynihan comments on the remaining preparations for the U.N. Conference, the draft conventions anticipated to come before the Conference, and the complex questions of development and the environment; describes the concerns of developing countries over possible efforts to control their populations; discusses emission control by developed countries.

1879. **Gillette, R., "News About Stockholm Isn't All Bad, State Officials Say",** *Science,* **v. 175, no. 4025, 3 March 1972, p. 969.**

Notes expressions of cautious optimism about the prospects for concrete accomplishments at the forthcoming United Nations Conference on the Human Environment in Stockholm; anticipates agreement on a Declaration of the Human Environment and on a convention to regulate ocean dumping; emphasizes an important spin-off of the elaborate international preparations for the Conference – the arousal of global interest in environmental problems on a large scale.

1880. **Hawkes, N., "Human Environment Conference: Search for a Modus Vivendi",** *Science*, **v. 175, no. 4023, 18 February 1972, pp. 736-738.**
Discusses the controversies in store for the U.N. Conference on the Human Environment: the diplomatic dispute over whether E. Germany should have full representation at the Conference, the conflicting views on the seriousness of certain environmental problems (population explosion, pollution, pesticides, noise pollution) between developed and underdeveloped countries, and the differences in emphasis within the developed world; concrete accomplishments are expected, however, in the areas of ocean pollution, establishment of a global atmosphere and ocean monitoring system, creation of an international registry of chemical compounds, and support for research into forecasting the effects of economic growth on human welfare.

1881. *The Human Environment*, **a two-volume work published by Woodrow Wilson International Center for Scholars, Smithsonian Institution Building, Washington, D.C. 20560.** ($5.00 per volume)
Volume I consists of an annotated bibliography of reports and documents on international environmental problems, including documents issued in preparation for the U.N. conference on the Human Environment and individual works dealing with various social, political, and economic aspects of widespread environmental problems; Volume II contains full summaries of official reports prepared for the Conference by more than 70 nations and an overall commentary; the reports summarized in Vol. II analyze environmental problems and priorities of the participating nations and include recommendations for national and international action.

ENVIRONMENTAL AGENCIES

1882. **Symington, J. W., "Environmental Protection Agency",** *Congressional Record*, **v. 118, no. 28, 28 February 1972, p. E1706.**
Presents two articles, one revealing the imbalance in the Environmental Protection Agency's (EPA) buget – $2.16 billion for water pollution control leaving only $29 million for control of air pollution, solid waste, pesticides, radiation and noise – and the other revealing the low priority given to the environment in the total budget, with the space shuttle program being given the lion's share ($5.5 billion); both question the degree of emphasis on, and the sincerity of the Administration's commitment to, environmental quality.

1883. *Toward a New Environmental Ethic*, **Environmental Protection Agency, September 1971.** (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 60 cents.)
Describes the many roles of the Environmental Protection Agency in combating pollution: serving as a regulatory agency and as a research body; providing technical and financial assistance to state, regional, and local jurisdictions; providing training to develop highly skilled manpower needed to deal with environmental problems; and serving as a source of information to the public.

1884. **"EPA Publishes Manual on Agency's Legal Authority",** *Environmental*

News, Environmental Protection Agency, Washington, D.C. 20460, 1 March 1972, 1 p.

Announces the publication of a 2-volume manual entitled *EPA Current Laws*, which contains all existing statutes and executive orders governing the Agency; the manual will be available through the U.S. Government Printing Office.

1885. *Environmental Quality: The Second Annual Report of the Council on Environmental Quality*, August 1971, 360 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.00.)

Examines in depth two fundamental aspects of environmental quality – economics and legal developments; reviews the status of and trends in environmental quality and developments, particularly among the States, since 1970; describes a number of environmental problems of the inner city; includes the President's transmittal message, 7 Chapters, numerous tables and charts.

1886. Andrews, R.N.L., "The Council on Environmental Quality: An Evaluation", *Congressional Record*, v. 118, no. 44, 22 March 1972, pp. E2853-2854.

Examines the powers, achievements, and problems of the CEQ during its first years of existence; discusses CEQ's guidance of Federal agencies in their implementation of the National Environmental Protection Act; describes legal limitations in CEQ's power to compel action, CEQ's "prolonged birth pangs", lack of any objective framework for systematically evaluating environmental consequences, and planned future activities.

1887. *National Environmental Laboratories*, A compilation of comments and materials related to a proposed environmental laboratory, prepared for the use of the Committee on Public Works, U.S. Senate, No. 92-3, 1971, 459 pp. (Available from Committee on Public Works, U.S. Senate, Washington, D.C. 20510.)

Presents a collection of solicited comments from interested parties (primarily from universities and existing laboratories) in the U.S. to be used as background for anticipated hearings on a bill to establish a system of National Environmental Laboratories (Ref. 1895); presents the text of the report of the Environmental Study Group to the Environmental Studies Board of the National Academy of Sciences, entitled "Institutions for Effective Management of the Environment", which concludes that present institutional arrangements for effective environmental management are inadequate and makes a number of suggestions aimed at improving them, including greater emphasis on environmental monitoring and the establishment of a National Laboratory for Environmental Science.

1888. Serrin, J., "'Earth Day' Year Around", *American Education*, January 1972; reprinted in *Congressional Record*, v. 118, no. 21, 17 February 1972, pp. E1279-1280.

Describes ventures of the Ecology Center and ENACT (Environmental Action for Survival), two groups of dedicated amateur environmentalists: in particular, the Center's waste recycling efforts and establishment of organic gardens, and ENACT's sponsorship of a cleanup of the Hudson River and its highly successful environmental teach-in.

1889. "EPA Sets Up Interagency Group to Aid in Review of State Air Implementation Plans", *Environmental News*, Environmental Protection Agency, Washington, D.C. 20460, 13 February 1972, 2 pp.

Spells out the objectives of the newly established interagency task force: to keep the concerned Federal agencies informed on the status of EPA's review of the State plans, to identify key issues raised by EPA's analysis of the cumulative effects of the proposed State plans, and to coordinate the appropriate agency analysis of significant policy issues.

1890. "The Engineer as Environment-Fixers", Editorial in *Washington Star*, 27 February 1972; reprinted in *Congressional Record*, v. 118, no. 28, 28 February 1972, p. E1675.

Discusses the practicality of redirecting the resources and skills of the Army Corps of Engineers toward such environmental redemption tasks as depollution and reclamation; describes the Corp's efforts to expand its environmental contributions and its conflict with the Environmental Protection Agency.

ENVIRONMENTAL LEGISLATION

1891. Carpenter, R. A., "National Goals and Environmental Laws", *Technology Review*, v. 74, no. 3, January 1972, pp. 58-63.

Examines U.S. laws directed toward environmental protection (such as the National Park Service Act of 1916 and the National Environmental Policy Act); concludes that in light of today's knowledge and change made possible by technology our laws are internally inconsistent; points out that environmental-protection strategies based on rigid numeral standards and time tables of compliance have been rejected as being arbitrary and unscientific, and holds the view that in a democracy, an ethic of environment quality is the only basis for progress.

1892. Connor, J. T., "Zero Discharge: National Goal or National Calamity?", *Congressional Record*, v. 118, no. 10, 31 January 1972, pp. E638-640.

Secretary of Commerce Connor expresses concern that water-pollution legislation emerging in the form of Senator Muskie's bill would result in considerable damage to U.S. industry, to the entire economy, to Federal, state, and local government credibility, and to all taxpayers; suggests studies to determine the human and economic costs of enforcing such legislation; contends that the goal of zero discharge would be costly to attain, is unrealistic, and is perhaps even an unnecessary degree of perfection.

1893. "Government Backs Environment", *Environmental Science & Technology*, v. 6, no. 3, March 1972, pp. 207-211.

Describes the budget outlays for Federal environmental programs for FY 1973, in which the largest single increase goes to the air pollution program; notes the backlog of environmental legislation facing Congress, for which amending the Water Pollution Control Act is of first priority; discusses the relative success of the Environmental Protection Agency and the Council on Environmental Quality; describes the effectiveness of National Environmental Policy Act (NEPA), some agencies' failure to comply with the law's requirement for environmental impact statements, and how statements prepared fared in the courts.

1894. Atkeson, T. B., "An Overview of the Impact of NEPA on the Federal Government Decision Making Process", *Congressional Record*, v. 118, no. 26, 24 February 1972, pp. E1626-1629.

Describes support of the Executive Branch of the U.S. Government in implementation of the policies and requirements of the National Environmental Policy Act (NEPA); discusses the role assigned to the Council on Environmental Quality under NEPA (coordination, guideline, and impact-statement-review responsibilities), and the issues NEPA posed for the governmental decision maker; emphasizes the need for comprehensive energy, transportation, and land-use policies to resolve the questions posed by NEPA.

1895. *National Environmental Laboratories, Part I*, Hearings before the Subcommittee on Air and Water Pollution of the Committee on Public Works, U.S. Senate, 28-29 April, 3-6 May 1971, no. 92-H17,

1971, 609 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.50.)

Presents the text of the hearings on S.1113, a bill to "establish a structure that will provide integrated knowledge and understanding of the ecological, social, and technological problems associated with air pollution, water pollution, solid waste disposal, general pollution, and degradation of the environment, and other related problems"; discusses the objectives and organizations of the National Environmental Laboratories which would be created by S.1113 (the National Environmental Laboratory Act of 1971).

1896. Rarick, J. R., "Water Pollution Legislation: Its Benefits and Its Threats", *Congressional Record*, v. 118, no. 11, 1 February 1972, pp. E678-680.

Contends that if the House version of the Federal Water Pollution Control Act Amendments of 1972, H.R. 11896, is passed, its environmental benefits will be more than offset by the social, economic, and technological costs required to implement it; reprints an article which examines certain concepts embraced by the bill and expresses concerns about the technical feasibility of elimination of all discharges into waterways by 1985; about the effluent limitation standards; about the two-phase approach to attaining the "no discharge" goal; and about the impact of the contract-authorization concept of the economy.

ENVIRONMENTAL RESEARCH

1897. Johnson, H. W., "Toward a National Policy for Environmental Research", *Technology Review*, v. 74, no. 4, February 1972, pp. 8-9.

Describes the complex nature of environmental problems and the inadequacy of our standard classic research and development approach in dealing with them; claims that institutional innovation is necessary to develop structures for both basic and applied research, development, demonstration, early warning, post-hoc evaluation, and feedback; suggests expansion of a variety of environmental activities, such as research and educational activities in colleges and universities, and R&D laboratories coupled to educational institutions, to industrial groupings, or to government agencies; observes that the Federal Government should see to the "formulation and enunciation of a coherent national strategy for R&D on environmental problems".

1898. *Environmental Research Laboratories in the Federal Government*, An Inventory in Two Volumes, 1972, approx. 1000 pp. (Available from Policy Institute, Syracuse University Research Corp., 723 University Ave., Syracuse, N.Y. 13210. Price: $20.50.)

Provides data on over 170 Federal laboratories with capabilities in environmental research; includes information on personnel, function, budget, facilities, publications, history, responsibilities, and major current in-house environmental research programs for each site; accompanied by a user's guide and detailed index.

FACILITIES FOR R&D

1899. *Problems Associated with Converting Defense Research Facilities to Meet Different Needs: The Case of Ft. Detrick*, Report to the Congress by the Comptroller General of the United States, 16 February 1972, 31 pp. (Available from U.S. General Accounting Office, Room 6417, 441 G Street, N.W., Washington, D.C. 20548. Price: $1.00.)

Describes Fort Detrick conversion problems, including size of the

facility and its work force, finding an agency willing to assume responsibilities as landlord, and lack of firm plans and funds by prospective users; recommends that the Office of Management and Budget (1) coordinate the efforts of defense and civil agencies in planning the conversion and transfer of national resources, (2) consider favorably requests for funds to help such a facility remain operational, and (3) designate a host agency where multiagency use of a large facility is proposed.

1900. "A Stringent Recipe for Viability", *Nature*, v. 236, no. 5341, 10 March 1972, pp. 52-54.

Describes the consequences of decreased funding for the AEC's high-energy physics program: reduction in manpower supported by the program, withdrawal of support from three accelerators, and decline in use of the remaining one; discusses possible actions the AEC might take to keep each facility viable and productive, even with a lowered budget, e.g., reduce the program scope of some facilities or operate at less than full capacity.

FINLAND

1901. "Finland: Organization of Environmental Control", *Science Policy*, v. 1, no. 1, January/February 1972, pp. 2-2 – 2-3.

Describes the proposed reorganization of Finland's now scattered environmental bodies into a single unit within the Ministry of the Interior; this would involve consolidation of the Water Board, the Conservation Bureau, the Delegation for Air Pollution Questions, the Committee for the Living Environment, together with the Delegation for Environmental Questions.

FOREIGN AFFAIRS

1902. "Notes on Recent Developments in International Science/Technology Affairs", *International Science Notes*, no. 26, January 1972, pp. 3-6, U.S. Department of State, Bureau of International Scientific and Technological Affairs, Washington, D.C. 20520.

Discusses State Department's recent emphasis on the *technology* aspects of science and technology in foreign affairs, in the interest of improving the U.S. balance of payments through high-technology exports like computers, launch vehicles, satellites, and fuel; describes the U.S.-French informal agreement to share each other's unique research facilities over the broadest spectrum; outlines some problems to be faced at the Stockholm Conference, State Department interest in NATO's Committee on the Challenges of Modern Society, the scientific cooperation Agreement with Brazil, other cooperative R&D programs abroad conducted with excess foreign currency stemming from U.S.-supplied food and development programs, and prospects for increased scientific exchanges with China and the USSR.

1903. "The Peking Visit: What Does It Mean for Science?", *Science News*, v. 101, no. 10, 4 March 1972, p. 148.

Views the attitudes of U.S. scientists regarding the outcome of President Nixon's visit as "cautious optimism" and "wait and see", pending elaboration of the communique issued at that time; describes the efforts, meanwhile, of private groups (National Academy of Sciences, National Committee on U.S.-China Relations, Federation of American Scientists) to improve relations with China's scientific community.

1904. Scott, D. R., "European Trip Report", *Congressional Record*, v. 118, no. 6, 25 January 1972, p. E476.

Gives impressions of Apollo 15 crew from visit to England, Sweden, Germany, Italy, and France, including interest and

enthusiasm of Europeans; discusses English as the universal scientific language, and the role of space as an arena where the U.S. "can demonstrate at the same time its technological strength, scientific expertise, its peaceful intentions and the openness of a free society".

FRANCE

1905. "France: Science Budget for 1972", *Science Policy*, v. 1, no. 1, January/February 1972, p. 3-6.

Reports on France's increased science budget for 1972, which includes a 15% increase in both program authorizations and operational budget; lists the appropriations for 1972 given to various institutes and programs, including space, along with figures for 1971.

1906. "Science in the Provinces" (in French), *LaRecherche*, v. 2, no. 18, December 1971, pp. 1010-1012.

Consists of a question-answer interview of chemist Guy Ourisson, president of Strasbourg'e Pasteur University and former member of the Advisory Committee on Technical and Scientific Research, discussing whether or not Paris should continue to dominate major decisions as to how and why scientific research should be done in France and reviewing some of the resources and problems of scientists in the provinces.

GOVERNMENT-SCIENCE INTERACTION

1907. Murphy, T. P., *Science, Geopolitics, and Federal Spending*, Heath Lexington Books, D.C. Heath and Company, Lexington, Mass., 1971, 568 pp. ($16.50)

Focuses on broad policy questions such as contracting, university support, economic development, and the geographic distribution of Federal support of R&D projects; attempts, by selecting a sample of major Federal facility decisions, to examine how politics interweave with administrative and professional considerations; relates R&D expenditures and their geographic implications to institutional changes developing in Congress and society at large.

1908. *Science for Development, An Essay on the Origin and Organization of National Science Policies, 1971*, 224 pp. (Available from the Unesco Publications Center, P.O. Box 433, New York, N.Y. 10016. Price: $4.50.)

Analyzes the currents of thought and action which characterize national science policies among European states, and outlines the pressing problems facing those responsible for governmental development policies based on science; examines objectives usually associated with a national policy of economic development, scientific and technological change, the point of departure of government action, size and scope of the scientific revolution in the world today, methods and organizations for promoting research, the role of science policy as part of overall governmental policy, and scientific and technical cooperation between nations.

1909. Polinger, M., "Congress Takes Activist Role in Science Policy", *Chemical & Engineering News*, v. 50, no. 11, 13 March 1972, pp. 16-19.

