Issues in Science Policy

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TEN ISSUES IN SCIENCE POLICY

Each issuesis preceded by a short description of the situation after the current Nixon-Ford administration, and comprises a very brief description of the topic and some of the specifics. If they are to be developed into fully staffed briefing papers for Carter, significant additional work will be needed. Volunteers cheeffully accepted, for improvements or elaboration. Theyewere done quiee hastily. Please pardon my home typing.

1) Dev. of Sci. and technology policy: role of OSTP
2) Sci, technology and the ecomomy
3) Technical competence of hte federal government
4) Public participation in decisions of govt with high sci. content
5) Science and national defense
6) Science and international affairs
7) Basic research and academic science
8) Environment: climatology and earthquakes
9) Social sciences: managing and measuring new social programs
10) Reorganization of the federal Sci and R and D agencies

THE NIXON - FORD ADMINISTRATION AND SCIENCE

L. Destruction of the Office of Science and Technology, Nixon Feb. '73, and dilatory efforts to re-establish a central policy-making capability by Ford (Aug. 1976).

In Feb. '73 Nixon fired Science advisor E.E. David Jr., and used his authority under the reorganization act to abolish the Office of Science and Technology in the Exec. Office of ghe President. Nixon's hostility to the scientific community was open. Evidence can be found in the "enemy list", in his orders to cut off all research support to M.I.T. (not carried out by the agencies), by his failure to name any recipients for the national medal of science for over a year in a half.

As a result of this hostility the agencies of government began to lose contact with the new ideas arising in the universities and other laboratories. Worse, the President lost a technically competent mechanism for objective, independent judgments about technology issues arising th the agencies. By allowing the only techical expertise to exist in the agencies, he made the presidency helpless in the face of the narrow self interests of those agencies and their constituencies. Thus, for 4 years the federal government has been drifting, without a clear sense of purpose in science and technology, without strong management of the agencies, and with ineffective contact with the majority of scientific expertise, which exists outside government.

Pressured by committees of both houses of congress, which held extensive hearings on the need to establish a central policy-making capability for science in the executive office, President Ford finally sent forward a bill to establish an Office of Science and Technology Policy. This bill was a watered down version of the legislation originating in the House and Senate. The president took little interest in it personally, turned over the entire matter to the Vice-President. Even after the bill passed and was signed in the early spring of 1976, months went by before the President sent up a nomination for the director of the office. This delay was largely the result of hostility to the choice of Dr. Guyford Stever, Director of the National Science Foundation, on the part of conservative republican senators. Thus Dr. Stever will take office as director OSTP during the waning months of the term; little can be accomplished before January.

The nation has suffered during this four year period of neglect of the responsibilities of leadership, not because science has suffered but because the attainment of important natgional objectives has been frustrated. The four years of lost time have extracted their toll in many fields - environment, health, energy, defense, economic vitality, and agriculture. In each case - and in others - the stimulation to excellence and the strength of coordination of federally sponsored R and D have been missing.

1. The development of science and technology policy: role of OSTP

PROPOSED POSITION:

OSTP is a particularly important office in the Executive Office of the President because of the accumulated problems during the four years of republican neglect. The Director of the Office will also serve as the President's Science Advisor, in addition to his statutory duties, to insure that the President is aware of the critical scientific issues in major public decisions and to help the President foresee long range issues that result from new scientific knowledge.

Scientists and engineers in America share the Gov. Carter's own conviction that the nation's technical capabilities are not as effectively contributing to the people's long term well being as they might be, and a vigorous, productive and well challenged scientific community is essential to this end. Thus, the OSTP will not be the voice for science in the White House, but the voice of science and engineering providing objective evaluations of the technical aspects of important public matters. This high level, independent source of technical evaluation and judgement will help insure that individual departments and agencies do not take an excessively parochial view, that technical issues are dealt with on a consistent basis across the government, that technical risks are squarely faced before new programs are launched.

OSTP will not attempt to relie on its own staff for its evaluations. The president will insure that the scientific and engineering skills of the agencies are available for addressing specific issues. More important, the OSTP will draw upon the best talent and experience in the nation, outside of government for advice.

OSTP can make important contributions to better management of

federal R and D programs. The Advisory Committee called for in the statute willcarry out the mandate fo theCongress to consider alternatives for reorganizing the federal agencies dealing with science and technology. Thus OSTP will have a major contribution to the President's determination to streamline the governmental structure, improve its efficiency and make its activities more responsive to public needs.

A critical factor in the federal government's technicalh competence and efficiency is the qualifications of the Assistant Secretaries for Science and Technology or Research and Development in the major departments, and the heads of major independent R and D agencies. The Director of OSTP will be provided hte opportunity to suggest experienced scientists and engineers for these positions, and will have the opportunity to comment on their professional qualifications during the process of White House review of proposed appointments.

OSTP will have to deal with economic aspects of technological issues; this calls for close working relations with the CEA and particularly with the OMB. There is no R and D program for which costs are not a matter of concern. OSTP will be expected to provide critical evaluations of proposed and on-going federal R and D programs of particular importance to insure that their goals are technicallyappropriate, the approaches and schedules and realistic and the benefits are correctly defined. These evaluations will be made available to the Director, OMB and will form a part of the budget and program development process.

OSTP will give special attention to the development of the capabilities of state and local government to deal with technical matters. This is particularly important as increasingly the politically difficult issues concerning scientific questions involve subjective estimates of public risk. It is desireble to internalize as many of these decisions on the

local level as one can consistent with a coherent national strategy.

ISSUE:

After four years of abandonment by the present administration, OSTP has been recreated by statute. Howeeffectively this office is staffed and used by Pres. Carter will be watched intensely by scientists, engineers and all those concerned with the technical components of public decisions. The key indicators are the personal relation of the OSTP director to the President and white house staff, the scope of the OSTP, its role in reorganization and R and D management appointments, its utility to the president for early warning and for keeping the agencies technically honest.

2. Failure to address the policies that would enhance the nation's scientific and technological contributions to economic health.

Ever since 1968 it has been increasingly obvious that the health of the American economy was a matter of concern, and was an increasingly important component of national strength and security. Economists know that technology and the training level of the work force are the source of much of the productivity growth in the economy. They are the source of virtually all new industries. U.S. productivity has during this period grown more slowly than almost all of our commercial competitors in world trade. U.S. public and private investments in R and D, and in new capital facilties to use the new technologies have lagged. Inflation and unemployment are associated with this trend.

