NSF/RA-790082

APPLIED SCIENCE AND RESEARCH APPLICATIONS

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RECENT RESEARCH REPORTS

June 1979

Entries
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Directorate for Applied Science and Research Applications
National Science Foundation
Washington, D.C.

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National Science Foundation
1800 G Street, N.W.
Washington, D.C. 20550

13. Type of Report & Period Covered
Bibliography

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

Abstracts of new technical reports and other documents resulting from research supported by the Directorate for Applied Science and Research Applications (ASRA) of the National Science Foundation are presented. These citations have been compiled to alert members of the scientific and technical community to current research results and are organized under the following categories: public policy and regulation; public service delivery and urban problems; physical, mathematical, and engineering applications; geophysical and environmental applications; earthquake hazards mitigation; chemical threats to man and environment; alternative biological sources of materials; state government; energy systems; fire research; weather modification; non-renewable resources - fossil energy; exploratory research and technology assessment; renewable resources - crops and solar energy; and symposium proceedings. The goal of ASRA is to increase the contribution of science and technology to the Nation by identifying and supporting research and related activities having the highest potential for contribution to the understanding and resolution of significant problems. A description of the major ASRA program elements and objectives is provided.

17. Document Analysis a. Descriptors

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Bibliographies	Resources	Technology assessment
Document announcement	Energy	

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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(See ANSI-Z39.18) See Instructions on Reverse

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Department of Commerce

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Introduction

This report contains abstracts of new technical reports and other documents resulting from research supported by the Directorate for Applied Science and Research Applications (ASRA) of the National Science Foundation. These citations have been compiled to alert members of the scientific and technical community to current research results.

The Directorate for Applied Science and Research Applications (ASRA) was established in February 1978 as a result of an extensive reorganization of the Foundation's applied research programs. The goal of ASRA is to increase the contribution of science and technology to the Nation by identifying and supporting research and related activities having the highest potential for contribution to the understanding and resolution of significant problems. ASRA both replaces and incorporates many of the functions of its predecessor, the Directorate for Research Applications, and its Research Applied to National Needs (RANN) program. A description of the major ASRA program elements and objectives is provided in Appendix A.

ASRA awards grants and contracts for research projects within its areas of program interest. ASRA recognizes the importance of ideas for projects generated by the research community itself and therefore makes numerous awards based on unsolicited proposals. In addition, proposals in areas of priority concern are solicited from the research community.

To receive proposal solicitations or to obtain further information on submitting proposals, please contact the appropriate ASRA division, or:

Programs and Resources Officer
Directorate for Applied Science
and Research Applications
National Science Foundation
1800 G. Street, N.W.
Washington, D.C. 20550
Telephone: (202) 632-7388

NATIONAL SCIENCE FOUNDATION

news

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FOR RELEASE:
IMMEDIATE
Mail: June 4, 1979
NSF PR79-50

NSF REORGANIZES ENGINEERING SCIENCE AND RESEARCH APPLICATIONS ACTIVITIES

Dr. Richard C. Atkinson, Director of the National Science Foundation (NSF) announced today the establishment of a Directorate of Engineering and Applied Science (EAS) to strengthen the Foundation's programs of engineering and applied research.

The new Directorate, which becomes effective July 1, replaces the present Directorate for Applied Science and Research Applications and the Division of Engineering, now located in Directorate for Mathematical, Physical, and Engineering Sciences.

The primary purposes of the reorganization are to provide increased recognition of the importance of the NSF engineering programs; to provide a broader base of science and engineering for programs of applied and problem-focused research; and to emphasize the key role of engineering in the transfer of science into technology by concentrating major engineering, industry-related, and problem-oriented programs into one organization.

-more-

Dr. Jack T. Sanderson, currently Assistant Director for Applied Science and Research Applications, will serve as Assistant Director for Engineering and Applied Science. Dr. Henry C. Bourne, Jr. former Division Director, Engineering, will serve as Deputy Assistant Director.