Discusses how Congressmen and Congressional committees interact with a complicated nexus of advisory groups, witnesses, the Congressional Research Service, the scientific and engineering communities, and trade associations; concludes that the Execu-

tive Branch is much more influential in science policy decisions than Congress, and that few legislators have "political clout as well as interest in science and technology".

1910. Zerkel, F. H., "White House Shapes Strategic Approach to R&D", *Chemical & Engineering News*, v. 50, no. 12, 20 March 1972, pp. 24-28, 33.

Examines the total Federal involvement in science, and the disappearance of plurality of support of basic research in universities in favor of "a de facto centralization of support"; discusses other emerging changes in Federal science and technology policies, particularly as reflected in the gain in FY 1973 Federal obligations for the National Science Foundation and the Department of Health, Education, and Welfare; presents an organization chart showing the key agencies and people in the Executive Department's science structure; tabulates Federal R&D obligations for FY 1970 through 1973 for each agency.

1911. "FCRSs: Under Fire from Congress", *Astronautics & Aeronautics*, v. 9, no. 12, December 1971, pp. 12-15, 80, and v. 10, no. 1, January 1972, pp. 14-15.

Examines the characteristics and practices of nonprofit Federal advisory institutions, known as Federal Contract Research Centers, which account for about 8% ($1.4 billion) of the Federal R&D budget; notes charges by Congress that FCRC's are less efficient or more costly than private industry — called unfounded by FCRC officers who cite salary structure and overhead to support their position — and the Armed Services Committee's recommendation for improvement of in-house capability.

1912. Humphrey, H. H., "Peace Through Change: The Risk and Promise for Man's Future", *Science*, v. 175, no. 4023, 18 February 1972, pp. 716-719.

Emphasizes that achievement of peaceful change requires cooperation between science and politics; urges that the U.S. create an effective, constructive capacity for peaceful change and that we direct our energy and talent to attaining the goal of peace and development, to establishing a common agenda for science and politics in support of that goal, to creating new institutional arrangements for the production and utilization of knowledge in pursuit of that goal, and to inducing other nations to establish complementary capabilities.

1913. Denny, B. C., "The Politics of Public Understanding", *Congressional Record*, v. 118, no. 29, 29 February 1972, pp. H1590-1594.

Discusses the problem of growing public distrust of science and technology; argues that public acceptance of science and government depend on keeping both representative of and responsive to human needs; discusses the relative qualifications of the Federal government and of state and local governments for dealing with the urgent domestic problems close to the people, and the political problem of putting technology and government at the service of man.

1914. *Guide to Programs, Fiscal Year 1972*, National Science Foundation Report NSF 71-22, 80 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 75 cents.)

Summarizes the various support programs of the NSF for the benefit of individuals and institutions interested in participating in these programs; describes principal characteristics and basic purpose of each activity, eligibility requirements, and closing dates (where applicable), and gives the address from which more detailed information, brochures, or application forms may be obtained.

1915. *National Bureau of Standards, Oversight Hearings*, Hearings before the

Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, 16, 21-23, 28 September 1971, no. 12, 1971, 387 pp. (Available from Committee on Science and Astronautics, U.S. House of Representatives, Washington, D.C. 20515.)

Attempts to achieve a complete overview and review of the activities of the National Bureau of Standards; inquires into its organization, operations, functions, and effectiveness via testimony and statements of some 30 witnesses.

1916. Manheimer, B., "Tax-Free Professional Societies: Time to Earn Their Subsidy", *Astronautics & Aeronautics*, v. 10, no. 2, February 1972, pp. 14-15, pp. 78-80.

Points out that (1) professional societies have contributed virtually nothing to the decision processes, (2) decisions involving billions of dollars are made by political leaders with almost no objective professional advice, and (3) scientists and engineers lack a basic knowledge of government; concludes that these societies have a responsibility to the public — they must inform themselves as to the locus and methods of decision making involving their fields and where intervention would be most fruitful, inform the public so it can take part in the decision process, and define their fields and forecast and assess them.

1917. "Robert Gottschalk", *Chemical & Engineering News*, v. 50, no. 11, 13 March 1972, p. 20.

Describes the efforts to improve operations of the U.S. Patent Office undertaken by Gottschalk as acting head, including creation of a customer relations center and computerization of some tasks; presents ideas he hopes to implement now that his appointment as Patent Commissioner has been approved by the Senate, including infusion of an overall management approach into the agency, possible extension of computer use to the patent examining process, and utilization of outside information services.

HEALTH AND SAFETY

1918. Nixon, R. M., "Health Care", *Weekly Compilation of Presidential Documents*, v. 8, no. 10, 6 March 1972, pp. 504-516.

Reviews those parts of the "National Health Strategy" upon which Congress has acted, and emphasizes the importance of action on the remaining parts such as the National Health Insurance Partnership Act, the Health Maintenance Organization Assistance Act, and the welfare reform bill; outlines important ways in which technology can be utilized to aid health care in such areas as emergency medical services, collection and delivery of blood, health information systems, and conditions of the handicapped.

1919. Sinclair, C., "The Incorporation of Health and Welfare Risks into Technological Forecasting", *Research Policy*, v. 1, no. 1, November 1971, pp. 40-58.

Describes the shift in the pattern and distribution of health and safety risks to worker, user, and third parties (families of workers, local populations, and the public at large) resulting from the application of the outputs of scientific and technological developments to industry and society; suggests a quantitative method of measuring and controlling this redistribution in an economic and socially acceptable way.

1920. Klass, P. J., "Decision on Collision Avoidance Delayed for Joint Investigation", *Aviation Week & Space Technology*, v. 96, no. 3, 17 January 1972, pp. 27-28.

Announces the delay in selecting a national standard airborne-collision-avoidance system for at least 1 year occasioned by the desire of the FAA and the Defense Department to investigate all potential techniques; briefly describes the many possible alternatives and the problems inherent in choosing among them.

HOUSING AND CONSTRUCTION

1921. "Building 'Sciences': A National Institute", *Washington Science Trends*, v. 27, no. 23, 13 March 1972, p. 134.
Announces Senate approval of a housing bill calling for creation of a nongovernmental National Institute of Building Sciences, to be charged with development, promulgation, and maintenance of "nationally recognized" performance criteria, standards, and other technical provisions relating to building systems, components, products, and materials; the Institute would also evaluate and "prequalify" existing and new building technology.

INDIA

1922. Wood, G., "National Planning and Public Demand in Indian Higher Education: The Case of Mysore", *Minerva*, v. 10, no. 1, January 1972, pp. 83-106.
Describes the difficulties encountered by the Government of India in providing for the education of manpower needed to carry out its three 5-year plans for economic development; discusses the tendency toward private management of colleges and the public demand for low-cost colleges of arts, science, commerce, and law.

INFORMATION MANAGEMENT

1923. Fallwell, W. F., "Information Explosion Closer to Control", *Chemical & Engineering News*, v. 49, no. 52, 20 December 1971, pp. 28, 33, 36.
Reports that the "information explosion" characterizing the development of science and technology in the past two decades has been brought almost under control through new information technology and management techniques, particularly integration of information services throughout the world to eliminate duplication, and computerization of data handling.

1924. Brady, E. L., and Bransomb, L. M., "Information for a Changing Society", *Science*, v. 175, no. 4025, pp. 961-966.
Notes past errors engendered by unsound decisions and changing societies' need for more and better technical information; summarizes an OECD report which (1) defines the user communities in need of information, and (2) lists the goals for a national policy on information; the OECD report recommends expansion of OECD's information-policy activities.

1925. Dubois, J. E., and Cornier, M., "Scientific Information" (in French), *La Recherche*, v. 3, no. 19, January 1972, pp. 35-44.
Describes a system for rendering the overwhelming flood of scientific information in any given area readily available; with chemistry as an example, shows how a well-conceived system of documentation can be exploited and how it facilitates research and creativity.

1926. Brooks, J., "The Need to Improve the Quality of Information Available to Federal Policymaking Officials in Matters Involving Data Processing Technology", *Congressional Record*, v. 118, no. 22, 18 February 1972, pp. E1338-1339.
Emphasizes the need for the U.S. to maintain its supremacy in

computer technology and presents the text of a bill to improve the quality of information available to Federal policymaking officials in matters involving data processing technology, and for other purposes.

1927. *Analytical Methodology Information Center Established*, Press Release from Battelle's Columbus Laboratories, 27 March 1972, 2 pp. (Available from Battelle, Publications Department, Columbus, Ohio 43201.)
Announces the organization of a center for gathering, analyzing, and disseminating technical information on methods for determining water quality and effects of pollutants, which is being created for the Environmental Protection Agency's Analytical Quality Control Laboratory at the Columbus Laboratories of Battelle; this center will enable EPA personnel to obtain quickly information related to their environmental questions.

ISRAEL

1928. *Scientific Research in Israel, 1971*, Prepared by the Center of Scientific and Technological Information, 316 pp. (Available from Prime Minister's Office, National Council for Research and Development, Hakirya Building 3, Jerusalem, Israel. Price: $6.00.)
Discusses Israel's geography, population, economy, education, science policy, principal national organizations and scientific bodies which plan and implement that policy, and scientific and cultural relations with the world; chapters describe institutions of higher learning, agricultural research, industrial research, regional and environmental studies, biomedical research, nuclear research, social and economic studies, and services to the scientific/technical community; indexed; 89-reference bibliography.

1929. Tal, E., "Scientific Research in Israel – Challenge to Government", *Science Policy*, v. 1, no. 1, January/February 1972, pp. 1-5 – 1-8.
Describes the organization of the Israeli government and the instruments it currently possesses for making decisions with regard to the various aspects of science and technology; discusses the three levels of the new structure: the Government research institutes, the various ministries, and the proposed R&D Authority for national planning; suggests three structures which would enable the Government to make decisions concerning applied and basic research and higher education: a Minister of Science and Higher Education, a Ministerial Committee for Science and Technology, and a Special Committee for Science, Technology, and Higher Education.

ITALY

1930. "Proposed Remedies for Italian Research", *Science Policy*, v. 1, no. 1, January/February 1972, p. 3-2.
Describes the critical state of Italian research, and lists some reasons for the crisis: lack of orientation in fundamental research, absence of any coordination between economic and research planning, proliferation of scientific projects entailing an undue scattering of resources, and lack of instruments and machinery for implementing science policy; lists recommendations by the Interministerial Committee for Economic Programming relevant to the structure and organization of scientific and technical activities in Italy.

1931. "Italy: Increased R and D Expenditure", *Science Policy*, v. 1, no. 1, January/February 1972, p. 2-4.
Describes recommendations of a committee appointed by the Minister of Scientific Research to report on the state of Italian science and technology and to advise on R&D planning; recom-

mendations include an increase in R&D funding by a factor of about 4 by 1980 and the establishment of an effective Ministry for Science and Technology.

JAPAN

1932. "Japanese Science: Information from Japan's Press", *International Science Notes*, no. 26, January 1972, pp. 10-12, U.S. Department of State, Bureau of International Scientific and Technological Affairs, Washington, D.C. 20520.

Presents highlights of Japanese press releases discussing Japanese-Soviet scientific and technological cooperation agreements for exchange of scientists and work on MHD; visits by Japanese computer and semiconductor technicians to Mainland China; and Japan's activities in space, environmental protection, and information-processing education.

1933. "Japan Seeks New Approach to Technological Innovation", *Science Policy*, v. 1, no. 1, January/February 1972, p. 3-1.

Mentions Japan's recent phenomenal scientific and technological strides and the social problems which have resulted; contends that a new "systems approach" should be applied to each project, and recommends 3 guidelines for Japan's future technological innovation: (1) Japan should positively develop technology on its own; (2) importance should be attached to social factors in the development of technology; and (3) the idea of "technology assessment" must be introduced.

LAND MANAGEMENT

1934. Nephew, E. A., "Healing Wounds", *Environment*, v. 14, no. 1, January/February 1972, pp. 12-21.

Suggests that West Germany's program of full restoration of all lands disturbed by surface mining could be an environmentally acceptable alternative to banning surface mining completely; cites 4 main principles of that program which contributed to its success: incorporation of surface mining regulation within an overall regional development plan; formulation of detailed requirements for mining and restoration before mining begins; review in public hearings; and delegation of powers to enforce the approved plan.

MANAGEMENT OF R&D

1935. Ingersoll, R. S., "What the Corporate Executive Expects of R&D", *Research Management*, v. 15, no. 2, March 1972, pp. 52-58.

Describes the organization of research at the Borg-Warner Corporation; discusses the primary missions of research at the corporate level: to introduce a technology not in the divisions as a base for new business, support the technological activities of the divisions, and to supply know-how from one part of the company's operations to the needs of another; points out what is expected from research at the division level: to maintain and improve the health of the company's present business, to undertake projects that expand the scope of the division's operations, and to create opportunities to move the division into new businesses that are related to its present operations; stresses the need for close liaison between corporate management and research, and for periodic assessment of research goals.

1936. Summer, J. A., "Business and Research – Uneasy Strangers in the Same House", *Research Management*, v. 15, no. 2, March 1972, pp. 60-66.

Discusses the conflicts between research and marketing over which leads and which follows and whether short- or long-term endeavors best serve the interests of the company; describes scientists' difficulty in shedding their professional identity and gaining an organizational identity; believes that short- and long-term programs are of equal value and that the corporate purpose must be primary to the professional purpose; emphasizes that management must define research's role and involve research in the decision-making process where pertinent.

1937. Radnor, M., "Management Sciences and Policy Sciences", *Policy Sciences*, v. 2, no. 4, December 1971, pp. 447-456.

Suggests that Policy Sciences may imply a fundamental difference between policy processes in the general public sector as compared with those required for business organizations, hospitals, educational and other formal institutions; argues that such a differentiation "would not be compatible with the best interests of the development of improved goal setting and decision methodologies and perspectives"; examines the potential contributions and the role of Policy Sciences in systems analysis and engineering, operations research, and systems management; calls for cooperation between Management Science and Policy Science through recognition of the fundamental unity of their goals and approaches.

1938. Gordon, G., "Preconceptions and Reconceptions in the Administration of Science", *R&D Management*, v. 2, no. 1, October 1971, pp. 37-40.

Uses recent findings from small group research and the sociology of science in attempting to show how the distinctions between applied and basic research and other related dichotomies can serve as guidelines in the administration of science; notes that most 1950-1961 publications dealing with research administration are speculative and have led to patterns of administration based on misconceptions rather than on knowledge.

1939. Holzmann, R. T., "To Stop or Not – the Big Research Decision", *Chemical Technology*, February 1972, pp. 81-89.

Presents general guidelines to assist research managers in deciding when a program or project should be terminated; points out that research must be accountable and relevant, that the object of industrial research is to generate innovation, and that knowledge of each stage of development and implementation of the industrial and commercial system is essential to the achievement of an integrated system.

1940. Shapley, D., "Towards a Better Managed Military-Industrial Complex", *Innovation*, no. 28, February 1972, pp. 59-60.

Describes the operation of the Defense Systems Management School (DSMS), set up by the Department of Defense (DoD), which offers graduate management courses to DoD's program managers; cites the drawbacks and advantages of the program.

1941. "The Important Link in Fulfilling the Mission", *Challenge*, v. 10, no. 3, Fall 1971, pp. 20-25. (Issued by G.E. Space Division Information Services, P.O. Box 8555, Philadelphia, Pa. 19101.)

Describes the functions and organization of the 100-plus-man Air Force's Plant Representative Office (AFPRO), located at General Electric's Re-entry and Environmental Systems Division and Space Division, as an arm of the Systems Command's Contract Management Division (CMD), whose main job is to insure that the weapons and aerospace systems meet performance, schedule, and cost requirements.

MANPOWER, TECHNICAL AND SCIENTIFIC

1942. *Scientific, Engineering, Technical Manpower Comments*, published monthly by the Scientific Manpower Commission. (Available by subscription from Scientific Manpower Commission, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $7.00/year – 11 issues.)

Summarizes news and current developments affecting the recruitment, training, and utilization of scientific, engineering, and technical manpower; the January 1972 issue (v. 9, no. 1) treats the Washington scene (Federal budgets, organization, legislation), education (enrollments and financial aid), khaki kingdom (draft affairs), supply and demand, salaries, and relevant literature.

1943. Metz, D., "Ph.D.'s Should be Planned", *New Scientist*, v. 53, no. 783, 17 February 1972, pp. 386-388.

Discusses the need for manpower planning mechanisms to match the supply and demand of scientific Ph.D.'s, especially if the Ph.D. degree is regarded as primarily a vocational training in research methods; contends that manpower planning has to take account of long-term trends as well as short-term effects; discusses the problems involved in the execution of such a policy.