Even dthe Nixon administration recognized the seriousness of the threat to our leading industries from the growing technology strength of other nations. But the response was vacilating and ineffective.

While virtually every other industrialized, market-economy nation has established both policies and programs for revitalizing their economies by encouraging industrial innovation and organizing applied research and development programs intended to create employment and economic strength in the private sector, the U.S. has continued with a technologically toothless Commerce Department, with technology policy made by default by the Treasury and Justice Departments, with no effective dialog on R and D matters with the private sector, which performs 70 % of the R and D in the U.S.

In the fall of 1971, the Nixon White House discussed a "new technology opportunities" program. The only result of this supposed billion dollar investment program was a $44million program which has been cut and trimmed until today its only vestige is the "Experimental Technology Encentives Program" (ETIP) in the National Bureau of Standards. This subcritical activity is only a symbol of what needs to be done.

The major difficulty is that the administration has been unsuccessful in organizing federal R and D programs in such a way that the results can be effectively pickedup and translated into jobs and new technology for the public through the private sector. The most obvious example is the national energy program in ERDA, which still fails to engage the best efforts of the national technical commu-nity, to stimulate private investment in new energy technologies.

2. Science and technology and the economy.

ISSUE: How can government more effectively promote employment, productivity and trade by encouraging effective use of R and D in U.S. industry? Today economic policy is made everywhere in the federal government; technology policy is made nowhere. The Department of Commerce should be renamed and technologically upgraded so it can deal with assessments of the technological strengths and weaknesses of U.S. industry, can cope with the overt and massive subsidies in R and D being given to competing home industries by other nations, and can devise the policies and the programs that will re-energize U.S. industrial technology.

Recent presidents have been pursuaded that the health of the economy can be addressed through monetary and econmic policy alone. But questions of industrial technology performance are microeconomic matters. Government must have the capability to evaluate the opportunities for technology to improve international competitiveness, create jobs and improve the quality of the work environment. This must be approached on an industry-by-industry basis.

To insure that the research capabilities of the universities private sector laboratories and are able to make their contribution to healthy economic development, four policy elements are required:

1) govefnment policies (regulatory, tax, and procurement and patent policies) that provide a more competitive, innovative and productive environment for american business, so business will have the confidence and the daring to reach out for new technology for the future.

2) a national science and engineering manpower policy which aligns the training of scientists with the needs of a vigorous scientific-industrial

enterprise. (Today, half the science PhD graduates enter jobs essentially unrelated to their professional training. Universities haven't the resources to develop the new programs that would permit them to meet the demand for new skills, such as software engineering, for which their is unfulfilled demand and bring their programs up to date.)

3) A re-emphasis of government-funded univeristy and national laboratory research on a balanced program of both basic and applied research aimed at challenging long range goals. We must get away from the current effort of the administration to demand economic justification on the basis of near term benefits from academic research (a required that industrial research managers do not place on their must long-range exploratory research, despite the view to the contrary held by Ford's OMB). Instead we should replace the burocratic paper-shuffling criterialfor program priority and project selection by the best scientific and technical judgments the experts in America hav to offer. The technological users of new science should participate in these judgments, which calls for greater involvment of experts from industry as well as universities and other laboratories.

4) In the conduct of research and advanced development to stimulate the civil economy and solve identified national problems, better ways of coupling the researcher to the end user must be found. Projects jointly carried out by univeristy and industry teams should be encouraged, with the results in the public domain. Expensive demonstration projects should be restricted to technically meaningful tests of daring new ideas, Where possible the sector of industry that must ultimately deliver the service should be involved.

3. Scientе, technology and the national laboratories; technical competence of government.

During the 1950's and 1960's major efforts were made to build up the scientific and technical competence of the federal government and to assist the states to this end. The national laboratories, some directly operated like the National Bureau of Standards (NBS), others contractor operated provided an innovative and flexible tool for addressing new problems facing America. Serious efforts were made to improve the internal capabilities of the federal agencies, especially those with regulatory responsibilities, so the government could carry out its responsibilities without undue reliance on technical judgemetns made by those with vested interests.

Today, when correct government judgemetns on technical matters are more important than ever, the agencies are farther than ever from being able to carry out their technical responsibilities adequately. We read of FDA rulings made on the basis of "botched experiments" in FDA laboratories. We hear of the FCC staff complaining they haven't the manpower and expertise to regulate properly the communications industry. The EPA has been studied by the National Research Council, whcih found its technical capabilities severely lacking.

There is no excuse for the government's incompetence frustrating the proper conduct of the public's business. When the agencies have the needed competence, they understand what scientific questions they must answer and become capab le of using outside studies and advice. They are also much less vulnerable to technical arguments from special interests that may not be objectively presented. Finally, they are more likely to make their decisions on a political basis - or what is often worse - make no decisions at all.

The national laboratories are very weakly coupled to this aspect of government responsibility. They are primarily engaged in the major research and development programs of ERDA, NASA, DOD. They, too, are being poorly used. On the one hand, their freedom of action to innovate has been restricted by too much nit-picking from agency headquarters staffs. On the other hand their applied work is too weakly coupled to the intended users of their output, which increasingly is private industry. Finally, the technical problems facing thenation are increasingly varied and need a quick response. The national laboratories remain rigidly confined to their sponsoring agencies missions. In the absence of a Science Advisor to the President, there has been no innovative thinking about how this resource of talent might be managed differently to make it more responsive to current priorities.

In government science and technology, "why not the best?" indeed.

#3 Technical competence of the federal government.

Why must the federal government operate laboratories of high competence? There is no other way the government can manage properly its responsibility for financing half thegnation's R and D. There is no other way the government can exercise its regulatory responsibility or even understand whether its major programs are effective. Without its own competence, the agencies are forced to depend on outside advice, without the ability to evaluate it, and thus with loss of accountability. With internal competence the agencies can be hld accountable and extensive use of contractor support, research and advice from outside government can be very advantageous.

For the four years in which OST was abolished there was no central oversight in the executive branch of the quality of the agencies' scientific capability. The demoralization of the scientists in these laboratories, their sagging technical vitality, the tendency of regulatory agencies to duck the hard responsibility of facinggup to their stern duty to make hard decisions based on sound analysis--all testify to a serioss neglect.of

A new management structure should be found, undersuhich some of the national laboratories could be given new assignments quickly, without the restraint of narrow agency missions and a 3 year budget cycle.