The Directorate for Engineering and Applied Sciences will consist of the following six divisions:

- Division of Electrical, Computer, and Systems Engineering, Dr. Yoh-Han Pao, Director (formerly Electrical Science and Analysis Section (ENG).

- Division of Chemical and Process Engineering, Dr. Marshall M. Lih, Director (formerly Engineering Chemistry and Energetics Section (ENG).

- Division of Civil and Mechanical Engineering, Dr. Ronald L. Huston, Director (formerly Mechanical Sciences and Engineering Section and Environmental Engineering Section (ENG).

- Division of Applied Research, Dr. L. Vaughn Blankenship, Director (no change in title or function).

- Division of Intergovernmental Sciences and Public Technology, Mr. William H. Wetmore, Director (no change in title or function).

- Division of Problem-Focused Research, Dr. Donald E. Senich, Director (formerly Division of Integrated Basic Research, Division of Problem-Focused Research Application, and Office of Problem Analysis (ASRA).

The Directorate for Mathematical, Physical, and Engineering Sciences (MPE) will become the Directorate for Mathematical and Physical Sciences (MPS).

-END-

How to Order NSF/ASRA Research Reports

Documents cited in Recent Research Reports may be ordered from the National Technical Information Service (NTIS), Document Sales, U.S. Department of Commerce, Springfield, Virginia 22161. Please refer to the NTIS accession number when ordering. Where applicable, other availability and price information are noted.

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* For reports of 601 or more pages, add $2.50 for each additional 100-page increment. Prices are subject to change.

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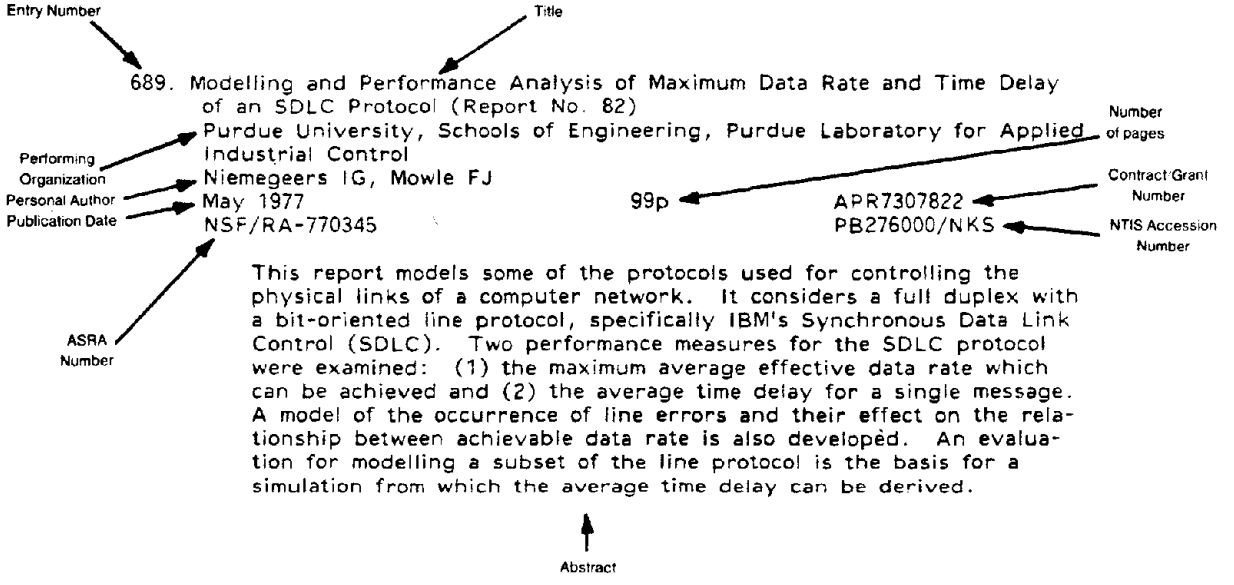


Information on NSF Applied Science and Research Applications Directorate reports may be obtained by writing to

Ms. Carmeen P. Adams
ASRA Information Resources
Room 1108
1800 G Street, NW
Washington, DC 20550
Telephone (202) 634-4262

Citations are arranged in broad subject categories. Entry numbers are assigned consecutively beginning with the first issue, published in October 1976. Indexes following the main body provide access by subject, performing organization, ASRA number, contract/grant number, and author and refer to the entry number of the document.