1944. *Manpower and Financial Resources Allocated to Academic Science and Engineering Activities, 1965-71*, Science Resources Studies Highlights, National Science Foundation Report NSF 72-302, 20 March 1972, 4 pp. (Available from Division of Science Resources Studies, NSF, Washington, D.C. 20550.)

Summarizes the results of the National Science Foundation's biennial survey of manpower and financial resources for scientific and engineering activities at institutions of higher education; all statistics point to marked slowdowns in the rates of increase of technical manpower employment and R&D expenditures in universities and colleges, particularly since 1968.

1945. Ginzberg, E., "The Outlook for Education Manpower", *The Public Interest*, no. 26, Winter 1972, pp. 100-111.

Gives reasons for the alarming excess of trained scientists and engineers in the U.S., and recommends 4 steps to moderate imbalances in supply and flow of educated manpower, involving planning and staffing of large Federal programs and Federal support of science and education.

1946. "Federal Scientific, Technical, and Health Personnel in 1970", *Science Resources Studies Highlights*, National Science Foundation Report NSF 71-47, 22 February 1972, 4 pp. (Available from Division of Science Resources Studies, NSF, Washington, D.C. 20550.)

Reports employment figures as of October 1970, which reveal a 1% decline from the previous year, mostly in the Department of Defense; also presents data on occupational trends and mean annual salaries, broken down by occupational group (field, professional, nonprofessional), Government Agency (DoD, USDA, Interior, NASA, DOT, Commerce, HEW), and year (1969 and 1970).

1947. Hanna, R. T., "Deplorable Situation in Aerospace Employment", *Congressional Record*, v. 118, no. 17, 9 February 1972, pp. E1109-1111.

Presents remarks by Dr. R. T. Parry before the California State Legislature concerning the future of aerospace scientists and engineers; observes that only a small proportion of those now unemployed would be suited for work in fields such as environmental engineering; discusses the possible effects of the Space Shuttle Program and large-scale production of wide-bodied jets

on employment levels; asserts that a successful diversification program can salvage the aerospace industry.

1948. Layton, E. T., Jr., *The Revolt of the Engineers*, Case Western University Press, Cleveland, Ohio, 1971, 286 pp. ($9.95)

Reviews the past efforts of engineers to create a professional group identity as a defense against the constraints imposed upon them by corporate structures within which they must work, through formation of national committees and by working with existing societies; observes that the attempts during 2 decades produced no significant change; notes, however, the changes in technical societies over the past 2 years, which suggest that the attitude of the contemporary engineer and the pressures he is placing on his professional society may drastically alter long-standing institutional relationships between him and the corporate structure and between him and society.

METRICATION

1949. "Commerce Official Predicts That U.S. Will 'Go Metric' to Benefit Trade Position", *U.S. Department of Commerce News*, Washington, D.C. 20230, Office of The Secretary, 8 March 1972, 8 pp.

Quotes a prediction by Dr. R. W. Cairns in a speech that the U.S. will go metric by measured steps; Cairns says that "of all the implications inherent in this Nation's going metric, perhaps the most serious is the consequence of not going metric. Thus, we would be ignoring the lessons of technological change, of international competitiveness, and of rationality in national decision making"; includes the text of Cairns' speech, "The Implications of Technological Change", given at a Briefing Conference.

1950. McClory, R., "It is Time to Adopt Program for Conversion to Metric System", *Congressional Record*, v. 118, no. 5, 24 January 1972, pp. H203-204.

Introduces a bill (HR 12555) to establish a program for the U.S. to convert to the metric system, which calls for establishment of a commission comprising nine members representing business, labor, education science, and technology, and charged with responsibility for implementing the recommendations contained in the final report on the U.S. metric study (issued in July 1971) by January 1, 1983.

1951. Gross, H. R., "The Case Against 'Go Metric' ", *Congressional Record*, v. 118, no. 36, 9 March 1972, pp. E2304-2308.

Presents a paper by G. C. Lovell which discusses the cost of conversion to the metric system and the disadvantages of the system to the economy, to small business, the small manufacturer, and the general public; claims that the conversion would increase the trade deficit and destroy any technological superiority and economic advantage the U.S. now has.

MULTINATIONAL SCIENCE ACTIVITIES

1952. Caplan, B., "Europe and the Scientists", *New Scientist*, v. 53, no. 781, 3 February 1972, pp. 272-273.

Describes the draft directives prepared by the European Economic Community (EEC) Commission in implementing Article 57 of the Common Market Treaty which provides for free movement of professionals and mutual recognition of diplomas throughout the Community; so far, these directives specify common educational training standards in fields such as medicine, dentistry, and engineering; notes the criticisms that proposals support quantitative rather than qualitative standards,

and that the EEC failed to seek advice from universities in preparing them.

1953. "Meeting of Ministers of Science of OECD Countries", *OECD Observer*, no. 55, December 1971, pp. 22-24.

Reviews the main points discussed, including goals for science policy in the 1970's, new directions for scientific R&D and information; linking the innovation process to social and economic development, assessing the impact of technology, and promoting research cooperation between member countries; concludes that increased support is needed for the relevant social sciences, and that intensified international scientific and technical cooperation will be needed in the 1970's to achieve common economic, social, and environmental objectives.

1954. "The International Centre of Insect Physiology and Ecology", *International Science Notes*, no. 26, January 1972, pp. 7-9, U.S. Department of State, Bureau of International Scientific and Technological Affairs, Washington, D.C. 20520.

Summarizes the progress of ICIPE, established in Nairobi, Kenya, for global research on methods and agents for the control of insect pests and supported by national scientific bodies in the U.K., the U.S., Japan, the Netherlands, Sweden, France, Switzerland, and East Africa; outlines 6 complementary programs planned or under way for the central laboratory, staffed by visiting directors of research, resident researchers, and graduate students from both within Africa and abroad.

NATIONAL SECURITY

1955. Shapley, D., "Defense Research: The Names Are Changed to Protect the Innocent", *Science*, v. 175, no. 4024, 25 February 1972, pp. 866-868.

Describes some of the findings of a study by Stanford University students on the role of the Department of Defense (DoD) in the university; the study, which listed 100-odd DoD research contracts at Stanford in February 1971 (25% of all Stanford contracts and grants) also presented the statements of military relevance, which DoD draws up in-house, for each research contract at Stanford; describes a few of these statements and also the reaction to them by the scientists involved.

1956. Walsh, J., "Arms Control and Disarmament: SALT, CCD, CTB, MBFR, Etc.", *Science*, v. 175, no. 4019, 21 January 1972, pp. 281-282.

Discusses various attempts to achieve a comprehensive test ban and arms control treaty, including the strategic arms limitations talks (SALT) and the efforts of the Conference of the Committee on Disarmament (CCD); briefly describes provisions of a promising draft biological-warfare treaty sent to the U.N. by the CCD; cites criticisms that research-gap arguments are based on unrealistic projections of Soviet capabilities and invalid comparisons between U.S. and Soviet arms development.

1957. Neild, R., and Ruina, J. P., "A Comprehensive Ban on Nuclear Testing", *Science*, v. 175, no. 4018, 14 January 1972, pp. 140-146.

Reviews the range of issues involved in the consideration of a comprehensive test ban (CTB) treaty, centered on means of verification, military significance of tests, and questions related to peaceful nuclear explosions; presents nine conclusions, chiefly related to effect of a CTB on the arms race, the merits of a CTB, the question of on-site inspection, the attitudes of near-nuclear powers, and significance of a CTB to nonnuclear powers.

1958. Myers, H. R., "Comprehensive Test Ban Treaty: Grounds for Objection Diminish", *Science*, v. 175, no. 4019, 21 January 1972, pp. 283-286.

Discusses the reasons for the diminishing objections to the negotiation of a comprehensive test ban treaty between the U.S. and Russia, which include emerging widespread skepticism regarding relevance of nuclear tests and advances in seismological research which will increase ability to determine violations as well as ease the demand for on-site inspection.

1959. Scott, H., "New Initiatives in Total Force Planning and Regional Considerations and Total Force Planning", *Congressional Record*, v. 118, no. 19, 15 February 1972, pp. S1742-1744.

Presents and discusses those portions of Secretary of Defense M. Laird's FY 1973 defense budget and FY 1973-77 programs dealing with new initiatives (e.g., Air Force-Navy cooperation to counter Soviet naval threats, use of merchant ships for underway replenishment) in U.S. Force planning and regional considerations which must be taken into account in the overall strategy of realistic deterrence; Laird describes plans to foster greater involvement of other free-world countries in R&D defense efforts to further implement the Total Force Concept.

1960. Smith, B., "Understanding Weapons Development", *Astronautics & Aeronautics*, v. 10, no. 1, January 1972, pp. 16-18.

Describes controversy surrounding weapons development: simple weapons for skilled people versus complex weapons for simple people; advocates the application of diverse high-risk programs, describes criteria for weapons effectiveness, and suggests methods of risk reduction.

1961. Bush, G., "U.N. Commends Biological Weapons Convention and Requests Continued Negotiations on Prohibition of Chemical Weapons", *U.S. Department of State Bulletin*, v. 66, no. 1700, 24 January 1972, pp. 102-109.

Comments on the draft Convention of the Prohibition of the Development, Production, and Stockpiling of Bacteriological and Toxin Weapons and on Their Destruction — on the contributions which it embodies, on some specific provisions, and on its general significance; describes the progress already made toward further prohibitions on chemical weapons, and contends that restraints are needed on all conventional weapons to ensure security of all countries; presents the text of 2 associated resolutions.

1962. Karber, P. A., "The Nixon Policy on CBW", *Bulletin of the Atomic Scientists*, v. 28, no. 1, January 1972, pp. 22-25, 27.

Examines the strategic rationale of biological disarmament, chemical arms control, and the unique problems of toxins and domestic agents; discusses the fallacy of lumping all chemical and biological weapons under one term (CBW), President Nixon's promotion of biological disarmament, and bridging the gap between our deterrent capability and disarmament hopes with adequate defenses against CBW.

1963. Gravel, M., "CBW Operations in Alaska", *Congressional Record*, v. 118, no. 26, 24 February 1972, pp. S2527-2528.

Calls attention to the chemical and biological warfare (CBW) program in Alaska, disclosing the Army's loss of a cache of nerve-gas rockets; presents a letter and an article by R. A. Fineberg, Professor of Political Science at the University of Alaska, questioning these activities and making further disclosures of possible cases of exposure; calls for careful attention to the provisions of P.L. 91-121 and P.L. 92-441 designed to assure Congressional oversight of CBW activities.

1964. Meselson, M., "Gas Warfare and the Geneva Protocol of 1925", *Bulletin of the Atomic Scientists*, v. 28, no. 2, February 1972, pp. 33-37.

Reprints March 1971 testimony before the Senate Foreign Relations Committee by Harvard Biology professor Meselson to the effect that the military value of riot gas (CS) to the U.S. is very low, that proliferation of biological and lethal chemical weapons would greatly enhance the destructive capability of smaller and poorer nations, that it is therefore very much in the U.S. interest to strengthen restraints on chemical warfare, and that the U.S. should relinquish first-use option for riot gas, thereby strengthening the political and psychological effectiveness of the Geneva Protocol.

NETHERLANDS

1965. "Netherlands: Minister for Science Policy", *Science Policy*, v. 1, no. 1, January/February 1972, p. 3-2.

Announces the appointment of Mr. M. L. de Brauw as Minister without portfolio for national science policy and university education within the Ministry of Education and Science; reports that the Minister intends to create more effective structures for the organization and financing of university research; describes the attitude of the Netherlands Science Policy Council toward scientific research in the universities and toward The Netherlands Organization for the Advancement of Pure Research (ZWO).

NIGERIA

1966. Bassir, O., "Nigeria's Development Problem", *New Scientist*, v. 52, no. 776, 30 December 1971, pp. 265-266.

Discusses Nigeria's need for an education policy to produce, on a long-term basis, the engineers, scientists, and technologists required for development of modern agriculture and industry; describes the exploitation of aid recipients by donor institutions and foreign contractors; emphasizes Nigeria's need to avoid dependence on foreign capital and aid from capitalist nations.

OCEAN – INTERNATIONAL ACTIVITIES

1967. Borgese, E. M., "The Seas: A Common Heritage", *The Center Magazine*, v. 5, no. 2, March/April 1972, pp. 13-23.

Discusses the activities of the second Pacem in Maribus Convocation, held on Malta June 29 to July 5, 1971; among the topics discussed were (1) pollution of the Mediterranean, (2) the economic potential of the oceans, (3) recommendations for an economic policy – an interim arrangement for the management of manganese nodules and the ocean development tax, (4) science policy, an integral part of ocean policy, and (5) the interests of the world community.

1968. "U.S. Participating in International Pilot Project for Exchange and Use of Ocean Data", *U.S. Department of Commerce News*, NOAA 72-17, 8 February 1972, 3 pp.

Describes U.S. participation in the 6-month pilot project of the Integrated Global Ocean Station System, which is designed to permit the exchange and operational use of ocean data and is expected to be a major step toward the development of a global ocean monitoring and information service.

1969. The Treaty on the Nonemplacement of Nuclear Weapons on the Seabed: A Brief Chronology", *Congressional Record*, v. 118, no. 18, 14 February 1972, pp. S1611-1613.

Senator Church documents step by step the development of the seabed nuclear arms prohibition treaty, from August 1967 to the present; includes the many contributions of Sen. Pell, the first to advance the concept of the treaty in a Senate resolution and who, on 14 February 1972, presented the completed treaty to the Senate for ratification following approval by 62 nations.

1970. "Executive Session — Seabed Arms Control Treaty", *Congressional Record*, v. 118, no. 19, 15 February 1972, pp. S1783-1790.
Presents the text of the Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil Thereof; presents statements by President Nixon, Secretary of State Rogers, and several senators supporting the treaty and emphasizing its international importance.

OCEAN — U.S. ACTIVITIES

1971. Morton, M., "The National Ocean Program: Implementation and Benefits", *Vital Speeches of the Day*, v. 38, no. 9, 15 February 1972, pp. 264-267.
Examines 3 oceanic projects which promise to have a profound influence on U.S. employment, economy, resource utilization, and environmental quality, and which also highlight key concepts concerning the formulation and implementation of a strong national ocean program: (1) the development and use of liquefied natural gas carriers; (2) the development of large, multipurpose offshore platforms; and (3) the large-scale monitoring of the ocean environment.

1972. *Toward Fulfillment of a National Ocean Commitment*, Marine Board, National Academy of Engineering, 1972, 255 pp. (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $4.95.)
Stresses that ocean goals for the U.S. are "essential for the nation's economic, social, and political well being"; recommends prompt expansion of exploration of ocean shelves and slopes and extension of man's capabilities in the sea, under consistent and long-term policies; argues for "a suitable climate in which industry can maintain a profitable position commensurate with the public interest".

1973. *Coastal Zone Baselines and Monitoring for Pollution and Environmental Quality*, Committee on Oceanography, National Academy of Sciences-National Research Council, April 1971, 23 pp. (Available within limits of supply from Committee on Oceanography, NAS, 2101 Constitution Avenue, Washington, D.C. 20418.)
Presents a proposal for a coastal zone monitoring program and points out that the Coast Guard, because of the location and type of its facilities, is well qualified to conduct such a program; the work proposed includes study of Coastal Zone water mixing and circulation, and water, air, and biological sampling and analysis; recommends that the monitoring program be identified as a regular and continuing activity of each Coast Guard district, and that Coast Guard personnel be given additional training.

PANAMA CANAL

1974. Flood, D. J., "Biological Perils of Proposed Sea Level Canal Across Central America Justify Abandonment of the Idea", *Congressional Record*, v. 118, no. 11, 1 February 1972, pp. H505-507.
Reprints an article by F. B. Kent, from the *Washington Post*, concerning the ecological consequences of a sea-level canal, along with a letter supporting the views expressed in that article; urges

abandonment of the sea-level-canal concept; contends that major modernization of the present canal is the most sensible, economical, operational, engineeringly feasible, and ecologically safe solution to the canal problem.

POLLUTION – AIR

1975. Miller, S., and Lewicke, C., "Air Pollution Over the States", *Environmental Science & Technology*, v. 6, no. 2, February 1972, pp. 111-117.

Discusses efforts by the states, with Federal help, to formulate the plans required to meet the goal of clean air by 1975 envisioned in the latest Clean Air Act; points out difficulties in some states, such as short lead time for submission of plans, diversity of pollutants among states, manpower shortages, lack of enforcement procedures, and lack of air quality standards; describes the efforts required of industry and the associated economic, technological, and political problems to be faced.