Exchange of scientists between government labs and university and industry laboratories should be directly encouraged.

Every agency shoud be expected to support the research and analysis that will reveal the long-range consequences of the policies and programs of the agency. Under OSTP leadership, these analyses must be brought together to test their consistency. Only in this way can we bring ahalt to the habit of government interventions to solve a short run problem in such a

way that an even greater risk is built up for thefuture.

Finally, government competence is a key to making the processes of government more accessible to the citizen. Much of today's secrecy and objuscation in government is only to hide a shoddy job only partly complete. Opening up the process, to which Gov. Carter is committed, will only lead to disillusionment unless th- glaring deficiencies are remedied.

4. Public participation in government decisions with high scientific content.

The processes of government must be opened up to public view, so that its fairness and the competence of those responsible for it can be judged by any interested citizen. (see issue # 3).

The public must also be increasingly involved in setting the national agenda, to which scientific research must respond. The political process, especially the election of the Congress and state and local government, is the most important mechanism. But in a pluralistic society many issues do not break on political lines, and other institutional forms must be developed through which a national consensus can be developed on the kind of future Americans want and the choices and risks involved. The scientific community is particularly sensitive to this issue of long range planning and public understanding of the limited nature of our choices. This is a real challenge and opportunity to a President who is idealistic and compassionate, but who knows that the laws of nature do impose limitations on our options -- that there is no free lunch.

The difficult problem of policy is, how to insure the highest level of rigor and objectivity in the search for the scientific facts if that search is also conducted in a political atmosphere of advocacy and media manipulation. The solution must be found in the development and use of non-self serving institutuions within which problem-oriented multidisciplinary research can be conducted in a manner open to input from anyone with the requisite skills and with pertinent information. These institutions would not make the value judgements and social choices, but would attempt to balance all of the quantifiable evidence and the residual uncertainties that surround it. One example of such an institution

is the National Research Council, operated by the National Academy of Sciences and the National Academy of Engineering under congressional charter. But the NRC serves to integrate the best available information at any time; it does not operate laboratories. If the government supported on problems of most active interest to the public were more widely supported in different parts of the country, local institutions can help air the issues, permit outlets for public concerns and help educate the public on the technical realities.

Thus, the necessity of encouraging participatory government imposes an obligation on government to help the public grasp the limits imposed on public choice by scientic and economic realities. The impossibility of a risk-free world must be understood so people can think about choices rather than demands. Scientific objectivity must not be sacrificed in the process of seeking consensus.

5 National defense and science.

The Nixon and Ford administrations have seen three trends that have inhibeted the achievement of a lower cost but fully effective national defense postare.

First, the trend toward staggeringly expensive, overly complex weapons systems (Trident, B-1, F-14, main battle tank) has continued and indeed accelerated. It takes more technical sophistication to make a weapons system simple, reliable and effective than it does to add new capabilities without gegard to the penalties of too high cost, too much vulnerability aggregated in a few expensive systems, and aboave all a design life time that goes so many decades into the future that the result is a military so postured that it cannot respond to new strategic or technological situations.

Second, the defense agencies and departments have allowed their internal laboratory capability to sag at the same time they have lost most of their contact with the independent ideas of the university research communities. During the best years of the Office of Naval Research, for example, the basic research sponsored by the Navy not only helped assure a strong science base for future naval technology, but the dailing contact between the technical communities in the navy and in universities created a more innovative environment inthe service and stimulated some very valualble applied research in universities that later found braod application.

Third, and most important, concerns the role of technical intelligence capabilities. Until the strategic arms race can be limited by treaty, it must be stabilized by very careful attention to assessing correctly the capabilities and intentions of possible enemies. Technical intelligence methods have been crucial in permitting the limited amount of agreement achieved so far, since "national means of verification" are the safeguard against cheating on limitations agreements.

The intelligence community is now in a state of disarray, partly because of the reluctance of this administration to maintain an independent capability to make intelligence assessments that may not fit the plans and desires of the military departments, and partly because the administration by misusing the intelligence services for domestic political purposes have sererely damaged their credibility, morale and capability.

Knowledge of potential enemies, a flexible and alert posture, and an investment in options for the future are key to a sound defense position.

5. National defense and science

A separate task force is dealing with the substantive issues of arms control and national security strategies. From the general point of view of science policy several issues should be dealt with:

1) How can the defense agencies be brought back into contact with the scientific and intellectual institutions of America? In a democracy it is politically dangerous, financially burdonsome and militarily risky to permit the military establishment to be estranged from the mainstream of the nation's intellectual life too long. A President with anew mandate can put the past behind us, and with his background in both technology and the military should be in an ideal position to heal these wounds. The scientific community has not forgotton the decisive role the Office of Naval Research performed after World War II in matching the navy's needs to the capability of our universities. Young people will understand that their fears of war canbe lessened by insuring that the military leadership is making effective use of the research talent of the nation to bring in new ideas, to question and evaluate long range goals of national security, to question the effectiveness of expensive, rigid weapons systems vulnerable to technological obsolescence.

2) What value can the research community be to the military in areas other than weapons development? In years past the extensive network of basic research support programs by defense agencies not only solved important scientific questions, but helped to stimulate new ideas and cooperation among the defense agencies themselves. Perhaps most valuable would be a broadening of public participation in research to define the goals of national security programs, indeed to clarify in the public mind the elements of national security, which goes well beyond defense preparedness.

3) What contribution can defense sponsored academic research make to the general development of U.S. technology and thus to the economy? The notion that defense technologies have a measurably large "spin-off" through direct commercialization has been overdrawn (except for civil transport airframes of the past). However, when the services go about satisfying their own objectives in a cost-sensitive, technically clever way - and use a broad base of research institutions to lay down the basic technology -- the result can be to drive the state of the art of materials, engineering design, measurement techniques and technical information on which all industrial progress rests. The extent of stimkulation of civil technology from military/space programs is a strong fucntion of the way in which these programs are carried out. The simple spedding of money on R and D in defense industry can well have a negative impact if proper policies are not followed.

4) Are there areas of national security technology that make a positive contribution to stabilization and thus to peace? Yes, there are. Aside from arms control research itself, the technology for non-intrusive technical intelligence has that effect. The rebuilding of public confidence in our intelligence services could be enhanced by insuring that theyare properly supported by the best technical thinking to do the job of assessment of capabilities and intentions of potential enemies. Only in this way can we avoid the political pressure to accelerate the arms race by allowing for large margins of uncertainty in the magnitude of the enemy threat.