RESEARCH REPORTS FROM CURRENT PROGRAMS

Intentionally Blank

Applied Social and Behavioral Sciences

Public Policy and Regulation

747. Voluntary Products Standards, An Index Based on Hazard Category
Mueller Associates, Inc.
Park AJ Jr, Gonnerman CH, Sommer T
1978 422p APR7400665
NSF/RA-780001 PB281086/NKS

Included are: (1) United States voluntary safety standards for consumer products as defined by the Consumer Product Safety Act and listed in Technical Note 762; and (2) safety standards from Technical Note 948, "Tabulation of Voluntary Standards and Certification Programs for Consumer Products," issued June 1977. The base data for the Taxonomy is provided by the Review Sheets (samples are presented in an Appendix). A Review Sheet was completed for each standard reviewed in the Program. The Review Sheet employs hazard categories as its organization format and also provides information on the level of intensity of treatment of the hazard category within the standard. The intensity of treatment is an important parameter which is incorporated into the indexing system. The safety standards have been classified with respect to the type of product and type of hazards, and are summarized. These data are represented in a matrix permitting entry by type of hazard or by type of product, permitting quick identification of those standards which pertain to the product or to the type of hazard. This study has provided an essential data source for the Consumer Product Safety Commission and for the National Bureau of Standards.

748. Interdependence of Nations: An Agenda for Research
Brookings Institution
Solomon R, Gault A
December 1977 140p AER7612283
NSF/RA-780003 PB279472/NKS

This six-month pilot study of international interdependence identifies unmet research needs and proposes an integrated program of studies of interdependence that would help to resolve national policy issues. The authors discuss a number of

aspects of international interdependence--giving some aspects an historical perspective--and sets forth a series of proposed research projects. The focus is on economic issues, with one chapter devoted to non-economic issues. The economic and non-economic research proposals formulated at various points in the report are brought together and further elaborated. Topics include: (1) the geographical structure and commodity structure of foreign trade; (2) international capital flows; (3) international migration; (4) international transmission of economic impulses and East-West economic relations; (5) international monetary system; (6) agricultural interdependence; and (7) the relation between economic, political, and security factors in interdependence. An extensive bibliography is included.

749. New Guide to Federal Cable Television Regulations
Massachusetts Institute of Technology
Rivkin SR
1978 325p APR7622016
NSF/RA-780048 PB283402/NKS

This book updates and revises an earlier edition entitled "Cable Television: A Guide to Federal Regulations." The author examines how the rules and regulations set forth in the first edition have fared, and he details the subsequent changes that have been made in them as a result of citizen and industry feedback during the past five years. The report also contains material on the expected impact of the new copyright law pertinent to cable television that becomes effective on January 1, 1978. Included in this book are: (1) Summary and Overview; (2) Definitions, Methods, and Procedures of F.C.C. Regulation; (3) Federal Regulation of Program Carriage: Broadcast Signals, Nonduplication, Exclusivity, and Copyright; (4) Federal Regulation of Cablecasting: Origination, Pay Cable, and Access Cable; (5) General Operating Requirements; Forms and Reports; Cross-Ownership; (6) Federal Technical Standards; (7) Microwave Auxiliary Facilities; (8) Summing Up: A Five-Year Perspective on Federal Regulation; and (9) A Compendium of Relevant Documents.