1976. Brodine, V., "Running in Place", *Environment*, v. 14, no. 1, January/February 1972, pp. 2-11, 52.

Claims that air pollution can be reduced only through choices made by society collectively to adapt or change the economic system (which is now heavily dependent upon the largely uncontrolled exploitation of nature) and the political system (whose decision-making processes were not developed to cope with environmental problems); describes the inadequacies of current efforts to control air pollution from such sources as fossil-fuel burning, automobiles, and nuclear power plants; points out that gains in controlling emissions from each single source will be offset by increases in size and number of sources.

1977. Williamson, S. J., "Local Politics and Air Pollution", *Technology Review*, v. 74, no. 4, February 1972, pp. 50-55.

Presents brief sketch of the present air-pollution-control organization in California, highlighting the dominant roles of local government and illustrating how citizen pressure backed by technical knowledge can be a persuasive tool; concludes that significant advances – both technical and political – must be achieved before society can be safeguarded by comprehensive air-pollution controls.

1978. *Air Pollution Control Active Research Grants for Fiscal Year 1971*, Environmental Protection Agency, Office of Air Programs Publication No. APTD-0740, July 1971, 55 pp. (Available from Office of Technical Information and Publications, Office of Air Programs, EPA, Research Triangle Park, N.C. 27711.)

Presents a simple listing of grants (totaling $6.9 million) active during FY 1971, by investigator, institution, title, period, and dollars in each of 8 categories: (1) effects on human health, welfare, or productivity, (2) agricultural effects, (3) economic and social studies and regional planning, (4) physico-chemical investigations, (5) development of analytic methods and equipment, (6) meteorology, (7) description and control of air pollution sources, and (8) communication.

1979. *Semiannual Report to the Environmental Protection Agency by the Committee on Motor Vehicle Emissions of the National Academy of Sciences*, 1 January 1971, 78 pp. (Available from Committee on Motor Vehicle Emissions, Division of Engineering, National Research Council, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)

Summarizes the work and the findings of the Committee in such areas as testing, emission-control technology, and maintenance and inspection of emission systems; concludes that the larger manufacturers *may* be able to produce vehicles by 1975 that will

qualify under the 1970 Clean Air Amendments at an increase in cost of about $200 over 1973 models, 3 to 12% increase in fuel consumption, and an increase in maintenance costs.

1980. *Technical Publications of the Office of Air Programs, U.S. Environmental Protection Agency*, January 1972, 29 pp. (Available from Air Pollution Technical Information Center, Office of Technical Information and Publications, Research Triangle Park, N.C. 27711.)
Gives titles, prices, and ordering instructions for 100 reports in the AP series and 401 reports in the APTD (Air Pollution Technical Data) series issued by the Office of Air Programs, covering the results of air pollution control studies; also available on request from APTIC (address above) are a description of the Information Center and its services and a 41-page list of air pollution films.

POLLUTION – NOISE

1981. *Report to the President and Congress on Noise*, Report of the Administrator of the Environmental Protection Agency in compliance with the Clean Air Act Amendments of 1970, February 1972, U.S. Senate, No. 92-63, 1 March 1972. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.75.)
Examines the effect of noise on living things; deals with the sources of noise and their current environmental impact; discusses present and future control technology and legislation for noise pollution; discusses government, industry, professional, and voluntary noise control activities; assesses noise concern in other nations, and provides a glossary of noise-related terms.

1982. Bragdon, C. R., *Noise Pollution: The Unquiet Crisis*, University of Pennsylvania Press, Philadelphia, Pa., 1971, 280 pp. ($15.00)
Presents facts and figures, scientific measurements, and data on what noise is, what it does, and how to combat it; demonstrates the drastic effect of noise on life and health, and evaluates existing noise-abatement programs; catalogues in an appendix the noise-free claims of manufacturers of numerous products; contains an extensive bibliography arranged in six major categories: Noise, general; Physical Effects; Psycho-Social Effects; Law; Noise Abatement; and Noise Sources.

POLLUTION – PROBLEMS AND CONTROL

1983. "Environmental Awakening – Message from the President of the United States (H. Doc. No. 92-247)", *Congressional Record*, v. 118, no. 16, 8 February 1972, pp. H840-845.
Outlines and discusses President Nixon's plan for dealing with environmental problems through actions in the following areas: tightening pollution control, improving land use, expanding international cooperation, enlisting the young, making technology an environmental ally, and protecting our national heritage.

1984. Rockwell, W. F., Jr., "Pollution Control: The Missing Data", *Congressional Record*, v. 118, no. 45, 23 March 1972, pp. E2918-2920.
Describes the enormous costs of massive pollution-control programs and questions whether the goal of zero discharge is economically realistic or feasible; stresses the need for assessment of the total economic impacts of such programs, detailing the types of data required to make this assessment; asserts that we must strike a reasonable balance between our national hopes and capabilities to avoid jeopardizing the nation's economic well-being.

1985. Collier, H. R., "Answers to the Problems of Pollution", *Congressional*

Record, v. 118, no. 30, 1 March 1972, pp. E1758-1760.
Reprints an article entitled, "Industrial Pollution: The High Cost of Prosperity", which analyzes the pollution problem in detail – the extent of pollution, the capability of current technology for curtailing it, and the high cost of cleaning up; also points out what actions industry, government, and private citizens can take to resolve the problem.

1986. McKinney, R. E., "Watch out for the Ecological Con Man", *National Observer*, 29 January 1972; reprinted in *Congressional Record*, v. 118, no. 17, 9 February 1972, pp. E966-967.
Discusses the environmental pollution problem, stressing that there is no magical solution, that spending more money is not the answer, and that the problem can be solved, but only through much work and effort on a continuing basis; cautions against implementation of the costly, possibly unnecessary, controls being urged by environmentalists.

1987. Levi, D. R., and Colyer, D., "Legal Remedies for Pollution Abatement", *Science*, v. 175, no. 4026, 10 March 1972, pp. 1085-1087.
Describes legal options available to an individual citizen or citizen groups in combatting environmental pollution – common law or statuatory regulations, constitutional amendments, or more general concepts, in particular the public trust concept – and urges that individuals exercise these options; emphasizes that realistic, rational, and equitable solutions to environmental problems must be found and implemented, and suggests that a substantial body of litigation might spur the efforts of legislators, administrators, educators, and industrialists in this direction.

1988. "Pollution Control: Economic Impact", *Washington Science Trends*, v. 27, no. 23, 13 March 1972, p. 136.
Cites studies performed by contractors for the Council on Environmental Quality showing that price increases of up to 10% can be expected to 1976, that the GNP in 1980 will be about \$7-\$8 billion lower than it would be without pollution controls, and that direct job losses attributed to pollution control are projected to be 50,000 to 125,000 for the entire 1972-1976 period. (For information about the studies, send a stamped self-addressed envelope to Subscriber Services, Trends Publishing Inc., National Press Building, Washington, D.C. 20004.)

1989. "The Cleaning Bill", *Nature*, v. 236, no. 5342, 17 March 1972, p. 94.
Concludes that present pollution control requirements are likely to retard growth in GNP, increase unemployment, and increase prices, but not severely; points out that estimates of economic impact fail to take into account possible effects of the sulfur-emissions tax and stringent requirement for using "the best available" technology, which are stipulated in bills now before Congress.

1990. Aspin, L., "Taxing the Profits out of Pollution", *Progressive*, March 1972; reprinted in *Congressional Record*, v. 118, no. 30, 1 March 1972, pp. E1765-1766.
Suggests that a comprehensive attack on pollution embody the use of economic incentives (taxes) to effect a unified, immediate, and continuing reduction in pollution; cites bills introduced in Congress by the author calling for taxes on such things as sulfide emissions, nonreturnable bottles, and discharges of effluents into our nation's waters to illustrate how economic incentives could help effect pollution abatement.

1991. Gerstacker, C. A., "Profits and Pollution", *Congressional Record*, v. 118, no. 35, 8 March 1972, pp. E2146-2148.
Contends that a profit motive is industry's strongest incentive for solving pollution problems, and that pollution control is good

business — it can be profitable; presents pollution-control guidelines established by Dow Chemical Co. for its plants in the U.S. and abroad, emphasizing reduction of waste and conservation of raw materials; describes Dow's recycling efforts, the reduction in operating costs effected thereby, and the profits derived.

1992. "Environment: Administration Seeks to Undercut Tough Laws", *Science & Government Report*, v. 2, no. 3, 1 April 1972, pp. 3-4.
Describes the effects of environmental legislation on the automotive and nuclear power industries; the latter has been virtually immobilized by citizens groups invoking the law; describes the AEC's efforts to get around tough laws and standards; cites a report by the Office of Science and Technology entitled *Final Report of the Ad Hac Committee on the Cumulative Regulatory Effects on the Cost af Automotive Transportation*, which concludes that the emission standards that the industry must meet are too stringent and costly.

1993. Evins, J. L., "Nature Described as Massive Polluter of the Environment — Greater than Man", *Congressional Record*, v. 118, no. 43, 21 March 1972, pp. H2307-2309.
Reprints an address by W. T. Pecora, Undersecretary of the Department of the Interior, which describes geological scars created by nature, chemicals entering the atmosphere and streams from natural sources, and air pollution and damage to large biosystems effected by volcanic eruptions as examples of pollution by nature; observes that the impact of man is minute on a planetary scale, but may be consequential in local situations; cautions against taking conservation actions out of fear and ignorance, and asserts that science and research are needed to provide guidelines for national action toward fulfilling human needs.

1994. "Scientists Show Indexes of Pollution", *Chemical & Engineering News*, v. 50, no. 2, 10 January 1972, pp. 33, 35.
Discusses efforts of scientists to establish the most critical problem areas by compiling indexes of pollution; presents indexes of priorities, U.S. environmental quality, and the amounts of certain substances polluting the air.

1995. Shapley, D., "Pollution: Military's Cleanup Stresses Plumbing, Not R&D", *Science*, v. 175, no. 4017, 7 January 1972, pp. 45-46.
Describes the Department of Defense's pollution problems, the biggest being the management of sewage on a large scale, and the level of effort being expended to solve them; of the money DOD will spend on pollution in FY 1972, only a relatively small fraction will go for R&D.

1996. Boggs, J. C., "Chairman Klaff Speaks on the Progress of the National Commission on Materials Policy", *Congressional Record*, v. 118, no. 41, 17 March 1972.
Reprints a speech by J. L. Klaff, Chairman of the National Commission on Materials Policy, stating the overall objective of the Commission: to determine the national policies needed to assure adequate resources and a clean environment in the future; reprints a news release which summarizes the remarks of J. Boyd, executive director of the Commission, relative to the hard choices facing the U.S. because of increases in population, consumption of raw materials, industrial production and environmental pollution.

1997. "Pollution, A European Problem", *Congressional Record*, v. 118, no. 13, 3 February 1972, pp. E817-818.
Reprints a *New York Times* editorial (January 21) which notes concerns over pollution throughout Europe, particularly in Italy; describes the efforts of the judiciary in Italy to curb pollution by

dealing sternly with polluters, in the face of inaction at the national, state, and municipal levels of government.

POLLUTION – RADIATION

1998. King, F. M., "A Question of Power", *Ecology Today*, v. 2, no. 1, March/April 1972, pp. 18-22, 45-46.

Discusses unanswered questions concerning radiation pollution from nuclear power generation, and contends that a top level board of scientists (including geneticists, medical researchers, ecologists, and biologists), totally independent of the Atomic Energy Commission, should have the responsibility for regulating nuclear power; discusses problems related to radioactive waste disposal: storage and perpetual monitoring of these wastes.

1999. Hamilton, L. D., "On Radiation Standards", *Bulletin of the Atomic Scientists*, v. 28, no. 3, March 1972, pp. 30-33.

Strongly criticizes the National Council on Radiation Protection and Measurements Report 39, "Basic Radiation Protection Criteria"; major criticisms are that the report is dated, and is inadequate in that it (1) provides no estimates of the biological risks of prolonged exposure to low-level radiation, (2) gives no assessment of the risks/benefits; and (3) fails to deal with the problems of waste disposal, nuclear explosions, and radiation from consumer products.

2000. Skubitz, J., "Kansas Versus Atomic Energy Commission – Round 2", *Congressional Record*, v. 118, no. 1, 18 January 1972, pp. H35-38.

Speaks out against the Atomic Energy Commission's plans to install an atomic-waste storage dump in Kansas; presents a paper by Dr. W. W. Hambleton, Director of the Kansas Geological Survey, which describes various storage methods including the salt vault and the planned storage concept for the Kansas dump, and the misgivings the Survey has expressed concerning these methods; Hambleton urges that scientists attend legislative and Congressional hearings and that they propose suitable alternatives.

POLLUTION – WATER

2001. "Water Quality Criteria Summaries Available", *Environmental News*, Environmental Protection Agency, Washington, D.C. 20460, 1 March 1972, 1 p.

Announces the availability of State-by-State compilations of the water quality criteria (including those for temperature, phosphate, mercury and heavy metals, nitrates, and radioactivity) approved under the national water quality standards programs, and a pamphlet of questions and answers on water quality standards; both may be obtained from the Environmental Protection Agency, Office of Public Affairs, Publications Branch, Washington, D.C. 20460.

2002. *Environmental Control: Everyone's Concern*, Rex Chainbelt, Inc., Bulletin No. EV-1, 1971. (For availability, write Rex Chainbelt, Inc., Milwaukee, Wisc. 53201.)

Discusses the environmental challenge and what is being done about it at the Federal level; outlines water-quality problems in each of the 20 regions of territorial U.S. and describes standards, goals, causes, symptoms, and cures for water pollution; lists 456 design firms and includes a glossary on control equipment components; lists pollution-abatement tax-exemption incentives by states.

2003. Dingell, J. D., "Conflict on Water Pollution", *Congressional Record*, v. 118, no. 1, 18 January 1972, pp. E95-96.

Reprints 3 articles revealing the opposing attitudes toward environmental pollution control which exist among members of the Nixon Administration, represented by the strong enforcement policy practiced by William Ruckelshaus, Chief of the Environmental Protection Agency, and the "go slow", "protect industry" policies advocated by Maurice Stans, Secretary of Commerce.

2004. "Groundwater Pollution and Conservation", *Environmental Science & Technology*, v. 6, no. 3, March 1972, pp. 213, 215.
Points out that groundwater supplies 20% of the fresh water used in the U.S.; discusses the seriousness of groundwater depletion and contamination; notes the limited Federal groundwater regulation and the inconsistencies in regulation policies among regions, a situation which the EPA hopes to eliminate by promulgating a national policy for groundwater protection; also notes two bills now before Congress designed to protect the subsurface environment.

2005. Rukeyser, W. S., "Fact and Foam in the Row Over Phosphates", *Fortune*, v. 85, no. 1, January 1972, pp. 71-73, 166, 168, 170.
Describes the continuing controversy surrounding phosphate-containing detergents; presents a thorough, factual discussion of phosphates, the environmental problems created by their use, and efforts by the Government and the detergent industry to solve these problems; suggests advanced sewage treatment as a possible solution, but warns against seeking quick, easy solutions to complex problems.

POPULATION

2006. "Academy of Sciences Recommends Voluntary Population Control", *Science Policy*, v. 1, no. 1, January/February 1972, p. 3-4.
Describes recommendations presented in the report *Rapid Population Growth: Consequences and Policy Implications* by a committee of the National Academy of Sciences: that national governments make available free or inexpensive birth control devices and permit abortion and sterilization and that they institute social policies to promote smaller families; argues against national compulsory sterilization, and denial of international food aid to countries which fail to curb population growth.

2007. "A Population Policy for the Enrichment of Life", *Science News*, v. 101, no. 13, 25 March 1972, p. 198.
Discusses recommendations of the President's Rockefeller Commission on Population and the American Future: the easing of adoption laws and practices, approval of the Equal Rights Amendment, "The elimination of legal restrictions on access to contraceptive information and services, and the development by the states of affirmative legislation to permit minors to receive such information and services"; the Commission emphasizes that abortion is not to be considered the prime or preferred method of birth control.

2008. "Has Demographic Stability Come to Stay?", *Nature*, v. 236, no. 5342, 17 March 1972, pp. 87-89.
Notes the view of the U.S. Commission on Population Growth and the American Future that continued growth would have no economic advantages; defines demographic stability, and considers possible methods of regulating the total size of the U.S. population; warns that a rapid population decline could be counterproductive and have economic consequences as severe as those of rapid growth.

2009. Packwood, B., "Population Commission Report", *Congressional Record*, v. 118, no. 45, 23 March 1972, pp. S4698-4705.

Presents brief summaries of parts I and II of the report by the Commission on Population Growth and the American Future, along with a statement by its Chairman, J. D. Rockefeller III; Part I focuses on the national impact of population growth and distribution upon government services, the economy, the environment, and natural resources; Part II covers recommendations on such subjects as child care, contraceptive information and services, fertility control, fertility-related health services and research, status of women, and educational programs.