6 International affairs and science.

Science and technology matters increasingly dominate in foreign affairs, but the Nixon - Ford administration has a sorry record of leadership. Some specifics:

a. The congress provided a new bureau in the state department to deal with fisheries, oceans and scientific affairs. Sec. Kissinger has indicated his lack of attention to the establishment of this office by the delays in making appointments to lead it, and the embarrassingly short time his appointees remained. Dixie-Lee Ray headed this office after leaving the AEC, and made it clear she felt she could not get the Secretary's attention and support. Other scientists have come and gone even faster. The search for a scientist to fill this post has met so much reluctance that finally it was filled by a career diplomat. With no office of Science and Technoloyg inthe White House, the U.S. has been bereft of adequately well placed governmental leadership to deal with science adn technology issues in foreign affairs.

b. Mr. Kissinger's preference for bilateral relationships, negotiated in secret - the secrets being kept from our own government agencies as well as the public - has tended to weaken the unity and effectiveness of leadership in scientific matters that the western alliance ahs traditionally enjoyed. Deep suspiscions have been building about our bilateral relations with the USSR, initiated by Nixon in May 1972, and today we seen increasing tendencies to scientific and technological protectionism in our relations with our allies and major trading partners. Kissinger frequently commits the U.S. to programs of technical coopeation - for example with the Saudi Arabians and in the major address in Africa - in which he commits an exchange of technology which involves private sector capabilities not necessarily available for this purpose . The agencies chosen to emplement agreements of this type are poorly funded and managed for such programs, and frustration of the foreign policy objectives of such hasty public initiatives is the inevitable result. Clearly we need a consistent long range policy governing the balancing of political, economic and technological interests.

c. The whole concept of "foreign aid" is politically bankkupt. The public has made clear its impatience with the mixture of military assistance, consessional capital aid and the shoring up of regimes whose opposition to communism cloaks reactionary and authoritarian policies most likely to bring communism. Yet Americans have always been eager to lend a helping hand when poor nations genuinely wanted our professional and technical advice and help rather than just our weapons or our money. A new concept in technical cooperation arrangements with poor countries is urgently nedded, one that mobilizes private institutions that have the needed talent, one that insists the receiving nation pay if it can and sets its own goals and internal commitments to achieving them. The only effort of this kind in the last four years was the proposal to create the International Development Institute. It died in 1970. Since then our relations with the 3rd and 4th worlds has been a pattern of increasing hostility.

6. International affairs

ISSUES:

a) Importance of scientific affairs in the Department of State. Historically, the state department has a major responsibility for government policy in scientific matters because of the naturally international character of natural events, and the importance of technology in trade, national security affairs, international development and the global problesm of environoment, population and food. Yet the bureau within State that must staff these questions has always been a step child. During the current administration, it has not even enjoyed stabile leadership. Governor Carter should ensure that his Secretary of State will strengthen the departments capabilities and seek outstanding leadership for them to ensure that the U.S. is correctly postured and has an effective presence in international scientific affairs.

b) Bilateral versus multilateral relationships. Reversal of the current administration's pattern of bilateral negotiations, which has tended to weaken the multilateral relationships with friendly nations has left us more isolated than necessary. U.S. leadership in science and the strong commitment of our scientific community to non-governmental international institutions such as the international scientific "unions" (discipline oriented associations to foster cooperation and information exchange) make such institutions a great asset, particularly as the U.N. agencies become more and more hopelessly embroiled in red-tape and politics. Another excellent example of a non-governmetnal multilateral institution is the Consultative Group for International Agricultural Research (CGIAR). It is the managing agent for the international complex of laboratories drivign the "green revolution". This mixed government/private multilateral institution is almost uniquely effective, is well suited to U.S. strengths and should

form the basis for U.S. initiatives in other fields, suchas energy.

c) Technology and trade. New policies must be developed to be sure that U.S. interests (employment, trade balance, future market opportunities) are properly protected in those trade areas where technology leadership is critical to success. Thus the many newforms of non-tarrif barriers to U.S. companies and the direct subsidies to R and D in foreign companies by their governments must be factored into GATT and other trade negotiations. U.S. companies also compete in a totally different anti-trust environment, for example, than Japanese competitors. But inthe pursuit of these objectives we must guard against a temptation to erect barriers to the free flow of non-proprietary information and the movement of scientists.

d) Technical assistance to poor nations requesting our help. The need for a new initiative, divorced from the traditional notion of concessional "foreign aid", is needed to build bridges to the people of 3rd and 4th world contries desirous of a relationship with the U.S. The President should be careful to avoid a trap that has characterized many U.S. programs in the past: because our political strategy has sought to strengthencertain governments, we have supported the elites of those countries with our assistance programs. They often do not speak for the well being of the people. Where this is glaringly the case, we must have the self-restraint to decline participation. Where the country genuinely desires to seek help from the US, emphasis should be placed on building up indigenous capabilities.

7 Basic research and academic science:

After a period of hostility to the academic science community by President Nixon and indifference by President Ford, the basic research potential of our universities - where most new science is generated - are enmeshed in burocratic red tape, are patronized and afflicted with meaningless tests for "relevence" by agency project monitors. An adversary relationship has begun to replace the spirit of partgnership, of responsive, lean administration, of the quest for excellence we knew in the 1960's.

While the level of federal investment in basic science has increased, largely in response to inflationary pressures, there is a widely held confiction that the administration of science programs by the federal government isg producing more paper and less science. The financial and administrative emphasis in grant and contract administration tends to suppress the opportunity for localginitiative, for responding swiftly to new discoveries and inventions. At the same time agency requests for documentation of project relevence to economic social benefits provide a false aura of good management, while in reality inhibeting the flexibility to sieze worthwhile scientific opportunitiees as they arise.

Another problem is the backing away from sponsorship of academic basic research by the agencies with specific missions, such as ERDA, NASA, DOT, the three military service agencies, etc. This deprives the nation of a very natural way to insure the appropriate "relevence" of academic research to national priorities.

Finally, the relationship between the amount of scientific research and the number of jobs for recently trained scientschas changed substantially in recent years, but government policy has not been rethought except to the extent of cutting back on financial support to young scientists in graduate school and just starting their careers.