750. Regulation of Insurer Solidity Through Capital and Surplus Requirements, Summary Report
Pennsylvania State University, College of Business Administration
Hammond JD, Shapiro AF, Shilling N
April 1978 29p APR7516550
NSF/RA-780092 PB285620/NKS

The research into the regulation of insurer solidity through capital and surplus requirements rests upon the proposition that the capital required to conduct insurance underwriting is

primarily related to the variability of underwriting experience. To study that experience, both a time-series and cross-sectional data base were assembled. The principal focus of this research was to develop information that would help assess the risk of entry into the various lines of insurance and to help assess the underwriting risk and capital needs of operating insurers. This type of information is directly relevant to the statutory capital requirements needed in every state for entry into the insurance business. The data collected was used to assess: (1) the difference in underwriting risk among lines of insurance; (2) the relative safety of different ratios of premiums to surplus; (3) the relationship between premium volume and underwriting risk; (4) diversification effects on underwriting risk; and (5) estimates of the probability of ruin from underwriting for the years 1972 through 1975, with special attention to the years with greatly contrasting high and low combined ratios.

751. Regulation of Insurer Solidity Through Capital and Surplus Requirements, 8 Part Set
Pennsylvania State University, College of Business Administration
Hammond JD, Shapiro AF, Shilling N
1978 1206p APR7516550
NSF/RA-780093SET PB285665/NKS

This research examines the capital required to conduct the insurance underwriting function in different lines of insurance by developing extensive information on the variability patterns in all lines of insurance in different time periods. The project is concerned with: (1) the differences in underwriting risk among different lines of insurance; (2) the relationship between premium to surplus ratios and the probability of surplus depletion from underwriting activity; (3) the relationship between premium volume and underwriting risk; (4) the effect on the probability of surplus depletion of the contrasting years of 1972 (low combined ratios for the industry) and 1975 (high combined ratios for the industry); (5) the development of additional information to supplement traditional rules-of-thumb in assessing the capital adequacy of operating insurers; and (6) the possible means of which statutory capital requirements for entry into insurance can be formed or administered with more precision. Volume 1 of the report examines the analysis of entry capital requirements. Volume 2 measures the underwriting variability of each of the sample insurers of the time series data base and the factors which appear related. The appendices consist of graphic and tabular material, and a summary of state laws governing capital requirements.

752. Regulation of Insurer Solidity Through Capital and Surplus Requirements, Technical Report, Volume 1
Pennsylvania State University, College of Business Administration
Hammond JD, Shapiro AF, Shilling N
1978 229p APR7516550
NSF/RA-780093 PB285666/NKS

See entry 751 for abstract.

753. Regulation of Insurer Solidity Through Capital and Surplus Requirements, Volume 2
Pennsylvania State University, College of Business Administration
Hammond JD, Shapiro AF, Shilling N
1978 56p APR7516550
NSF/RA-780094 PB285667/NKS

See entry 751 for abstract.

754. Regulation of Insurer Solidity Through Capital and Surplus Requirements, Appendix 1, Distributions of Combined Ratios By Line of Insurance and Size Class, 1972 and 1975
Pennsylvania State University, College of Business Administration
Hammond JD, Shapiro AF, Shilling N
1978 224p APR7516550
NSF/RA-780095 PB285668/NKS

See entry 751 for abstract.

755. Regulation of Insurer Solidity Through Capital and Surplus Requirements, Appendix 1, Continued, Distributions of Combined Ratios By Line of Insurance and Size Class, 1973 and 1974
Pennsylvania State University, College of Business Administration
Hammond JD, Shapiro AF, Shilling N
1978 217p APR7516550
NSF/RA-780096 PB285669/NKS

See entry 751 for abstract.

756. Standard Deviation of Combined Rations (Underwriting Risk) As A Function of Written Premiums (Insurer Size), Appendix 2
Pennsylvania State University, College of Business Administration
1978 30p APR7516550
NSF/RA-780097 PB285670/NKS

See entry 751 for abstract.

757. Estimated Probability of Ruin from Underwriting as a Function of Premiums-to-Surplus Ratios, Each Line of Insurance and by Insurer Size, 1972-1975, Appendix 3, Graphs, Appendix 4, Tables
Pennsylvania State University, College of Business Administration
1978 242p APR7516550
NSF/RA-780098 PB285671/NKS

See entry 751 for abstract.