2010. Hellman, L. M., "A Five-Year Plan for Population Research and Family Planning Services: Overview", *Family Planning Perspectives*, v. 3, no. 4, October 1971, pp. 35-40.
Describes research being done on contraceptives and the personal and societal consequences of human fertility; discusses Family Planning Services and Population Research Act of 1970 (P.L. 91-572), which provides for the extension of family planning services to all desiring such services and for family planning and population research programs, with the information gained being rapidly and effectively made accessible to all segments of our society.

2011. Eisenhower, M., and Tydings, J. D., "A National Population Policy", *Ecology Today*, v. 1, no. 11, January 1972, pp. 18-20.
Consists of two articles: Eisenhower examines the problems population growth will cause in the U.S. unless forthright action is taken; Tydings discusses the possibility of achieving a voluntary zero population growth in the U.S. "if we begin developing voluntary population stabilization programs now".

2012. "Quality or Quantity", *Science News*, v. 101, no. 12, 18 March 1972, pp. 181-183.
Reviews findings of the Commission on Population Growth and the American Future, which include: (1) population growth has aggravated many of the nation's problems and hampered their solutions, (2) the U.S. must adopt a deliberate population policy, (3) a gradual approach to population control would not hurt the U.S. economy, and (4) overpopulation is not the sole factor involved in energy depletion and ecological damage; the Commission is expected to recommend a two-child family and liberalized abortion laws.

2013. Cranston, A., "Improvement of the Quality of Life", *Congressional Record*, v. 118, no. 19, 15 February 1972, pp. S1700-1702.
Reviews the history of programs for family planning and puts into perspective the interrelationships of efforts by international, Federal, state, and community organizations to solve the problems of population growth, in line with the mandate of the Family Planning Services and Population Research Act of 1970 – to provide adequate family planning services to all persons who want them but cannot afford them.

2014. Zablocki, C. J., "Ethical Dimensions of Population Control", *Congressional Record*, v. 118, no. 38, 14 March 1972, pp. E2459-2465.
Presents letters calling for more in-depth research on the ethical-moral aspects of population control by the Agency for International Development; presents an article by D. Callahan discussing population control in the light of general moral rules, criteria for ethical decision-making, and final values to be pursued; the article also examines specific ethical issues related to the right of governments to establish fertility controls.

2015. Fraser, D., *The People Problem: What You Should Know about Growing Population and Vanishing Resources*, Indiana University Press, Bloomington/London, 1971, 248 pp. ($6.95)

Analyzes the nature of biological populations and potential serious problem areas (space, food and water supply, mineral resources, energy requirements, pollution, and solid wastes); concludes that intensive research and birth-control education might limit population to a level at which the environment can support it, that humans have the capacity to solve this problem, but that we may not be smart enough to do it in time.

2016. "Population Policy in Britain", *Bulletin of the Atomic Scientists*, v. 28, no. 1, January 1972, pp. 26-27.
Criticizes the British government's effort to define a population policy, contending that neither the methodology nor wisdom to do so exists at present; notes the gap between technology of population controls and traditional beliefs in developing countries; examines the work of gerontologists, pointing out the need to consider the sociopolitical implications of slowing down the aging process in humans.

2017. "Toward the Year 2000: The Ultimate Goal of a Population Policy", *The Hastings Center Report*, no. 3, December 1971, pp. 1-3.
Contends that the ultimate goal of a population policy should be human welfare, not just the reduction of population growth rates; states that "the ethical acceptability of a population policy will be enhanced by its compatibility and consistency with policies designed to meet a broad range of other social needs".

PRIORITIES FOR R&D

2018. Krauch, H., "Priorities for Research and Technological Development", *Research Policy*, v. 1, no. 1, November 1971, pp. 28-39.
Considers the divergencies between the results of a public opinion poll on R&D programs and actual government expenditures, which suggest that in the present distribution process of funds for the promotion of R&D projects and programs, uncontrolled interest groups (organized "big science" and government bureaucracies) can prevail; suggests the development of methods which would allow due consideration of interest structures and priorities in formulation of new R&D programs, leading to a more "democratic" distribution of funds, and describes a system which would accomplish this.

2019. Sanders, H. J., "Federal Funding of R&D: A Complex Mechanism", *Chemical & Engineering News*, v. 50, no. 10, 6 March 1972, pp. 10-13.
Discusses how Federal agencies decide which scientists and engineers will be supported; examines the controversy over the use of in-house or out-of-house experts to evaluate grants and contract proposals; concludes that most scientists believe that the agencies are striving to support the most worthwhile "projects possible within the limits of their missions and restricted budgets".

2020. Walsh, J., "National Science Foundation: Managing Applied Research", *Science*, v. 175, no. 4022, 11 February 1972, pp. 611-614.
Describes the history, organization, budget, and activities of the National Science Foundation's RANN (Research Applied to National Needs) program, directed toward helping to solve critical social and economic problems; anticipates Administration stress on energy problems, industrial research, and research directed toward increasing productivity in the services sector, which would lead to greater prominence for NSF and result in increased pressure to produce results.

2021. "NSF: More Money for Relevance", *Astronautics & Aeronautics*, v. 10, no. 3, March 1972, pp. 10-12.

Describes the objectives of 3 new initiatives planned by the National Science Foundation for FY 73: The Experimental R&D Incentives Program, a National R&D Assessment Program, and the Institutional Grants for Research Management Improvement; other activities will include expanded research focused on economic, environmental, and social problems, support for the initial development phase of the Very Large Array antenna system, and continuation of a program of Research Applied to National Needs (RANN).

2022. Shapley, D., "Industrial Laboratories: Whither Basic Research?", *Science*, v. 174, no. 4015, 17 December 1971, pp. 1214-1215.
Reports on the motives behind the cuts in employment for basic research by four major U.S. corporations, a trend which, if continued, could spell the decline of basic research in U.S. industry for a long time to come.

2023. Ellis, R. H., Jr., "Seven Laboratories in Search of a Mission", *Innovation*, no. 28, February 1972, pp. 30-38.
Discusses questions concerning the future of the Atomic Energy Commission's large multiprogram laboratories and of "Big Science" itself; notes the public's disillusionment with science; describes the recent diversification of the AEC's laboratories and their interdisciplinary nature; presents A. Weinberg's views on how Big Science should be managed – favoring establishment of "advanced technology centers" and extension of the "big laboratory, Big Science" approach to social problems.

2024. Ware, W. H., *The Ultimate Computer*, Report X72-038, 1972. (Available from Institute of Electronic and Electrical Engineers, 345 E. 47th St., New York, N.Y. 10017, Attn: SPSU. Price: $1.50.)
Argues the case for spending several hundred million dollars to develop computers up to 10,000 times faster than the best machines in design today, as a national asset of enormous value to society; outlines a number of complex problems that could benefit from such a machine, and suggests that construction be financed by a consortium or by the Government.

2025. "Kennedy Challenging Administration Science Policies", *Washington Science Trends*, v. 27, no. 25, 27 March 1972, pp. 145-146.
Describes proposals soon to be introduced by Sen. Kennedy: one, the National Science Policy and Priorities Act, would provide funds for identifying priority areas of civilian research, attacking the problems of our communities, and aiding in the conversion from defense to civilian programs; the other, a Technical Innovation Act, would be designed to provide economic aid to small technical firms.

2026. Mondale, W. F., "Science and the City", *Congressional Record*, v. 118, no. 38, 14 March 1972, pp. S3930-3932.
Emphasizes the vast potential of unemployed scientists and engineers for resolving the problems of the cities; presents a statement by Sen. Kennedy highlighting the same subject and describing the key provisions of his bill to establish a framework of national policy and priorities for civilian science and technology.

SCIENCE POLICY STUDIES

2027. Price, D. de S., *The State of the Art in Science Policy Studies*, Lecture on Studies in Science Policy, 23 March 1972, 28 pp. (Available from Forskningssekretariatet, Store Kongensgade 45, 1264 Copenhagen K, Denmark.)
Discusses research on science policy; examines what science policy studies are, what sort of content they include, and how

they are researched, taught, and promoted; discusses manpower in science policy research and teaching units in Europe and the U.S.; 16 references.

2028. Rubenstein, A. H., and Barth, R. T. (Eds.), *A Directory of European Research-on-Research,* Current studies of the R&D Process, 15 October 1971, 59 pp. (Available from Prof. A. H. Rubenstein, Northwestern University, Department of Industrial Engineering and Management Sciences, The Technological Institute, Evanston, Illinois 60201.)
Lists European studies on research arranged by principal investigator, and indicates briefly the nature of each study including a description of the project, research methods used, setting of research, sponsors or sources of funds, and approximate number of man-month or man-years used; emphasis is on studies on the management of R&D including studies on scientific information exchange and science policy.

2029. Fuller, J. K., "Science Policy Research Unit, The University of Sussex", *SPPSG Newsletter,* v. 3, no. 1, January 1972, pp. 14-19.
Describes the SPRU, set up in 1966 "to contribute through its research to the advancement of the complex social processes of research, invention, development, innovation, and diffusion of innovation, and thereby to a deeper understanding of policy for science and technology"; describes briefly a number of current projects involving technical innovation, water pollution, long-term forecasting, European cooperation in science and technology, activities related to developing countries, engineering manpower, and education.

2030. "People and Their Technologies", *Mosaic,* v. 3, no. 1, Winter 1972, pp. 14-19.
Describes a new curriculum at Cornell University, the Science, Technology and Society Program (STS), which includes courses with titles such as, *Biology and Society* and *Law and Environmental Control*; describes the research and some case studies carried out under STS.

SOCIETY-SCIENCE INTERACTION

2031. Skolimowski, H., "Science and the Modern Predicament", *New Scientist,* v. 53, no. 784, 24 February 1972, pp. 435-437.
Examines attitudes toward science today and questions whether science controls people, or people control science; defines the concepts of science — as an eternal truth, as an ideology, as pure knowledge, as a social institution, and as technology; concludes that science controls people only within the social institution and technology concepts; suggests that the answer to today's problems is not to curtail existing science but to create a new science.

2032. Spilhaus, A., "Ecolibrium", *Science,* v. 175, no. 4023, 18 February 1972, pp. 711-715.
Examines the problems of population, man's needs, his work to satisfy these needs, and the energy required to accomplish these works in the light of personal choice as a basic index; contends that our slowness in changing outmoded social practices, institutions, and traditions should not be allowed to slow technological realizations of potential benefit to all; states that "only by ensuring a continuity of long-term planning in our government can we hope to build toward the harmony of a bountiful economy with a beautiful environment", and offers a guideline — preserving and multiplying choices for people.

2033. Cartwright, E. M., "Technology and Our Future", Address to National Security Industrial Association; reprinted in *Congressional Record,* v. 118, no. 26, 24 February 1972, pp. S2506-2508.

Describes the developing antitechnology attitudes in the U.S. and its impacts: unemployment of scientists, setbacks in the aerospace industry, sharp decline of student interest in science and engineering, and weakening of technical colleges and universities; underscores the important contributions that technology can make to the Nation's future by attacking the "superproblems" of today, for example, environmental control.

2034. Gould, C. L., "Pollution, Politics, and Protest", Address to National Association of Real Estate Boards; reprinted in *Congressional Record*, v. 118, no. 27, 25 February 1972, pp. E1656-1659.

Emphasizes the need for reason, truth, logic, study, and action based on research rather than emotion in dealing with the environmental and overpopulation problems; cites historical disasters which could have been avoided or minimized by application of today's technology; questions the costs/benefits ratio of Federal social programs; concludes by pointing out the vast accomplishments of the U.S. people.

2035. McCaull, J., "The Politics of Technology", *Environment*, v. 14, no. 2, March 1972, pp. 2-10.

Discusses questions concerning the introduction of scientific information into social and political areas; examines the relevance of GNP as a measure of economic and social well-being, and describes interactions among technology, GNP, and national policy.

2036. Hackes, P., "Communicate or Die", Address before American Oceanic Organization; reprinted in *Congressional Record*, v. 118, no. 2, 19 January 1972, pp. E245-247.

Suggests that better communication between the scientific community and the public might have engendered more support for the National Oceanic and Atmospheric Administration and forestalled the drastic cuts in its budget; urges greater communication of scientists with the news media, who can, in turn, keep the public better informed on the environmental issues of today such as those surrounding the phosphates, mercury, lead in gasoline, and nuclear power plants.

2037. Morss, E. R., "Social Indicators: A Look at the State of the Art", *SPPSG Newsletter*, v. 3, no. 1, January 1972, pp. 1-3.

Reviews briefly the proceedings of a November 1971 conference composed chiefly of NSF grantees in the social-indicator field to examine communications among social-indicator researchers and with Government policy makers; discusses the variety of stumbling blocks to effective work on social indicators (definitions, recognition, social scientists not being "sufficiently plugged into public-policy issues", etc.).

2038. "Scientists Probe Public Interest Problems", *Chemical & Engineering News*, v. 50, no. 6, 7 February 1972, p. 16.

Describes the ideas emerging from a conference, sponsored by the Center for Science in the Public Interest (CSPI), focused on the fact-finding and advocacy roles of scientists and scientific societies in public interest work; suggestions included the following: facts alone won't guarantee action, a multiplicity of scientists' and citizens' groups is needed to apply pressure on proper agencies and officials, and scientific societies should support their members who speak out on social issues.

2039. Hogan, C. L., "'Technological Change' — Improving Our Living", *Vital Speeches of the Day*, v. 38, no. 5, 15 December 1971, pp. 139-142.

Describes phenomenal technological advances that have been made in the electronics industry alone; emphasizes that a new breed of marketeer, a "marketing catalyst", is needed to bring

together those scientists and engineers developing new technologies and experts in the marketing field who understand the needs of the great variety of marketplaces for these technologies; points out that the responsibility for seeing that technological change is applied for improving our living environment lies with us all.

2040. Lowe, W. W., "Creating Power Plants: The Costs of Controlling Technology", *Technology Review*, v. 74, no. 3, January 1972, pp. 22-30.
Describes the large-scale development of nuclear power plants; evaluates the effectiveness of technological controls imposed on this development, which are cumbersome and confusing, as well as costly; contends that technologists must make more effort to define goals and develop methods for societal guidance of new tools and techniques, since they would understand how these can be modified to meet specific purposes.

2041. Etzioni, A., and Remp, R., "Technological 'Shortcuts' to Social Change", *Science*, v. 175, no. 4017, 7 January 1972, pp. 31-38.
Assesses the effectiveness of the technological shortcuts in dealing with distinct social problems, such as heroin addiction, alcoholism, crime, and birth control, versus alternative approaches – the punitive, the information, and the therapeutic approaches; concludes that these technological shortcuts work insofar as they reduce cost and the pains of adjustment.

2042. "World Model Forecasts Collapse", *Chemical and Engineering News*, v. 50, no. 10, 6 March 1972, p. 2.
Describes a computer-based world model, developed at Massachusetts Institute of Technology for the Club of Rome, which incorporates relationships for changes among five physical quantities – population, industrial output, food, nonrenewable resources, and pollution; presents the model's prediction: "if current physical, economic, and social relationships continue unchanged, unrenewable natural resources will be exhausted" and "a soaring death rate and rapid drop in world population" will follow, probably by the 21st century; describes tests conducted with the model to locate changes that might prevent collapse or permit growth to continue, but the hoped for encouragements were not forthcoming.

2043. Rabinowitch, E., "Thoughts for 1972 – Living Dangerously in the Age of Science", *Bulletin of the Atomic Scientists*, v. 28, no. 1, January 1972, pp. 5-8.
Argues that mankind must change his sense of values and philosophy to cope with "the new technological apocalypse", whose "horsemen" are the threat of an all-destroying nuclear war, population explosion, and destruction of our natural habitat; presents a strong case for countering the bad side effects of technology with yet more utilization of our technological capabilities to overcome them.

2044. Seitz, F., "The Rejection of the SST – Reflections on the Causes and Effects", *Research Management*, v. 5, no. 2, March 1972, pp. 14-23.
Favors development of the supersonic transport through the prototype stage with public funds; considers 4 principal arguments against the SST and offers refutations for each: (1) technological advance has been too rapid, (2) the SST would be economically unsound, (3) it would damage the environment, and (4) other concerns (poverty and housing) should have higher national priority; examines possible reasons for deep changes in attitudes throughout our Nation; believes that the U.S. should continue to strive for leadership on the most advanced technological frontiers.