As a result, the young scientists are demoralized, faculties are caught up in administrivia, and no coherent policies are in place to energize the scientific community to respond creatively tothe new priorities.

7. Basic Research and Academic Science

The issues turn on need to build a new confidence and sense of common purpose between government and the universityies. As a technically trained person, the new President can approach the scientific community in this spirit and offer to work with the scientists and other professionals to mobilize their talents to national purposes more effectively. He must make clear that substantial improvemetns can and must be made, but that budgetary realities will not permit this to be done simply by a radical increase in science investments. Nevertheless, by

a) clarifying goals and strategies of major programs (e.g. energy, cancer, ocean science, materials, food etc.)

b) eliminating burocratic red-tape in sponsoring agencies, which has gotten out of hand,

c) broadening the base of research support by instructing the mission oriented agencies and departments to finance the research appropriate to their areas of responsibility

d) devising better interfaces with industrial research and encouraging such collaboration,

e) strengthening the quality of the government's own scientific work, and

f) establishing a scientific and engineering manpower plan for the nation,

much can be accomplished. It will require, however, taht the scientific community do its share. Most importantly:

a) accept responsibility to participate actively in the re-ordering of research priorities - by discipline and by problem area - and

b) rebalancing research effort and graduate training, consistent with research needs and manpower planining.

The goals for American science should include excellence in every sphere, a leadership position in areas of greatest promise and value, a long range view of the benefits from scientific knowledge, a dedication to supporting prudent decisions on the uses of technology and responsiveness to the needs of the people for a wider menu of technological choice.

A major issue is, of course the relationship between reorganization of federal agencies and the context within which science is supported in universities. This is discussed as a separate issue below.

Finally, the question of equality of opportunity for womenand minorities to get a technical education and to enter research professionsl is particularly important. Progress is being made, but the percentage of women and minorties in different disciplines varies widely. In engineering, for example, the number of womenis disgracefully low. EEO is important in every sphere, but is particularly so in technical fields, where performance and success are determined by intrinsic human ability. Given equality of opportunity for education, old social customs and attitudes should be less of a handicap. Also, in a knowledge intensive world, the lack of a technical education can be a particularly serious limitation to types of career opportunities.

In the face of economic difficulties and unemployment at record levels, the administration quickly showed signs of weakening their resolve concerning protection of the environment. Yet economists have shown that effective programs of environmental protection provide long term benefits to the economy, not unemployment and lagging growth.

The problems lie in the way environmental programs are managed and the attention given to understadding the technology and capital requirements of industry.

Apart from environmental protection to protect the quality of our lives and the beauties of nature, there are very major problems some of which could take the form of disasters that have been given inddequate attention by the administration.

CLIMATOLOGY:

Americans tend to regard the climate of the last 30 years as "normal". It has not been normal, but unusually good for agriculture. Many research findings suggest that a return to conditions that prevailed in the 1930's , when the middle west suffered the "dustbowl", is inevitalbe and may happen soon. The effect on food production in tye U.S., and in other temperate zone, wheat and corn growing countries could be great. This kind of climate fluctuation is responsible for the massive wheat purchases by the USSR. In years past such fluctuations would produce local shortages and rising food prices, but little impact elsewhere. But today the demand of the riseing world population for food has reduced world food surplus stocks down to levels of a few months. The world's people live on very narrow margins todya.h Climate fluctuations can now wreak a havoc unknown in the past. The effedts on inflation, on world political stability have been magnified.

On top of the problem of understanding, predicting if possible, world climate trends is hte spectre of climate changes inadvertently caused by man. The concern that spray cans release gases than can damage the natural protection of the stratosphere against solar ultraviolet has now become a concern that the global use of nitrogen fertiliser could have a similar effect. The consequence of a national energy strategy to rely on coal derived fuel instead of nuclear power in the next quarster centary could entail the injection of CO_2 inot the atmospehre, with effects on global circulation, temperature and water resources.

In the face of these kinds of considerations, a national program of climate research, to be harmonized with those of other nations was proposed in detail by the National Academy of Sciences. The Ford administration turned a deaf ear to the funding of an adequate effort, temporizing with a question than cannot be postponed witout serious risk.

EARTHQUAKE HAZARDS:

Despite the Alaska earthquake - as severe on the Richter scale as the China quake reported to have killed 100,000 people - and the mounting evidence that the San Andreas fault in Californiag is accumulating strain

and could produce a very serious quake, the administration has again temporized. In response to concerns in California, the administration released a few million dollars for some additional instrumentation to study the San Andreas fault. But it has not faced up to the two most important questions:

First, what program of reserach would advance U.S. capabilities in earthquake prediction most effectively? Experts note that the Chinese, Russians and Japanese all have leading capabilities in this field and progress is being made. Even though no prediction capability is likely to be exact as to time and place, or free of false alarms for many years, a predictive capability can be very valuable, to guide local government in public education on precautions, to alert emergency services and if needed relocate supplies, vehicles and the like, and above all to guide the development of sound landuse planning, building code requirements and the like.

More serious than the lack of commitment to earthquake prediction studies, is the failure of the administration to undertake to define clearly the locus of responsibility, the resources and the objectives of a federal capability to work with the states to help the public understand and react intelligently to scientific evidence of increased earthquake hazard in particular regions.

Government must not only use the scientific talentof the nation to understand threatening problems like earthquakes, but umust have the courage and leadership to develope the policies and institutions to use the knowledge and share it with the public.

Note: a briefing paper on Climate, and its relation to food production, is being prepared by Steve Schneider.

A briefing paper on Earthquake warning adn prediction is being requested of Frank Press.

9. Managing and measuring new social programs.

HEW's budget is now larger than that of DOD, which reflects a proper reordering of priorities. However, the social programs of HEW, and the programs of HUD, DOT, the VA and Agriculture - and other agencies intending to provide a better life for Americans are not subject to the kind of careful evaluation and evolutionary developemetn that is most likely to insure their effectiveness.

The social sciences are not without tools to make a much more effective contribution. Recent experience provides some examples of the value of trying out new proposals on a relatively small scale, subject to careful professional measurement, before launching them on a massive scale. Such tests have been - or are being - made for

housing allowances

national health insurance

negative income tax.

The advantages of this approach to "prototyping" new social initiatives are

a) a substantial sample of the public participates from the beginning' testing the critical element of acceptability and attitudes,

b) initial investmetn is small, the program can be redirected as it developes and thus evolve pragmatically into something that works,

c) the responsible agency can learn how to manage the program before it is begun on such a scale that it is inherently unmanagable,

d) the experience of one program, being measured and documented, can be used in the initial design of another.