758. Regulation of Insurer Solidity Through Capital and Surplus Requirements, Appendix 5, Summary of State Laws on Capital Requirements for Entry Into the Insurance Business, Appendix 6, Wisconsin Statute Governing Capital Requirements for Entry Into the Insurance Business
Pennsylvania State University, College of Business Administration
1978 157p APR7516550
NSF/RA-780099 PB285672/NKS

See entry 751 for abstract.

759. Regulation of Insurer Solidity Through Capital and Surplus Requirements, Appendix 7, Underwriting Experience by Line of Insurance, for Each Sample Insurer, Appendix 8, Underwriting Experience for Each Sample Insurer, for Each Line of Insurance, Appendix 9, Efficient Underwriting Portfolio Composition for Two Sample Insurers
Pennsylvania State University, College of Business Administration
1978 53p APR7516550
NSF/RA-780100 PB285673/NKS

See entry 751 for abstract.

760. NATO Symposium on the Evaluation and Planning of Interpersonal Telecommunications Systems, Final Report
New York University, School of the Arts, Alternate Media Center
Elton MCJ
March 1978 90p APR7720480
NSF/RA-780108 PB284361/NKS

The first international symposium devoted to research on the evaluation and planning of new person-to-person telecommunication systems took place at the University of Bergamo in northern Italy. The report lists the papers presented, provides brief summaries of their contents, and summarizes points arising in their discussion. The papers are devoted to (1) delivery of health care, education, and community services; (2) scientific and technical information (STI); (3) teleconferencing and computer conferencing services; (4) trials of new

services; (5) society's use of information technology; (6) developments in the field of electronic funds transfer (EFT); and (7) aspects of planning and design.

761. Two-Way Cable Television, an Evaluation of Community Uses In Reading, Pennsylvania, Final Report, Summary
New York University-Reading Consortium
Moss ML
April 1978 41p APR7514311
NSF/RA-780110 PB283601/NKS

This summary presents the findings of an experiment designed to test and evaluate the impact of two-way cable television on the delivery of public services to senior citizens. The experiment was conducted in Reading, Pennsylvania by New York University in collaboration with local government organizations and the ATC-Berks TV Cable Company. The four objectives which shaped the scope of the evaluative research and fostered the development of community support for the two-way cable system are (1) to design and establish three neighborhood communication centers (NCCs) which are linked together by interactive cable television; (2) to train a staff of citizens to operate the interactive cable system; (3) to involve senior citizens and public agencies in the system's operation; and (4) to provide live two-way public service programming through which senior citizens could communicate with each other and with service delivery organizations. This summary discusses the NYU-Reading Cable Television Project in terms of research design, evaluative framework, system establishment cost, system operation cost, Neighborhood Communication Centers, effects of the two-way cable system, knowledge about public services, involvement in political processes, participation in social and community activities, involvement of service delivery organizations, and continuation of the experimental system.

762. Two-Way Cable Television, An Evaluation of Community Uses In Reading, Pennsylvania, Final Report, Volume 1
New York University-Reading Consortium
Moss ML
April 1978 544p APR7514311
NSF/RA-780111 PB284982/NKS

Findings resulting from an experiment designed to test and evaluate the impact of two-way, cable television on the delivery of public services to senior citizens are presented. Volume 1, which contains the texts of papers focusing on this topic includes: (1) a perspective on the implementation process; (2) the planning and development of the two-way cable system;

(3) the technical equipment used in the Reading cable experiment and how it was tested, deployed, and adapted; (4) the role of citizens and public sector organizations in the development of the two-way cable system; (5) a detailed account of the actual cost of setting up and operating the system; (6) the communications processes and protocols which were used in the two-way cable system; (7) the use of two-way cable television as a means of communication between senior citizens and local government officials; and (8) the output of the cable system from three perspectives. Volume 2 presents the results of a before and after survey conducted to evaluate the capacity of two-way cable television to improve the competence of senior citizens as consumers of social services. Findings indicate that public use of two-way cable television can serve important community purposes at relatively low cost.

763. Two-Way Cable Television, An Evaluation of Community Uses In Reading, Pennsylvania, Final Report, Volume 2
New York University-Reading Consortium
Moss ML
April 1978 573p APR7514311
NSF/RA-780112 PB284694/NKS

See entry 762 for abstract.