2045. *The Hastings Center Report*, Institute of Society, Ethics, and the Life Sciences, v. 2, no. 1, February 1972, 16 pp. (For availability, write Bruce Hilton, Hastings Center, 623 Warburton Ave., Hastings-on-Hudson, N.Y. 10706.)

Contains articles on risk taking for the unborn, behavior control, medical ethics, brain manipulation and mongoloid children, plus 32 pertinent 1971 references.

2046. Bahm, A. J., "Science is Not Value-Free", *Policy Sciences*, v. 2, no. 4, 1971, pp. 391-396.

Disagrees with the assumption that science's willingness to be objective implies being completely value-free; contends that "not a single aspect of science is completely value-free"; supports this contention by examining 3 major aspects of science (problems, attitudes, and methods) revealing the value questions faced by scientists in each aspect.

2047. McElheny, V., "Exploration as Man's Destiny", *Technology Review*, v. 74, no. 4, February 1972, pp. 7-8.

Describes the part scientific activities played in early exploration, pointing out that the necessities for navigation were close to central discoveries in astronomy, optics, and physics; emphasizes the links between exploration and literature, particularly science fiction; claims that "the power of imagination, shaped by 3 centuries of exploration", was a major factor in space exploration; contends that the realization of hopes that had been raised in fiction opens the door to space exploration forever.

2048. Solomon, J., and La Brecque, M., "Social Responsibility of Scientists", *The Sciences*, v. 12, no. 1, January-February 1972, pp. 8-12.

Presents the views of a number of scientists concerning their role and that of scientific organizations in society, expressed at the New York Academy of Sciences' Conference on the Social Responsibility of Scientists; suggestions were offered that "individuals act by urging their professional societies to publicize the issues and recommend action" and that "scientists examine the validity of objectivity and disinterest in our technological society, and determine whether the rules of the 'scientific game' should be modified".

SOUTH AFRICA

2049. Naude, S. M., "Twenty-Five Years of the South African CSIR", *Nature*, v. 234, no. 5330, 24 December 1971, pp. 444-446.

Describes the development of the South African Council for Scientific and Industrial Research and its accomplishments, and highlights the underlying principles which guide it.

SPACE — EARTH RESOURCES SATELLITES

2050. "Earth Resource Satellite", *Center Report*, v. 5, no. 1, February 1972, pp. 8-9.

Presents exerpts from a paper by R. O. Mason, codirector of the social science sector of a NASA-sponsored integrated study of earth resources, predicting the impact of the Earth Resource Technological Satellite (ERTS) program — it will change personalities, social relations and institutions, create new values and outlooks on life, and change social patterns; describes the "whole-system debate" approach toward achieving an enlightened ERTS-based earth resources policy.

2051. Casey, B., "New Satellite Will Be Aimed at Solving Earth's Pollution

Problems", *Congressional Record*, v. 118, no. 1, 18 January 1972, pp. H26-27.

Rep. Casey denounces those who call NASA a "wasteful luxury", citing a Reuters article that details a few of the 130 experiments approved for the first Earth Resources Technology Satellite to be launched this spring – dealing with such things as pollution, land use, timber resources, icebergs, and crop damage.

2052. Glines, C. V., "Pick Up the Phone and Learn the Earth's Secrets", *Nation's Business*, December 1971; reprinted in *Congressional Record*, v. 118, no. 2, 19 January 1972, pp. E142-143.

Describes the Earth Resources Observation System (EROS), which will provide the public with data about the earth's resources obtained from unmanned satellites; presents many practical uses for this system, such as, in control of drug traffic for detection of opium fields and in agriculture for detection of corn blight or determination of range conditions, water resources and pollution, soil types, and fertility deficiencies.

SPACE – INTERNATIONAL COOPERATION

2053. "Status Report on NASA International Programs in Space Communications", *Congressional Record*, v. 118, no. 36, 9 March 1972, pp. E2336-2337.

Summarizes the current status of three cooperative experiments in space communications: the U.S.-India Satellite Instructional Television Experiment (SITE); the U.S.-Canada Communications Technology Satellite (CTS) project; and Brazil's proposed project SACI (Advanced Satellite for Interdisciplinary Communications); describes NASA's responsibilities under an agreement with Telesat Canada.

2054. Strickland, Z., "1975 U.S.-USSR Mission Urged", *Aviation Week & Space Technology*, v. 96, no. 6, 7 February 1972, pp. 12-15.

Presents the details of a U.S.-Russia space mission scheduled for June 1975, if the Soviets endorse the flight plan; plans are for the Apollo to rendezvous and dock with the Salyut/Soyuz and for the two spacecraft to remain docked for 2 days while astronauts and cosmonauts visit both spacecraft and carry out simple scientific tasks; also describes plans for a second joint mission during the summer of 1976, which include 2 weeks in the docking configuration.

2055. Fink, D. E., "Tug is Candidate for Europe Shuttle Role", *Aviation Week & Space Technology*, v. 96, no. 4, 24 January 1972, pp. 43, 45.

Describes the possible participation of the European Launcher Development and Space Research Organizations (ELDO and ESRO) in the U.S. space shuttle system, mainly in developing a space tug; points out that decisions on funding levels and on the European launcher system will have to be made before ESRO and ELDO can become active participants.

2056. "U.S. Indecision of Aerosat Plans Spurs Impatience of Europeans", *Aviation Week & Space Technology*, v. 96, no. 2, 10 January 1972, p. 20.

Discusses possible consequences of the delay of final agreements between the European Space Research Organization (ESRO) and the Federal Aviation Administration on a joint air-traffic-control satellite program (Aerosat) occasioned by failure of Congress to approve funding for FAA's participation pending resolution of objections raised by the Communications Satellite Corp.; ESRO maintains that "any attempt by the U.S. to back out now would deal a serious blow to future cooperative efforts", even in other areas.

2057. Johnsen, K., "U.S. to Press for Private Entity Aerosat", *Aviation Week & Space Technology*, v. 96, no. 8, 21 February 1972, p. 17.
Describes the new plan for an international aeronautical satellite system; now being developed to replace the $140 million FAA/ESRO plan recently rejected by the Nixon Administration; under the new plan, U.S. participation in an international structure would be by a private entity and the international organization would be profit-oriented, with services being leased to users.

SPACE – PROGRAMS AND GOALS

2058. Strickland, Z., "New Era Opens for U.S. Space Program", *Aviation Week & Space Technology*, v. 96, no. 11, 13 March 1972, pp. 27, 29-30.
Describes NASA's new philosophy of stressing the practical applications of the space program and increasing the program's productivity; points out the economies to be effected through use of the space shuttle; presents graphs showing the shuttle's impact on employment and the budgets for each of the space science and applications programs since 1962 (including the estimated FY 1973 budgets).

2059. Jastrow, R., and Newell, H. E., "The Space Program and the National Interest", *Foreign Affairs*, v. 50, no. 3, April 1972, pp. 532-544.
Describes the developments leading to the decision to establish the shuttle program; presents examples of possible application of space technology (weather forecasting, mineral resource detection, and communications) to illustrate the economic value of space, and describes the return-on-investment which could be realized in each of these three areas.

2060. "From Jupiter to Saturn", *Nature*, v. 236, no. 5340, 3 March 1972, p. 8.
Notes the National Aeronautics & Space Administration's plan to launch two Mariner class spacecraft in 1977 to fly by Jupiter and then Saturn, replacing the grand tour of the outer planets which was scrapped for budgetary reasons; predicts that mission objectives will include observation of satellites of both planets, with Titan, a Saturn satellite, being of particular interest because it is the only planetary satellite in the solar system known to have an atmosphere.

2061. "NASA Lowering Its Outer-Planet Sights", *Astronautics & Aeronautics*, v. 10, no. 3, March 1972, pp. 12-14.
Describes the distribution of funds allotted to NASA for FY 1973; main features of the NASA program now include a shift in emphasis of manned space flights from lunar to earth orbital, development of the shuttle, space research and technology-based efforts to support the shuttle and planetary programs, and emphasis on the V-STOL for short-haul transportation; casualties of the lowered budget include the NERVA engine and the Grand Tour.

2062. "End of the Road for NERVA", *Nature*, v. 235, no. 5339, 25 February 1972, p. 415.
Notes the cancellation of the NERVA (Nuclear Engine for Rocket Vehicle Application) project because of insufficient demand for such a large vehicle in the 1980's, when NERVA would have become available; discusses possible uses of NERVA technology (perhaps in developing the mini-NERVA) and the propulsion systems under consideration for the 1980's: advanced chemical rockets, nuclear-electric and solar-electric propulsion, and nuclear propulsion.

SPACE – SHUTTLE

2063. *Space Shuttle Fact Sheet*, National Aeronautics and Space Administration, February 1972, 20 pp. (Available from Public Information Office, National Aeronautics and Space Administration, Washington, D.C. 20546.)
   Describes the importance of the shuttle as "the only meaningful new manned space program which can be accomplished on a modest budget"; describes the configuration of the shuttle, estimates the costs and relative savings of its missions; lists the major space-shuttle study contracts; discusses the economics.

2064. Wilson, J. E., and Gould, H. A., *Space Shuttle-Skylab: Manned Space Flight In the 1970's*, Status Report for the Subcommittee on NASA Oversight, January 1972, 1004 pp. (Available from Committee on Science and Astronautics, U.S. House of Representatives, Washington, D.C. 20515.)
   Presents transcripts of statements, discussions, and exhibits gathered during late 1971 briefing sessions at NASA field centers and offices of major contractors; concentrates on the current Skylab development effort (description, cost, performance, and schedule), and spells out the options for a recoverable space shuttle system with a compromise between development costs and operational costs, and suitable for a range of applications.

2065. "Shuttle Decision Hailed as NASA Victory", *Aviation Week & Space Technology*, v. 96, no. 2, 10 January 1972, pp. 15-16.
   Describes the new aspects of the space shuttle system accepted by the Nixon administration, points out the significance to the aerospace industry, and suggests the possibility of foreign countries' low-level participation in the shuttle program.

2066. Lessing, L., "Why the Space Shuttle Makes Sense", *Fortune*, v. 85, no. 1, January 1971, pp. 93-97, 113.
   Answers criticisms (high cost and lack of immediate relevance) being hurled at the space shuttle system by pointing out ultimate economies to be effected through efforts of highly cost-conscious design engineers and the benefits in areas such as defense, military development, advanced industrial applications, and scientific applications; notes the status of foreign space efforts, and the benefits to be derived from international cooperation in space programs.

2067. Magnuson, W. G., "Space Shuttle Program", *Congressional Record*, v. 118, no. 37, 13 March 1972, pp. S3872-3873.
   Reprints two articles which highlight the importance of, and the many benefits to be derived from, a space shuttle system; one article compares the proposed expenditures for the shuttle with expenditures for social-oriented programs, and concludes that the shuttle is a sound investment.

2068. Nixon, R. M., "Space Shuttle Program: Statement, 5 January 1972", *Weekly Compilation of Presidential Documents*, v. 8, no. 2, 10 January 1972, pp. 27-28.
   Announces the decision to proceed with development of a space vehicle (estimated for 1978) that can shuttle repeatedly from earth orbit and back at sharply reduced cost and preparation time and replace all but a few of the present launch vehicles; claims fringe benefits in reduced astronaut training time, continued U.S. preeminence in aerospace, increased employment, and better opportunities for international cooperation.

2069. Anderson, C. P., "The Space Shuttle", *Congressional Record*, v. 118, no. 26, 24 February 1972, pp. S2509-2513.
   Describes the structure of the space shuttle, and reprints 10 articles from various newspapers supporting continued develop-

ment of the shuttle program; presents a letter from the Administrator of NASA pointing out that the configuration concept selected is technically sound, meets the future needs of the nation and the space program, and can be developed at the lowest possible cost consistent with meeting these objectives.

2070. Fulbright, J. W., "The Space Shuttle System", *Congressional Record*, v. 118, no. 2, 19 January 1972, p. S37.

Sen. Fulbright questions the need for a $6.5 billion shuttle program, particularly "at a time when many important social and development programs are severely limited because of a lack of funds"; presents a Jan. 8 *Arkansas Gazette* editorial to this effect, accusing the Administration of approving the shuttle to get the West Coast vote.

2071. O'Leary, B., "Do We Really Want a Space Shuttle?", *New York Times*, 17 February 1972; reprinted in *Congressional Record*, v. 118, no. 22, 18 February 1972, p. E1422.

Suggests that further effort outside NASA is needed to provide to decision makers technical information bearing on cost and benefits of the space shuttle before a national decision can be made; asserts that NASA must answer questions as to what the shuttle is and what it will do, NASA's goals for shuttle use, and whether the shuttle is intended primarily for use by the Defense Department.

2072. Abzug, B. S., "The Space Shuttle", *Congressional Record*, v. 118, no. 38, 14 March 1972, pp. E2491-2492.

Opposes the shuttle, contending that other national needs, such as housing or transportation, are of higher priority; deplores the cancellation of missions having great scientific worth – the Grand Tour and NERVA programs – to gain monies for the shuttle; fears that the shuttle's primary use will be for defense, and not for civilian or scientific purposes.

2073. Strickland, Z., "Space Shuttle RFP Stresses Innovation", *Aviation Week & Space Technology*, v. 96, no. 13, 27 March 1972, pp. 18-19.

Discusses NASA's request for proposals on the space shuttle, which stresses imaginative approaches to some of the technical problems facing the program; lists the 12 aerospace contractors on the initial bidders' list; presents a list of 25 questions contractors are being asked in connection with their proposals, such as, "What is your approach to basic design evolution?"

2074. Fink, D. E., "Europeans Speed Space Program Plan", *Aviation Week & Space Technology*, v. 96, no. 8, 12 February 1972, pp. 18-19.

Notes that the European Space Community's accelerating preparation of a long-range space plan, detailing the extent of Europe's participation in NASA's shuttle program; describes the specific areas of European participation prescribed by NASA: building of the tug vehicle and development of specific orbital payloads; also being considered is the inclusion of European astronauts in the program.

SPAIN

2075. *Reviews of National Science Policy: Spain*, Organization for Economic Cooperation and Development, November 1971, 123 pp. (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Price: $2.50.)

Reviews Spain's present state of research and science policy, examining such features as expenditures on R&D, recent trends in expenditures on foreign technologies, quality of research carried out in government research centers, and the problems involved in integrating research into development plans; describes

the principal requirements of a new policy, stressing the need for a considerably increased R&D effort.

2076. Navascués, J.M.O., et al, "Survey of Spain", *Nuclear Engineering International*, v. 17, no. 188, January 1972, pp. 25-40.

Presents 6 articles on nuclear energy in Spain: the history, actions, and plans, by Navascués, President of Junta de Energia Nuclear; "Nuclear Fuel Cycle", by L. G. Jodra; "Nuclear Industry", by M. G. Cortines, President, Forum Atomico; "Role of Nuclear Energy in Spain's Electricity Supply", by F. Pascual, Secretario General Tecnico, Junta de Energia Nuclear; "Manufacture of Components", by E. Kaibel; and "Nuclear Power Projects", by J. Cabrera.

2077. "Progress in U.S.-Spanish Scientific Cooperation", *International Science Notes*, no. 26, January 1972, pp. 6-7, U.S. Department of State, Bureau of International Scientific and Technological Affairs, Washington, D.C. 20520.

Outlines activities under the 1970 U.S.-Spanish Agreement of Friendship and Cooperation in 7 areas: information sciences, Institute of Molecular Biology in Madrid, Institute of Automation in Barcelona, Spanish Institute of Oceanography, urban affairs, plant and animal diseases, and air and water pollution — to be financed from a $3 million fund available under the Agreement.

STATE AND LOCAL SCIENCE ACTIVITIES

2078. Bickner, R. E., *Science at the Service of Government: California Tries to Exploit an Unnatural Resource*, 2 December 1971, 34 pp. (Reprint available from Office of Intergovernmental Science Programs, National Science Foundation, Washington, D.C. 20550.)

Describes briefly two of California's more exceptional experiments: the so-called "aerospace studies" and the "Assembly Science and Technology Advisory Council", to illustrate the variety of recent efforts to translate scientific analyses into public policies; comments on the comparative advantages of two other sources of scientific advice: the not-for-profit research organization, or "think tank", and the universities.

SWITZERLAND

2079. Speiser, A. P., "Science Policies in the U.S. and in Switzerland: A Comparison", *Embassy of Switzerland Bulletin*, v. 12, no. 1, 7 March 1972, pp. 35-41.

Examines the science policies of the U.S. and Switzerland; reveals that the R&D expenditures per capita of the population are high in both countries, whereas the extent of government support for R&D differs widely, that in the U.S. being appreciable and that in Switzerland being slight; points out that neither country has a formal science policy.