The disadvantage is that the process is time consuming. Early results can be misleading. Political sponsors ofthe program may not have the patience for th evolutionary approach. It calls for strong leadership from a president who knows that resources are limited and the promises must be restrained.

10. Reorganizing the federal R and D and scientifically intensive agencies.

The commitment of Gov. Carter to reorganization is unequivocal. The plans will not be announced until a year of effort after election. In the case of science, the statute establishing OSTP establishes a two year committee to advise on priorities and restructuring. Nevertheless, there has been such an extensive legislative hearing record on many proposals to accomplish such a reorganization, that it is difficult to sidestep the main issues in the campaign discussion. They are:

a) Department of Science (and Technology?). Many of the independent agencies are R and D agencies, especially the largest ones - NASA, ERDA. With more than 80 in total reporting directly to the President, some bringing together into cabinet level departments is necessary. How far should this go? The view s of experienced people differ, but something approaching a consensus exists for the view that the "mission oriented" departments (HUD, DOT, Defense, etc) should retain all their own R and D support structure. Applied science and especially development, must be as tightly coupled to the end user as possible. But the agencies missioned to support the "scientific and technical infrastructure" of the country--supporting technical capabilities broadly -- might be brought together into a cluster of agencies under central management.

b) What constitutes the core of "infrastructure" agencies? The major questions concern academic science/higher education (should the Office of Higher Education in HEW - which is quite ineffective - be joined with a broadened NSF?) and basic research/applied and industrial science (should the National Bureau of STandards, NASA, even ERDA be combined with NSF?). Should NIH remain in HEW as a mission oriented activity? (Most would say yes.)

c) What are the main disadvantages to sucha restructuring? The main argument is that anything tending to aggragate government expenditures

for activities not tightly supported by a politically effective constituency is bound to suffer from greater resource limitations. On the other hand, if the new combination were in fact able to deal more successfully with those programs that stimulate the economy and create jobs, or improved hte working environment, it might be possible to broaden the present academic constituency to include industrial and perhaps labor support. In anycase, the NSF as presently structured, and having weak contact with industrial technology (which constitutes 70% of the national R and D effort), is poorly postured to even assess the state of the nations technological strength. NBS, on the otherhand, which has substantial activity of significance toindustry has essentially no extramural activiteis and is too small to cover the areas of technology that are most important.

c) A question on which there is no unanimity is the correct strategy for organizing the research in support of regulatory missions (such as EPA). Should the same organization regulate and do the research that measures regulatory effectiveness? Should they be separate (as NOAA in Commerce is separate from the regulation of water and air quality in EPA)?

d) How can greater flexibility be provided to the government's research capability, so new problems can be investigated in depth before legislation is sought to establish a long term research program? One proposal is to assign several national laboratories - with general funding support - to a major broad-purpose agency with latitude to reassign programs without new congressional authorization.

In house - sci & tech

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SCIENCE AND TECHNOLOGY ISSUES - A FRAMEWORK

Background:

The scientific and engineering communities total about two million in the U.S. Because of the dependence of science on federal support and rapidly increasing media attention to impacts of science and technology on society, this community is on average highly aware on public issues. "Scientists and Engineers for Kennedy" (and Johnson and Humphrey) were effective national bodies in those presidential campaigns. The fraction of this community who are committed to a high degree of interest in public issues is indicated by the membership of the AAAS (American Association forthe Advancement of Science), which publishes Science magazine. These 150,000 individuals represent perhaps a quarter to a third of the total in this category.

Events of the last few years have intensified and broadened the base of this interest, particularly in engineering. The concept of "technology assesment" has been embodied in a congressional Office of that name, serving to aggragate the technical aspects of issues that arise in many different committees. The need to base national strategies on energy, environment, occupational and product safety, health services, communications development and agriculture on sound long range technical strategies has left political leaders in the uncomfortable position of being expected to be forward looking, but being vulnerable to the contrary opinions of self-styled experts. Thus the professionals in science and technology are vitally interested in the way in which the political leadership deals with such matters; their decisions affect the working lives of the technical community directly- and also determine the extent to which technical people feel proud or guilty about their impact on society.

Thus the abolition of the Office of Science and Technology in the White House by President Nixon was more than a blow to the political access to the White House by an interested consituency. It symbolized a retreat from what had been a growing commitment by the nation to institutionalize the management and policy formation for science and technology in the federal government. The congressional debates and hearing testimony concerning legislation to reestablish a White House science and technology policy office have been the vehicle for debate over many policy issues- including the need for a national science policy itself. A second issue has been the call for executive branch reorganization of federal Research and Development (R & D) activities. The other issues tend to be mixed technical-economic and social issues. The challenge to political leadership is to be able to see and speak to these questions (such as energy) from each point of view and in a consistent manner.

The items that follow are little more than an outline, certainly incomplete. Perhaps it can serve as a basis to test the candidate's interest in these issues, and thus form the basis for recruiting a panel of competent, supportive advisers to detail more specific proposals for use in the campaign after the convention.

(1) National Science and Technology Policy

Although the first articles of several of the bills to re-establish a science office in the White House contain extensive statements of national science policy, no President has ever promulgated such a policy. Only once has a President sent the congressa special message on S & T. Nixon's message in March 1972 was drafted by Science Advisor E.E. David (who was fired and his office abolished the next year!) That message, for example, made it clear that the government's responsibility to insure a vigorous and productive national science and engineering capability extends beyond the military and space fields to the industrial sector on which the economy depends. Little was ever done to flesh out this notion, nor has there been a clear statement on the proper role of university science, access to technical careers by all minority groups and women, the importance of using science to relieve rather than exaccerbate the ills of the world etc.

Many of the elements of such a policy are touched on in the paragraphs below. At this stage it may be sufficient to take the following position:

As President, a special message to congress will convey a long range science and technology policy for the nation. Its details will be worked out with the help of a Special Assistant to the President for Science and Technology, and after extensive consultations with scientists, engineers and other groups interested in the specific issuss. That policy will be based on several cornerstones that can be clearly stated now:

A. Science and technology are a primary source of well-being for our citizens and the people of the world; the United States will strive for excellence in every significant area of science, will enjoy world leadership in selected fields and will insure that the scientific and technological capabilities of the nation are adequate for fulfilling the aspirations of our people.