764. Small Claims Court, A National Examination
National Center for State Courts
Ruhnka JC, Weller S, Martin JA
1978 232p APR7507905
NSF/RA-780351

Findings from a detailed two-year examination of fifteen different small claims courts from across the nation are presented in this book. The present state of the small claims court is described in terms of its ability to provide all citizens with quick, uncomplicated, inexpensive, and just resolution of smaller civil disputes. The book also attempts to provide answers to important issues of small claims reform. Information is presented about the citizens who use small claims courts; for example, the actual time required to use these courts, hours lost from work, costs incurred to win or defend a small claim, the use of attorney services, and the ability of litigants to collect small claims judgments. Problems encountered by average citizens in using these courts and their opinions on the desirability of various changes in existing practices are examined. The fifteen samples were selected from states which use a wide variety of small claims procedures. Data obtained from these studies allow comparisons between individual courts and the different procedures used in those courts. The book

describes processes which take place before, during, and after the trial. Recommendations and final considerations are discussed.

Note: Available from National Center for State Courts, 300 Newport Avenue, Williamsburg, Virginia 23185. Price, $6.00.

765. Urban Models, Diffusion and Policy Application (Monograph Series No. 7)
Regional Science Research Institute
Pack JR
1978 421p SSH7419323
NSF/RA-780386

The literature on urban development models is reviewed to observe how model use has been defined and what specific uses have been anticipated. Evidence is presented on model use derived from a mail survey of some 1500 planning agencies which was undertaken in 1973 to determine the number of model users, the types of planning agencies, the types of models, and the purposes for which models are used. The evidence of 18 case studies on model use also is presented and evaluated. The reasons why some agencies choose to adopt models and others do not are considered. Case studies of five of the regional agencies are presented to add more specific examples to the above data. Of the 18 agencies visited these five agencies all use the same land use model, EMPIRIC, the most widely adopted of the available models. Comparison of the model use of these five agencies permits the more specific evaluation of the influences of the model itself on its use. The evaluations within and among the agencies of the model's quality and capability vary enormously and are seen to affect the extent of model use.

Note: Available from Regional Science Research Institute, P.O. Box 8776, Philadelphia, Pennsylvania 19101. Price, $9.00.

766. Cost-Benefit Analysis of Consumer Product Safety Programs, Final Report
University of Maryland, Department of Textiles and Consumer Economics
February 1978 314p APR7509984
NSF/RA-780020 PB282994/NKS

This research attempts to develop cost-benefit models for evaluating consumer protection programs in the area of product safety, and to apply the models to an analysis of actual and potential flammability standards for children's sleepwear and clothing. The two major consumer product safety programs considered were product regulation and safety education. The costs of the program included changes in consumer and producer welfare due to product regulation, and the costs of developing and implementing consumer protection programs. Cost-benefit models were developed for both durable and non-durable goods in the case of product regulation. The non-durable goods model was applied to an evaluation of flammability standards for children's sleepwear and clothing in 1974 and 1975. Various cost-benefit parameters such as the degree of protection provided by the standards, demand and supply considerations in the marketplace, and the discount rate were varied in order to assess the sensitivity of cost benefit rations to such variations.

767. Evaluation of the Consumer Research Program, Assessment of an Applied Social Science Research Program
Wax SB
December 1977 107p 77SP0980
NSF/RA-780021 PB282999/NKS

This is the first of a three-part examination of the consumer research program funded by Research Applied to National Needs (RANN). The program examines how the marketplace functions for consumers, what happens to consumers in the marketplace, and how and why they act as they do. This report includes: (1) specification and explication of the consumer research program objectives which serve as the foundation and paradigm for the research products; (2) a description of the projects, including the anticipated outcomes and progress of the projects and of the program; (3) a list of other related National Science Foundation sponsored research; and (4) specification of the relationship between the Advanced Productivity Research and Technology (APRT) consumer research subelement and research and related activities sponsored by other NSF and non-NSF sources.