TECHNOLOGICAL FORECASTING

2080. Weber, E., Teal, G. K., and Schillinger, A. B. (Eds.), *Technology Forecast for 1980*, Van Nostrand Reinhold, New York, N.Y., 1971, 228 pp. ($13.50).

Describes the changing character of technological forecasting and offers a speculative picture of the U.S. socio-economic environment in the future; presents forecasts on trends that will affect the future course of industry and, indirectly, society; specific forecasts include likely emergence of new metals, the significant role of ceramic materials, and advances in the fields of laser and

instrumentation technology and communications; also includes insights on computer and automatic-control-systems technology.

2081. Kiefer, D. M., "Industry Maps Tomorrow's Technology", *Chemical and Engineering News*, v. 50, no. 9, 28 February 1972, pp. 11-12, 17-19.

Cites reasons for the slow acceptance of technological forecasting in the chemical industry as a tool for planning and research management (e.g., lack of familiarity with the techniques by business officials, and the cost and complexity); notes the increasing interest expressed in this worthwhile tool; observes that the acceptance of technological forecasting by management and its integration into the decision-making process are essential to its successful application.

TECHNOLOGICAL INNOVATION

2082. Archer, L. B., *Technological Innovation — A Methodology*, SPF (Science Policy Foundation) Special Publication Series, 1971, 64 pp. (Available from Inforlink Ltd., 19 Carlisle Rd., London, N.W.9. Price: in U.K. – £4.60; overseas – £4.65 surface, or £5.00 airmail.)

Stresses the need for better techniques and criteria for decision making by individuals concerned with technological innovation; contends that there is no recognizable methodology for selecting and steering new ideas and inventions through to technological innovation; attributes the slow growth of Britain's economy to "failures of entrepreneurship"; utilizes diagrams, tables, and charts to discuss the variables involved in the interactions among the various mechanisms, institutions, and types of activity needed for innovation; indexed.

2083. "NBS Outlines Industry R&D Program", *Washington Science Trends*, v. 27, no. 20, 21 February 1972, pp. 115-116.

Describes experiments under consideration by the Bureau of Standards under the $14 million FY 1973 "new innovation" program to study incentives and mechanisms for stimulating R&D in U.S. industry; these include identification of technical opportunities for enhanced competitiveness, ways of assisting new technology-based ventures, ways of insuring patent exploitation, possibilities for procurement incentives, use of standards, and collaboration with industry to advance technologies.

2084. Shapley, D., "Technology Initiatives: Hints on the Magruder Effort", *Science*, v. 175, no. 4019, 21 January 1972, pp. 279-281.

Presents hints as to the possible extent of President Nixon's technology opportunities program designed to reverse the trend of fund cuts, unemployment, and charges of irrelevance to national problems now plaguing the U.S. research establishment; describes 8 problem areas which may receive Government support: productivity, health care, technology for meeting air-quality standards, protection from natural disasters, transportation, communications for social needs, natural resources, and cities and suburbs.

2085. Hotz, R., "A Significant Innovation", *Aviation Week & Space Technology*, v. 96, no. 7, 14 February 1972, p. 9.

Discusses the results of the New Technology Opportunities Program study of the advanced technology resources of the U.S., how they can be applied to help solve basic national problems, and what needs to be done to preserve and foster them to stimulate further growth of the national economy; the survey led to increased Government R&D funding requests in the FY 1973 budget, proved the necessity and feasibility of developing a national technology policy, and set a pattern for the techniques

of applying high technology to solution of major national problems.

2086. Winston, D. C., "Technology Effort Keyed to Law Changes", *Aviation Week & Space Technology*, v. 96, no. 13, 27 March 1972, pp. 16-17.

Discusses the proposed legislation, leading to potentially fundamental changes in the government-business relationship, which is a portion of President Nixon's $927-million FY 1972 technology stimulation program; lists requests to be submitted to Congress, including liberalization of Government support to small business investment companies and establishment of a national program of prize awards for outstanding achievements in R&D; discusses major technology stimulation areas in the program including transportation, energy sources, natural disaster protection, emergency health care, and drug abuse remedies.

2087. "A Factor for Progress: Technological Innovation", *OECD Observer*, no. 54, October 1971, pp. 10-13.

Describes the importance of interplay between universities and industry and the roles of industrial enterprise and governments in bringing about technological innovation, as set forth in the report, "The Conditions for Success in Technological Innovation", written by K. Pavitt and S. Wald and prepared at the request of the Third Ministerial Meeting on Science of OECD member countries; presents the authors' suggested objectives for government policy, including: ensuring industrial competition, ensuring that regulations consider social costs/benefits, and having active regional and manpower policies.

2088. "NSF Plans University/Industry 'Coupling'", *Washington Science Trends*, v. 27, no. 21, pp. 121-123.

Describes the National Science Foundation's academic counterpart to the NBS work with industry (Ref. 2083) in the new technological opportunities effort; lists major aspects of the experimental program, including "coupling" wherein NSF and industry would provide matching funds for joint research by universities and industry; describes the management and evaluation plans, as well as guidelines for proposed experiments of 3 types: cooperative research initiatives, R&D in the service sector, and human resources for technology innovation; concludes with a brief description of NSF's planned $2.5 million R&D assessment program to achieve a fuller understanding of R&D and innovations systems and their effects.

TECHNOLOGY ASSESSMENT

2089. Kasper, R. G. (Ed.), *Technology Assessment: Understanding the Social Consequences of Technological Applications*, Praeger Special Studies in U.S. Economic and Social Development, Praeger Publishers, New York/Washington/London, January 1972, 306 pp. ($16.50)

Presents 10 papers from seminars conducted in 1969-70 by the Program of Policy Studies in Science and Technology at The George Washington University, along with summaries of discussions of each; topics are Assessment of Information Systems by C. H. Danhof, Technology Assessment and the Congress by R. A. Carpenter, The Adversary Process in Technology Assessment by H. P. Green, The Management of Technology Assessment by L. H. Mayo, Technology Assessment in the Executive Office of the President by C. V. Kidd, The Social Function of Technology Assessment by F. P. Huddle, Technology Assessment and the Food and Drug Administration by A. H. Kaplan and R. H. Becker, Technology Assessment or Technology Harassment by L. Green, Jr., Processes of Technology Assessment — The National

Transportation Safety Board by E. Weiss, and Technology Assessment and Citizen Action by E. R. Mottur.

2090. Jones, M. V., "The Methodology of Technology Assessment", *The Futurist*, v. 6, no. 1, February 1972, pp. 19-26.
Describes a general technology assessment methodology, developed by the MITRE Corporation for the Office of Science and Technology; discusses each of the 7 steps comprising the methodology: (1) define the assessment task, (2) describe relevant technologies, (3) develop state-of-society assumptions, (4) identify impact areas, (5) make preliminary impact analysis, (6) identify possible action options, and (7) complete impact analysis; recommends developing better methods for determining which technologies should be assessed and devising ways to communicate the findings to the general public; presents a table exemplifying the standard questions that must be answered concerning each impact of a new technology and the types of answers needed.

2091. Jordan, B. E., "Technology Assessment, A Must for Today and the Future", *Congressional Record*, v. 118, no. 14, 4 February 1972, p. S1181.
Contends that technology assessment is urgently needed to cope with a "runaway technology"; observes that vital decisions that affect our lives and the universe must be made by men who lack the first-hand knowledge on which to base those decisions; calls for creation of a specialized information center to provide members of Congress with information on scientific, technical, economic, and social aspects of pending legislation.

2092. Huddle, F. P., "The Social Management of Technological Consequences", *The Futurist*, v. 6, no. 1, February 1972, pp. 16-18.
Comments on the current trends in technology assessment, which include a search for institutional mechanisms to assess technology, an increasing interest in technologies that have worldwide impact, and a growing consensus that assessment requires some statement of goals and priorities.

2093. Kiefer, D. M., "Technology Assessment: More Talk Than Action", *Chemical & Engineering News*, v. 50, no. 1, 3 January 1972, pp. 8-9.
Discusses the present ineffectiveness of technology assessment, but suggests that public pressure on environmental aspects may help remedy this; cites various problems to be considered in setting up a full-fledged institutionalized mechanism and methodology for technology assessment.

2094. "Establishing the Office of Technology Assessment and Amending the National Science Foundation Act of 1950", *Congressional Record*, v. 118, no. 16, 8 February 1972, pp. H865-886.
Presents comments by U.S. Representatives supporting the establishment of the Office of Technology Assessment to appraise the probable impacts of the applications of technology and coordinate information to assist the Congress in determining the priorities of programs; presents the text of the Technology Assessment Act of 1971.

2095. Winston, D. C., "Technology Assessment Bill Gains", *Aviation Week & Space Technology*, v. 96, no. 7, 14 February 1972, pp. 14-15.
Describes the organization and functions of the House-approved Office of Technology Assessment, designed to provide information solely for legislative purposes in response to direct Congressional Inquiry and, ultimately, to make Congress as independent as possible of technical studies supported by partisan executive agencies; OTA's functions include the identification of existing or probable impacts of technology or technological programs, determination of alternative technological methods or programs,

and estimation and comparison of impacts of the alternatives; emphasizes that OTA will not have a policy-making role.

2096. Shapley, D., "Office of Technology Assessment: Congress Smiles, Scientists Wince", *Science*, v. 175, no. 4025, 3 March 1972, pp. 970-973.
Describes the differing views surrounding the functions of the Office of Technology Assessment by Congress and by scientists: merely another research office, a technology-predictive tool, a source of competent and unbiased information, a means of predicting and then directing technology which could warp the free, creative development of American science and technology; describes expressions of doubt concerning the attainability of impartiality and the ability to predict all social impacts, and the fears of scientists that "Congress may now embark on a clumsy, destructive attempt to manage national R&D".

2097. "An International Society for Technology Assessors", *Science News*, v. 101, no. 12, 18 March 1972, p. 183.
Announces the establishment of the International Society for Technology Assessment, whose aim is to provide a forum for persons and organizations interested in studying and controlling the effects of technology; the Society plans to issue a quarterly journal, *Technology Assessment*, and will sponsor the First International Conference on Technology Assessment in March 1973 in The Hague; membership is open to anyone (for information write ISTA, Suite 5038, 1629 K St., N.W., Washington, D.C. 20036).

2098. "Science Policy Assessment", *SPPSG Newsletter*, v. 3, no. 2, February 1972, pp. 1-4.
Describes the final form of the bill, which passed the House February 8, 1972, to establish an Office of Technology Assessment (OTA); lists the functions of the proposed OTA, and describes the transformations of the original form of the bill which took place during its discussion in the House.

2099. Ebbin, S., "The Jamaica Bay Study", *The Futurist*, v. 6, no. 1, February 1972, pp. 27-28.
Describes the organization and procedures of the Jamaica Bay Study Group, formed by the National Academy of Sciences to assess the impact on the environment and area residents which might result from filling in part of Jamaica Bay for an extention of Kennedy International Airport; conclusions were that any runway construction would damage the natural environment of the Bay and reduce its use for conservation, recreation, and housing, and that while improvement of the Bay environment by technological means is possible, any airport expansion would increase the costs and dilute the benefits of these improvements.

TECHNOLOGY TRANSFER

2100. Vinikour, A. D., "Practical Applications of Aerospace Technology", *Congressional Record*, v. 118, no. 21, 17 February 1972, pp. E1241-1243.
Emphasizes that the application of aerospace technology is "industry-wide", and not restricted to a few companies; presents examples of the application of this technology in such categories as urban affairs, medicine, and the environment, to illustrate how aerospace developments are helping us achieve the social goals — in housing, education, health, transportation, pollution control, conservation, and safety.

2101. "The Transmission of Technology", *SPPSG Newsletter*, v. 3, no. 1, January 1972, p. 19.
Describes a new program at the Massachusetts Institute of Technology, with support of a $900,000, 5-year grant from the

Agency for International Development, to generate the knowledge needed for the efficient transmission of appropriate technology to developing countries and to train workers in the social diffusion of technical skills.

TRANSPORTATION

2102. *Social, Economic, and Environmental Factors of Transportation*, Highway Research Record No. 356, 1971, 174 pp. (Available from Highway Research Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $5.00.)

Presents 20 papers which fall into 3 general categories: public participation in highway planning, effects of highway changes on residential neighborhoods, and transportation corridor design and improvements; the articles deal mainly with social, economic, and environmental aspects of highways.

2103. Pikarsky, M., "Is a Viable National Policy on Urban Transportation Emerging?", *Congressional Record*, v. 118, no. 47, 27 March 1972, pp. E3088-3089.

Discusses groundwork for a viable urban transportation policy and describes the goals of such a policy: maximum mobility to all and desirable land-use and social patterns; discusses the concept of balanced transportation and the need for "comprehensiveness in envisioning goals, setting priorities, and developing programs for implementation".

2104. Taylor, S. F., "The Limited Tramway", *Congressional Record*, v. 118, no. 35, 8 March 1972, pp. S3642-3646.

Notes the requirement for flexibility in initial application and future development imposed on new urban transportation technology in the U.S. by rapidly changing economic and sociological conditions which characterize American cities; discusses the characteristics of a system, termed the limited tramway, which has been widely adopted in Europe and which can meet this requirement, notably the system's flexibility in route location, engineering, operations, function, and technological improvement.

2105. Biaggini, F. B., "The National Need for a Rational Transportation System", *Vital Speeches of the Day*, v. 38, no. 10, 1 March 1972, pp. 309-313.

Describes the present public view concerning the problems of U.S. railroads; contends that Amtrak's function should be to provide for an orderly shrinkage of rail passenger service; discusses the excessive costs of railroad nationalization and the need for regulatory and labor law reform in transportation; describes legislation which is laying the groundwork for a national policy on railroad transportation.

2106. "The Prospects for Faster Ground Transportation", *Astronautics & Aeronautics*, v. 10, no. 2, February 1972, pp. 52-64.

Examines the economic, technical, and practical difficulties connected with development of ground transportation systems, such as high-speed tube and rail vehicles, proposed for the future; concludes that improvement of existing rail systems would meet short-term requirements in the 70's and that rail service has the greatest potential for satisfying many transportation needs, but development would require vigorous and decisive support by industry and Government.

2107. Hanlon, J., "Who Derailed the Super-tube?", *New Scientist*, v. 52, no. 774, 16 December 1971, pp. 151-153.

Discusses the reasons for lack of acceptance of rapid mass transit systems, as demonstrated by the Skybus conflict in Pittsburgh,

for example, high costs, failure to meet reliability expectations, inability to convince the people that such a system is an improvement over the present one.

2108. Kleiber, M. C., and Vance, L. L., Jr., *New and Novel Passenger Transportation Systems: A List of Selected References*, University of California, Berkeley, April 1971, 23 pp. (Available from the Institute of Transportation and Traffic Engineering, University of California, Berkeley, Calif. 94720.)
Presents a selected bibliography of material available on new passenger transportation systems, arranged according to mode – land, water, and air – and subdivided according to service – interregional, regional, and local.

2109. "Transportation Funding Down to Earth", *Astronautics & Aeronautics*, v. 10, no. 3, March 1972, pp. 9-10.
Describes the distribution of the 1973 budget for the Department of Transportation, which for the most part will direct its R&D efforts toward practical problems such as urban mass transportation and air traffic control.

2110. "DOT R&D Matching Policy and Dollars", *Astronautics & Aeronautics*, v. 10, no. 1, January 1972, pp. 11-12.
Describes the new setup in the Department of Transportation designed to implement a total transportation R&D program; notes that "without large procurement and R&D budgets, DOT has to influence progress by demonstrating useful concepts and stimulating private industry to develop modern transportation systems"; describes areas in which R&D is planned, with air-traffic control receiving the most attention at present.

2111. "Aviation Advances Keyed to Fund Source", *Aviation Week & Space Technology*, v. 96, no. 6, 7 February 1972, pp. 16-17.
Reviews a report on the work of a study team under the auspices of the Domestic Council, which warns that the U.S. must soon find an acceptable means of funding high-risk, long-lead-time commercial aviation development projects or risk losing its civil aviation industry; describes efforts of the team directed toward that end; describes the recommended development projects as well as approved programs involving aeronautical applications in such areas as emergency health care, rapid mass transit, and energy.

2112. *Public Policy Toward General Aviation*, 1972, 193 pp. (Available from The Brookings Institution, 1775 Massachusetts Ave., N.W., Washington, D.C. 20036. Price: $7.95.)
Reviews business and pleasure aviation and its relationship to public policies; indicates that subsidies, currently at least $350 million per year, are expected to almost double by 1980, despite "user charges" imposed in 1970 to put civil aviation on a more nearly pay-as-you-go basis.