B Science can be a source of inspiration, of material well-being, of good health, abundant energy and food, of a clean environment; it can also be misused to create destruction, despoil the environment and afflict our people with hazards of which they are unaware. The challenge to government leadership is to create an ethical and legal environment within which science will flourish and innovation will flower with a minimum of obstacles, subject to the assurance that science is used for good, not ill. The concept of environmental impact assessment and technology assessment are fundamental to this aim.

C. To gain the benefits from science it must be put to effective use. Except for those limited areas where government has a consitutional obligation to assume an operational role, the U.S. will relie on private institutions and a free-enterprise market economy to maximize these benefits .

D. The proper use of technology in the economy can greatly increase productivity and make us more internationally competitive. In this way it is, in the long run, a key weapon for fighting stagflation. But it would be unconscionable if participation in scientific and technological careers were restsricted by any barriers of discrimination, inferior education or other artificial obstacles.

E. While the U.S. cannot take on the responsibility for the well-being of the people of other nations, neither should we hold back the knowledge that has proved so beneficial to our own society. Particularly in the global struggle to satisfy the basic needs for food and health, we will actively seek to offer a scientific and technical partnership to developing nations prepared to do their part.

F. The greatest challenge to the commitment to beneficial uses of science is the prevention of war, especially nuclear war. The U.S. must be firmly committed to the quest for reliable and binding agreements to limit strategic weapons. Pending progress in that area new weapons technology investments will be aimed at stabilizing the balance, and diminishing the danger that an potential aggressor will believe he has an invulnerable first strike capability.

G. The health of the educational institutions of the nations, and the research laboratories associated with them, is the most decisive factor in the long term scientific capability of America. The federal government must insure that we do not sacrifice the future to the pressures of the present by taking those steps, in policy and program, that will foster vigorous, productive schools and universities whose students are well prepared for the world of the future. Universities should also continue as the primary, though not the only, institutions for the creation of new scientific knowledge in America.

H. The federal government is the largest sponsor and employer of science and engineering talent in the nation. The government must be committeed to the strength of organization, the quality of management and the vision of leadership to make its own R & D activities a model of creativity and productivity, and must plan its own activities in such a way that the benefits are mazimized to the nation as a whole.

(2) Organiztion

The number of bills and congress and the number of scientists favoring executive branch reorganization grows each year. A strong case can be made for pulling together into one department (of Science and Technology?) those agencies concerned primarily with the health and productivity of the scientific and technical "infrastructure" -- the NSF, NBS, the scientific information agencies, and NASA. Almost everyone agrees that to pull <u>all</u> R and D activities into a single department would be a serious mistake; every "mission-oriented" agency must be held accountable for performing or sponsoring that research necessary to the achievement of its mission. More controversial is the question whether specialized - but broad - R and D agencies like ERDA should be included. No position needs to be taken on specifics now, but there should be a commitment to a hard look at executive reorganization to achieve more flexibility in setting goals and deploying federal resources, to besure that the government's investments are responsive to the long term demands of the users of new knowledge, and to provide strong and visible leadership for this vital activity. The most difficult problem is how reorganization can best enhance the economic benefits of science and engineering. This requires building stronger ties between government and industrial science and raises the question of the future of the Commerce Department, which falls far short of needed capabilities in industrial technology policy. (I assume the White House science office legislation will be signed in a week or two.)

3) Information Policy

Determining scientific truth and settling technical arguments is a major problem in policy making by government. A major committment to research to support better decision making in areas of likely controversy is needed. Commitment to openness, integrity in this work. "Sunshine" principles are generally healthy, but must be balanced against the need for protecting privacy. A permanent and effective institution within the executive branch is needed to guide the evolution

(5) Environment

Take a firm position that environmental protection, properly managed, is good - not bad - for the economy in the long term. Renew a firm commitment to the National Environmental Protection Act and the environmental impact assessments that it calls for in connection with government projects. One should seek, however, means to speed up the process of decision and review. Rational policy making is desired; obstructionism is not. Where effective and economical alternatives to polluting technologoes do not exist, government and private investment , in partnership, should seek alternatives.

A very strong emphasis should be given to expanded research in those areas of environmental and health science where the effects of a multitude of human activirties are aggregated and the most serious long term effects occur. Climatology: the changing temperature and humidity conditions around the globe may have the most profound impact on global agricultyre, and thus on world security and politics. The scientific means for understanding the sources and consequences of climatological fluctuations can be substantially advanced. Even more important, the production of carbon dioxide from burning fossile fuels to exhaustion over the next 50 years or so may have a disastrous additional effect on global temperature and thus on the level of the oceans. Obviously, we need to understand how important this question may be if we are to decide whether nuclear power is just an "optional" alternative to primary reliance on coal. Major studies by the National Academy of Sciences and the Domestic Council have recommended a major new effort in climatology research, but the administration has put essentially no money in it.

The second area of this time is the health implications of the increasingly artificial food, packaging and atmospheric environment. In many environmental issues, the most serious gaps and quantitative understanding are in the health effects fo the pollutant, not the chemistry or meteorology. We need not only more research, but a new approach to defining the acceptable level of hazard.

(6) Education and Reserach

Universities are under very heavy financial pressure, and even more pressure from trying to adapt to a very rapid change in the growth rate of student bodies. These demographic trends can be predicted to continue for at least another decade. The result is a radical change in the patterns of scientific training and by implication the place where research will be done inthe future, for while in the 1960's most science PhDs sought employment as university teachers and researchers, very few places will open up in coming years. Thus the availability of this talent to industrial employment may be a plus for the economy, but with it goes an aging faculty poorly suited to motivate you-ng people for industrial work, and inadequate resources to staff the fine basic science laboratories of the universities. A national policy to keep basic science on the campus without overexpanding the number of graduate students in the pipe line is needed. So also is a closer cooperation between academic and industrial science. Finally, special emphasis must be placed on continuing education and the updating of professionals in midcareer to avoid technical obsolescence.

(7) Energy

An energy technology strategy is needed based on moderated growth of demand (based on a national conservation strategy and moderate increases in

prices) together with a pluralistic approach to energy technologies designed to keep our options open. Each technology has its place, and sound national policy to define that place is as important as creating the technology itself.