768. Research for Consumer Policy, Proceedings (July 1977, Cambridge, Massachusetts)
Massachusetts Institute of Technology, Center for Policy Alternatives
Denney WM, Lund RT
March 1978 289p APR7714152
NSF/RA-780027 PB283058/NKS

The purpose of the conference was to begin building stronger connections between consumer research and consumer policy formulation in both the public and private sectors. The participants included nearly one hundred specialists from business, academia, consumer advocacy groups, and the private research community. This report includes: (1) an overview of the total proceedings, with recommendations for future such efforts; (2) a synthesis of issues raised in the workshops and open discussions of the conference; (3) the full texts of ten original papers prepared for the conference, accompanied by summaries of discussants' remarks; and (4) an inventory of suggested research priorities in the consumer policy areas. Topics chosen for discussion include: product safety; economics of warranties; consumer information processing issues for public policy; providing nutritional information to consumers; sociology of consumption and trade-off models in consumer public policy; and life-cycle costing.

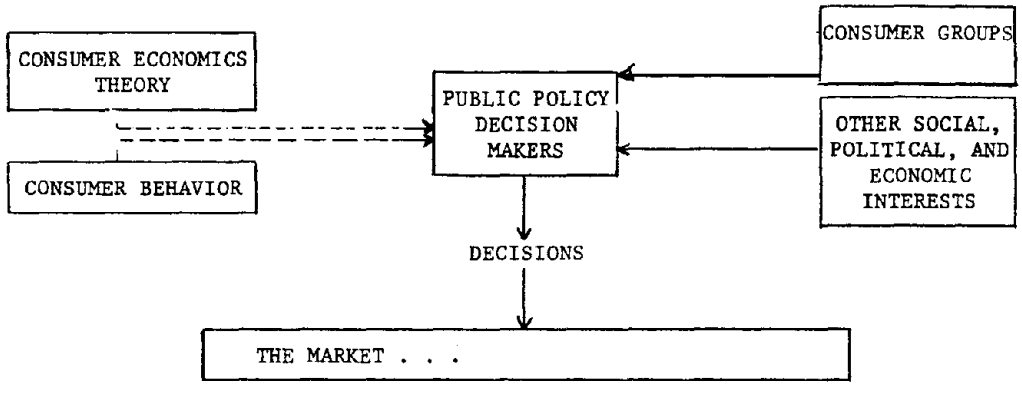
769. Evolving a Consumer Research Program
University of Miami, Consumer Affairs Institute; Florida International University
Blum ML
1978 141p APR7705168
NSF/RA-780028 PB282932/NKS

Problems encountered in the evolution of a consumer research program are identified. This study intended to discover: (1) how people perceive the relative importance of various consumer problems; (2) the differences between consumer research and market research; (3) how consumer problems relate to societal problems; (4) taxonomies useful in developing a comprehensive consumer research program; and (5) how several research methodologies can be used to generate a more complete understanding of consumer affairs. Also included are an in-depth probe of small-sized examples of various population segments and the use of varying methods such as Cue Sort, Interactional Workshop, and Public Notes. A basis was established for a research program in Consumer Affairs.