2113. Rice, R. A., "System Energy and Future Transportation", *Technology Review*, v. 74, no. 3, January 1972, pp. 31-37.
Presents statistics and graphs comparing energy consumption and net propulsion efficiency (number of passenger miles moved per gallon of fuel) of many components of the transportation industry which accounts for 24% of the total energy or over half of the petroleum consumed in the U.S.; projects future total energy consumption by transportation mode and describes the long-run energy implications for the transportation industry.

UNITED KINGDOM

2114. *Research and Development Expenditures (In the U.K.): A Compari-*

son of Industries, 7 pp. (Available from Centre for the Study of Industrial Innovation, 162 Regent Street, London WIR 6DD, England.)

Presents an analysis of 1968-69 R&D expenditures by manufacturing and construction industries in the U.K.; principal conclusions are: (1) the largest R&D expenditure was that of the aerospace industry; (2) chemical industry expenditures ranked among the top ten; (3) leading industrial R&D-performing sectors were electronics, industrial and marine engines, and scientific instruments; (4) there were large differences between the high- and low-spending sectors; (5) no industry spent more than 10% of its net output on R&D from its internal resources.

2115. Perutz, M. F., "Health and the Medical Research Council", *Nature*, v. 235, no. 5335, 28 January 1972, pp. 191-192.

Contends that the U.K. Medical Research Council's achievements, on a total budget of £150 million over the last 20 years, belie the implication of the Rothschild report that the council does not give the country value for money spent in terms of human health; offers examples, including the Council's outstanding contributions to clinical medicine; describes the Council's policies which enable it to achieve so much with its limited budget — for example, supporting research in universities, hospitals, and its own laboratories.

2116. Keynes, R. D., "Control of Strategic Research in Agriculture", *Nature*, v. 235, no. 5338, 18 February 1972, p. 358.

Describes problems associated with application of Rothschild's customer-contractor principle to the planning of R&D in agriculture; discusses the implications of Rothschild's proposal to transfer control of a major portion of the Agricultural Research Council's funds to the Ministry of Agriculture, Fisheries and Food (MAFF).

2117. Leigh, G. J., "Proposal for a Constructive Response", *Nature*, v. 235, no. 5337, 11 February 1972, p. 303.

Suggests an alternative to the Rothschild proposal which calls for the individual research councils to be replaced by a single research council dealing with all the sciences; the council would be supervised by a committee to be composed of scientists, members of government and industry, and laymen; describes the many functions envisioned for this committee.

2118. Langrish, J., "Rothschild is Right for Industry", *New Scientist*, v. 53, no. 779, 20 January 1972, p. 144.

Supports Lord Rothschild's contention that decisions concerning R&D should be made by people other than scientists, citing evidence from the Queen's Award Study, as well as his customer-contractor principle, but foresees problems in applying this principle in the organization of government research.

2119. Sutherland, G., "How Green Was My Paper", *Nature*, v. 235, no. 5336, 4 February 1972, pp. 245-246.

Points out that the Rothschild and Dainton reports fail to establish a framework for government research and development, the former leaving the present framework unaltered and the latter merely proposing a Board of Research Councils as a substitute for the Council for Scientific Policy; presents three requirements which should be satisfied by such a framework: each department should make full use of science and technology to achieve its objective; where the necessary science and technology do not exist, the department must ensure that the required research and development are carried out satisfactorily; and an organization for government research and development should be set up by the Cabinet to fulfill the above objectives

efficiently and economically; contends that the introduction of a customer-contractor principle for applied research is no substitute for, nor will it automatically lead to, a satisfactory new framework.

2120. "Shadow of Rothschild over Strathclyde", *Nature*, v. 235, no. 5333, 14 January 1972, pp. 71-73.
Describes the discussions during a January 1972, meeting organized by the Council for Scientific Policy at the University of Strathclyde, which centered on the research-council system, links between discoveries in pure science and technological development, opportunities for Ph.D.'s, and science and social priorities; notes the general acceptance of the customer-contractor principle for applied research advocated by Lord Rothschild in his report on the organization and management of government R&D, but points out that widespread disagreement prevailed concerning Rothschild's application of the principle.

2121. Ubbelohde, A. R., "Value for Money from the National Labs", *New Scientist*, v. 53, no. 779, 20 January 1972, pp. 142-143.
Criticizes the Rothschild and Dainton reports for failure to provide answers to two key questions: whether Britain is receiving adequate returns for its large investment in national research institutes, and by what means and how effectively can scientific knowledge be brought into practical use; describes the constraints placed on science-based industry by economics and patent implications, and emphasizes that an important principle of government policy should be that no sector of research of national importance remain uncultivated.

2122. Goldsmith, M., "Britain's Scientists Alarmed About R and D Proposals", *Science Policy*, v. 1, no. 1, January/February 1972, pp. 1-1 – 1-4.
Summarizes the salient points and implications of the Rothschild and Dainton reports; Rothschild's paper is concerned with the framework in which the efficiency of government R&D can be maximized, and is based on the principle that applied R&D must be done on a customer-contractor basis; Dainton's report reviews the Research Council System, concluding that the Research Councils ought to be more closely integrated among themselves and with public policy and social needs, not fragmented.

2123. Gibbons, M., and Johnston, R. D., "A Question of Efficiency in Research", *Nature*, v. 235, no. 5338, 18 February 1972, p. 359.
Comments on the differing views regarding the proper framework for conducting government R&D expressed in the Rothschild and Dainton reports; describes coupling, or interaction, of science and technology and summarizes findings of others which support his view that the chief contribution of science is the transfer of information to technology via personal contact, often when it is not being specifically sought; suggests that reorganization of government R&D include expansion of this coupling to facilitate the flow of the benefits of science to the entire community.

2124. Coleman, H. J., "U.K. Government Backs Concorde As Commercially Viable Project", *Aviation Week & Space Technology*, v. 95, no. 25, 20 December 1971, pp. 16-17.
Notes the firm decision of the British Government concerning the Anglo-French Concorde SST; discusses the tentative production plans for the SST and suggestions for joint ventures (with the U.S.) in SST development.

2125. Valery, N., "Pragmatism among the Plane Makers", *New Scientist*, v. 53, no. 777, 6 January 1972, pp. 17-19.
Discusses the British Government's confidential study on the future of the aircraft industry, which concerns basically the

industry's organization; contends that the British aircraft industry's biggest mistake was in building complex, prestigious aircraft at crippling national expense, and that there would have been fewer failures had the industry been willing to risk more of its own money on its aircraft projects; notes the trend toward application of the return-on-investment criteria in aircraft activities and Government insistence on market researching of new projects in the civil aviation field before agreeing to back them.

2126. Tinker, J., "Britain's Environment – Nanny Knows Best", *New Scientist*, v. 53, no. 786, 9 March 1972, pp. 530-534.
Describes Britain's pollution control system which operates on 2 principles: (1) close cooperation between regulatory authority and industry, and (2) consideration of each case on its own merits, with emission limits being based on local conditions; deplores government actions to conceal the permitted emission limits, discharge levels, and the results of environmental monitoring; charges that industrial secrecy is being preserved at the expense of public participations and at the risk of public safety.

URBAN PROBLEMS

2127. Glover, C., "The Problems Associated with Rapid Urban Growth", *OECD Observer*, no. 54, October 1971, pp. 5-9.
Identifies some of the main problems of urban growth in OECD (Organization for Economic Cooperation and Development) countries, where these problems are often national and sometimes international in scope, for example, problems of providing employment, dealing with pollution, providing adequate transportation, and maintaining the quality of the environment.

U.S.S.R.

2128. White, S. (Ed.), *Guide to Science and Technology in the USSR*, Francis Hodgson, International Publication Service, New York, 1971, 300 pp. ($38.50)
Presents a brief summary of the social aspects of Soviet science; describes the organization and planning of Soviet R&D, and treats individually the natural sciences, space research, and military affairs; covers major industry groups – their backgrounds, technology, R&D, research institutes, and journals; presents material on patents, information services, and Soviet literature translations.

2129. "Rationalizing Research", *Nature*, v. 235, no. 5336, 4 February 1972, p. 242.
Notes the establishment of two new science centres by the Soviets (the West Ukranian and Uralian) and the double aim in the plans for these centres: to study immediate and local problems as well as to conduct basic research on the all-Union scale.

2130. Kirby, E. S., "Environmental Spoilage in the USSR", *New Scientist*, v. 53, no. 777, 6 January 1972, pp. 28-29.
Describes the environmental degradation in the Soviet Union arising from unsound deforestation and agricultural policies of the Government, pollution, water loss, overhunting, and the dumping of industrial and urban wastes.

2131. Dingell, J. D., "Soviets Fighting Water Pollution", *Congressional Record*, v. 118, no. 42, 20 March 1972, pp. E2712-2713.
Suggests that the U.S. might be in another race with the Soviet

Union — a race to clean up waterways; presents an article by T. Shabad which reports on the Soviets' latest attack on pollution: a billion-dollar program calling for the construction of waste-treatment plants and strict enforcement of control measures in the entire drainage basins of the Volga and Ural Rivers, and prohibiting, by 1980, the discharge of all untreated wastes into these River basins.

2132. Winston, D. C., "Weapons Seen Soviet Space Effort Goal", *Aviation Week & Space Technology*, v. 96, no. 4, 24 January 1972, pp. 15-16.
Discusses a report by the Library of Congress *(Soviet Space Programs 1966-70)* on possible future developments in the Soviet space program: a strategic and tactical orbital weapons system, a reuseable space shuttle, and a manned planetary space flight not only to the moon but also to other planets.

2133. Gillette, R., "The Soviet Space Program: Effort Said to Surpass U.S. Peak Level", *Science*, v. 175, no. 4023, 18 February 1972, pp. 731-736.
Describes the findings of a study, "Soviet Space Programs, 1966-70", produced for the Committee on Aeronautical and Space Sciences: that the Russians have a manned lunar program which may put a cosmonaut on the moon by the mid-1970's and that the current level of Soviet space activity exceeds that of the U.S. at its peak in 1966; the study also included a general comparison of the size of the U.S. and Soviet programs, and an analysis of the close relationship between the Soviet military and civilian programs.

WASTE MANAGEMENT

2134. "EPA Reorganizes Solid Waste Programs Office", *Environmental News*, Environmental Protection Agency, Washington, D.C. 20460, 6 March 1972, 2 pp.
Describes EPA's creation of three new divisions in its Solid Waste Program — Resource Recovery, Processing and Disposal, and Systems Management — designed to permit expansion of the EPA's technical assistance and related aid to municipalities in solving their solid waste management problems.

2135. Ruckelshaus, W. D., *Recycling, Recovery and Reality*, Speech presented at Aluminum Association Annual Meeting, New York, N.Y., 27 and 28 October 1971, 6 pp. (Available from The Aluminum Association, 750 Third Avenue, New York, N.Y. 10017.)
Presents views on whether nonreturnables should be banned, contending that banning of nonreturnables would create more problems and that "we will gradually move toward an economy which embraces extraction, manufacture, distribution, consumption, disposal, and total reclamation of all materials".

2136. "Senate Resolution 260 — Submission of a Resolution Relating to Management of Nuclear Wastes", *Congressional Record*, v. 118, no. 24, 22 February 1972, pp. S2204-2207.
Describes the international scope of the radioactive-waste-management problem, and efforts of the U.S., W. Germany, France, and Britain to find a safe way to store nuclear wastes; presents text of a resolution introduced by Sen. Pearson calling for an international conference to consider siting of repositories for nuclear wastes, and related matters.

2137. Kenahan, C. B., and Flint, E. P., *Bureau of Mines Research Programs on Recycling and Disposal of Mineral-, Metal-, and Energy-Based Solid Wastes*, Bureau of Mines Information Circular 8529, 1971, 53 pp. (Available from U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh, Pa. 15213.)

Summarizes the research activities of the Bureau of Mines under an in-house program designed to (1) develop and demonstrate new or improved techniques for recovery and recycling of values contained in urban wastes, (2) reduce environmental pollution resulting from inadequate treatment of a major solid waste, (3) develop technology and provide training in solutions to problems involving the use and reuse of urban solid wastes, and (4) alleviate the acute problem of urban solid waste disposal.

2138. *A Glossary of Solid Waste Management*, 1971, 11 pp. (Available from National Center for Resource Recovery, Inc., 1211 Connecticut Ave., N.W., Washington, D.C. 20036.)
Briefly defines in nontechnical language some of the most commonly used, but frequently misunderstood, solid-waste terms.

WATER RESOURCES

2139. Sterling, C., "Within a Century — Will We Run Out of Water?", *Washington Post*, 28 February 1972; reprinted in *Congressional Record*, v. 118, no. 29, 29 February 1972, pp. S2809-2810.
Discusses growing worldwide concern over water supplies, noting the shortages already existing in thickly settled regions around the globe and the U.N. Food and Agriculture Organization's prediction that the planetary shortage will become serious in 30 years, when world population will have doubled and demands for water nearly tripled; describes the squandering and excessive fouling of our water resources, and the decline in river flow and the lowered level of inland lakes and seas due to increased drain by people and industry, diversion of water by hydroelectric dams, and carrying of water to the oceans by floods caused by deforestation; observes that water problems alone may force world society to stop growing.

2140. *Coordination Directory for Planning Studies and Reports, August 1971*, U.S. Water Resources Council, October 1971, 11 Sections. (Available from U.S. Water Resources Council, Suite 800, 2120 L St., N.W., Washington, D.C. 20037.)
Describes each of the Federal agencies represented on the Water Resources Council under the Departments of Agriculture, Army, Commerce, HEW, HUD, Interior, and Transportation, as well as the Environmental Protection Agency, Federal Power Commission, Council on Environmental Quality, and the Water Resources Council itself, giving organization, history, functions, activities, and principal office locations; objective is to facilitate communication and coordination of all water and related land resources development programs; looseleaf format makes updating easier.

2141. *Water Resources Thesaurus*, 339 pp. (Available from U.S. Bureau of Reclamation, Engineering and Research Center, Attn: Code 922, Building 67, Denver Federal Center, Denver, Colo. 80225. Price: $3.25.)
Presents more than 6500 technical and scientific terms relating to water resources, arranged for use in indexing technical documents.

WEST GERMANY

2142. "German Federal Republic: Science Expenditure Still Rising", *Science Policy*, v. 1, no. 1, January/February 1972, p. 2-3.
Describes the GFR's continually increasing science expenditures, which doubled between 1964 and 1970, with private-industry expenditures for R&D increasing slightly faster than public expenditures; in 1970, the Government spent 5.1% of its budget

on science; presents data showing that the R&D expenditures by enterprises bears no direct relationship to the size of the enterprises.

2143. "German Federal Republic: New DFG Research Groups", *Science Policy*, v. 1, no. 1, January/February 1972, p. 2-3.
Mentions the recommendation of the German Research Association (DFG) that 19 new research groups be set up in 1972, making it possible for small groups of researchers to work together on scientific problems for limited periods of time; groups will be financed on selected themes in the humanities, on theoretical and practical medicine, on biology, agriculture, natural sciences, and the environment; reports the initiation in 1972 of 23 new DFG-supported priority programs in a wide range of fields.

2144. "Reorganization of German Science Ministry's Advisory System", *International Science Notes*, no. 26, January 1972, p. 13, U.S. Department of State, Bureau of International Scientific and Technological Affairs, Washington, D.C. 20520.
Describes changes to improve the "critical partnership" between the Ministry of Education and Science and its advisers and to strengthen the influence of the informed public on political decision making for research priorities; changes include replacement of existing committees by a 15-member Advisory Committee and 4 12-member bodies, each responsible for a different field (nuclear R&D, radiation protection, space research, and data processing).

2145. "Trends in the German Education and Science Budget", *International Science Notes*, no. 26, January 1972, pp. 12-13, U.S. Department of State, Bureau of International Scientific and Technological Affairs, Washington, D.C. 20520.
Outlines the major items in the 1972 draft budget of the German Federal Republic for Education and Science (28.6% higher than in 1971, with about 40% for science and 60% for education); major increases were for space research, data processing, and promotion of new technologies.

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Man and Ecosphere, Freeman, San Francisco, Calif. 94104, 1971, 307 pp. ($11.00)

The Atmospheric Sciences and Mans Needs: Priorities for the Future, National Academy of Sciences, 2101 Constitution Avenue, Washington, D. C. 20418, 1971, 88 pp. ($3.50, Paperback)

Matthews, W. H., Kellogg, W. W., and Robinson, G. D. (Eds.), Man's Impact on the Climate, M I.T. Press, Cambridge, Mass. 02124, 1971, 594 pp. ($19.50)

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