It is obvious to all objective experts that after oil and natural gas (for which domestic sources are now diminishing) primary reliance for expanding energy supplies must be placed on coal and nuclear energy. The nuclear safety and wastedisposal issues are deserving of serious attention, much more serious than was accorded by the old AEC. But these are still matters of technology and economics, and the necessary technical work must be put in place to explore all reasonable doubts about the safety aspects of nuclear power and determine the minimu cost solution to insure than such plants are reliable and safe.

The safety conserns associated with the rail shipment of used fuel rods for reprocessing to recover the unspent fuel might be alleviated by the "nuclear park" concept, in which power stations and fuel reprocessing plants are co-located in a suitably chosen site. Every effort must be made to convince ourselves that nuclear power can be adequately reliable and safe, for the costs of electricity generated this way are quite fav orable compared with even optimistic predictions of other non-fossil fuel alternatives that might become available in the next decade or two.

Solar energy is a class of technologies, not just one. It is almost certain that electricity cannot be made from solar energy at costs competitive with coal or nuclear costs today without some new inventions or discoveries. Nevertheless, such discoveries are clearly not excluded by what we know about materials, and the solar programs should be pressed forward with increased vigor, oriented more toward exploring new ideas than a brute force attempt to bring in an uneconomic technology prematurely.

The most obviously underfunded aspect of the federal energy program is conservation technology. In the choice of materials for fabricating almost everything we make there are many opportunities to save energy, money and improve performance (and thus productivity)- This is the justification for many calls for a national materials policy, and it also justified a substantially expanded program of basic and applied materials research and engineering. By comparison with the minor efforts in the conservation (demand reduction) area and the solar related energy sources, the $400 Million effort in fusion research is excessive.

So much for technical strategy; the big issue is the relationship between public policy on energy, publicly sponsored energy R & D and the private secotr investment. To insure that energy objectives are actually met, a much more effective relationship with the private sector will have be needed.

(8) Health and Medical science

There are many national issues - insurance, malpractise, the poor distribution of doctors, excess of hospital beds, overcrowded medical schools. It is appropriate that increased emphasis be placed on health care delivery, but there is no justification for cutting back on medical science and clinical research. However, the emphasis needs to be rebalanced to match more nearly the real public health problems of the public, avoiding the "war on cancer" notion that overwhelming a serious problem with applied research money will solve the problem. Obviously, serious attention must be given the opportunities for reducing the cost of medical care, to which research can contribute.

(9) International Development

As a political concept, "foreign aid" is dead. The tradgedy is that the concept of technical assistance to deserving underdeveloped countries-- a notion the public has always supported and which costs very little compared to capital assistance-- has almost died with it.

A courageous and farsighted president would make a new declaration of mutual self interest with the 3rd and 4th worlds. Among the proposals should be the establishment in the U.S. of a government chartered and funded private, not-for-profit organization through which U.S. expertise can be mobilized for development assistance. Much of this work can be paid for by the recipient country; some cannot. The institution would need funds to sustain a continued involvement by certain universities and other organizations with special skills. Through it, even private companies could learn authoritatively about the technology requirements of the poor nations. A major reason for making this institution non-governmental is to insulate it from the fluctuations of the political environment that in the past have shut off technical assistance efforts of many years careful development as amatter of political discipline.

This proposal was carefully studied by the President's science advisory committee in the last year of the Johnson administration, and was proposed to the congress in Nixon's first year (as the International Development Institute). The death of Otto Passman revives the possibility of its acceptance.

(10) International Science

Many important issues have received inadequte attention in the State Department, which has had such difficulty pursuading anyone to take the job as Assistant Secretary for Science, Oceans and Fisheries that effective functioning of the office is a standstill. Any president would want not only a strong Secretary of STate, but one who understands that science and technology are critical elements of a great many foreign policy issues. The state department simply must have more internal competence and leadership in science.

A fine example is the Law of the Sea Conference, in its second session this month. At stake is the last opportunity for the nations of the world to adjudicate the rules for exploiting the resources - food and minerals - of 3/4 of the earth's surface. Protecting our fisheries, avoiding ocean pollution, and determining how ocean minerals are to be developed are major objectives. In maratime states, this is a major political issue as well.

(11) Space

Our space program has dwindled to the point that one project: the shuttle- dominates the program and threatens the continuation of planetary and space science and economically advantageous earth oriented applications as well. Every effort should be made to strengthen the economically justifyable earth applications programs. The space science budget should be put on a long term stable basis so sensible planning can be done without wasting money. The shuttle program should be continuously evaluated so that its rate of developemnt can be tied to the time scale on which the launch capability it will provide can be exploited with a net savings in total launch and space vehicle costs. There is no other obvious justificaiton for it.

(12) Consumer protection and public safety

The loss of life and property per capita in the U.S. marks us worst among all of the developed nations. This sad statistic is well known, and legislation has been passed to take some action through a new bureau in the Commerce Department and expanded fire research at the National Bureau of Standards. The current effort is total inadequate, and without major additional muscle will not significantly reduce the appalling losses associated with fire.

The Product Safety Commission has done good work, but in spite of the obstacles placed in its way. Its first Chairman, Mr. Richard Simpson, has now given up and left. A new president interested in the consumer would look to the integrity, technical competence and vigor of this new agency.

The entire field of safety research needs sound underpinnings. "How safe is safe enough?" is the most perplexing question in the regulatory field. The government has a real responsibility to the public to support the work than can put a rational, objective answer to this question in each of the areas of public concern.

(11) Agriculture

Agriculture is the success story (along with computers and aircraft) of U.S. exports. Productivity increases have been much larger than in manufacturing industries, and the U.S. now feeds itself through the labors of only a tiny fraction of its population. In this situation it is easy to become complacent. There is much evidence that the basic research base supporting the excellent applied work in agriculture is not keeping up with the latest advances in science. A special study by experts should be made of the opportunities in the sciences underlying agriculture to insure that our leading position is not forsaken through inattention.

(12) Defense R. and D

The objectives of defense technology were summarized in the first section- arms control being the long range objective. With defense resources under heavy pressure, major weapons systems must be selected with great care, being sure that they really represent the lowest cost solution to a real problem. Often they do not, and more defense can be had for less money. Nevertheless, defense technology is very complex, and the vigor and continuity of advanced development work is critical to maintaining enough technical options so we can react in timely fashion to the unexpected. If the technological level of research and exploratory development is kept high, and the large procurements are focused on low cost, flexible systems of demonstrated effectiveness, a strong defense posture can be afforded.