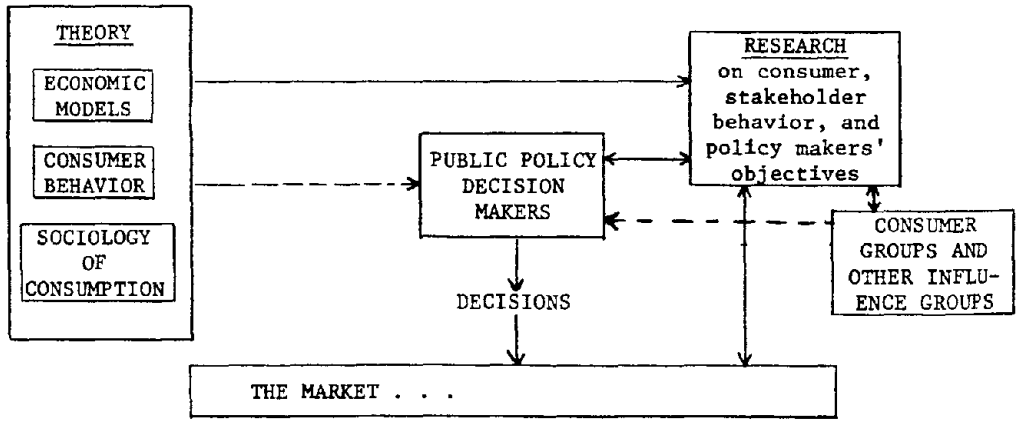
EXHIBIT 1

AN ILLUSTRATION OF THE PROPOSED CHANGE
IN THE APPROACH TO PUBLIC POLICY DECISIONS

From: The "Current" Approach to Public Policy Decisions



To: The Proposed Approach to Public Policy Decisions



See Entry 768

770. Multiple Water Supply Approach for Urban Water Management, Annual Report
Weston Environmental Consultants-Designers
Deb AK
March 1978 132p ENV7618499
NSF/RA-780030 PB279768/NKS

A systems model was developed to help cities, planners and engineers to decide whether the multiple supply approach to urban water management is beneficial in long-term planning of water resources. Three grades of water were considered in developing the model: potable, subpotable, and nonpotable. The potable water can come from protected, or unprotected sources treated beyond present standards to assure the highest quality for ingestion. The subpotable supply can be of questionable quality in terms of trace chemicals, but bacteriologically safe. The nonpotable supply will not be safe for human ingestion, and will essentially be reuse of wastewater effluent for industrial uses and for urban irrigation. Basic water supply data were generated by conducting surveys of water supply systems serving populations around 20,000, 100,000 and 500,000 people all over the country. Cost functions of 36 unit processes were developed and incorporated in the model. The model is very flexible and can handle a conventional system, a dual or multiple system including reuse, or a regional system with up to ten cities. The applicability of the model was illustrated by applying the model to several hypothetical single, dual and multiple water supply systems.

771. Measuring the Quality Dimension of Service Productivity
University of Missouri at Columbia, College of Business and Public Administration; Arizona State University, College of Business Administration
Adam EE Jr, Hershauer JC, Ruch WA
January 1978 214p APR7607140
NSF/RA-780035 PB282243/NKS

This research develops a methodology for measuring the quality dimension of productivity that could be utilized in service organizations and within service functions of any organization. Both service and quasi-manufacturing functions were examined. Two organization units within the Federal Reserve Bank System (a service industry) were chosen: check processing and personnel. Check processing involves the receipt, sorting, balancing, and dispatching of checks from commercial banks. It is quasi-manufacturing in that a product forms the basis for the flow of the process, yet no physical transformation of the checks takes place with the exception of sequencing or grouping. The personnel function is nearly pure service and is

typically found in any manufacturing, service, and governmental organization. The report includes: (1) a summary of previously published research relevant to the productivity and quality aspects of the study; (2) models of the quality dimension of productivity that were developed to provide a conceptual framework or background for the study to follow; (3) the selected theoretical concepts that underlie the measurement system process which has been developed; (4) the actual result of the project--a prototypical procedure for creating a measurement system of the quality dimension of productivity for a service function or organization; and (5) a description of the functions within the Federal Reserve Banks used for testing the measurement system procedures.

772. Productivity Measurement System for State and Local Government Purchasing and Materials Management Services, Executive Summary
City of Detroit, Mayor's Office, Productivity and Management Improvement Division; Wayne State University, College of Engineering
Burrell WE, Pattee B, Mikiel V
1978 47p APR7520542
NSF/RA-780107 PB283485/NKS

This research provides local governments with valid approaches and procedures for measuring the productivity of the Purchasing and Materials Management (P&MM) function. The authors attempt to identify the state-of-the-art of P&MM productivity measurements through a survey and synthesis of applications, and in cases where the state-of-the-art is found lacking, develop and test new approaches to productivity measurement through basic and exploratory research. The survey and synthesis of applications (1) reviewed the literature concerning the use of productivity measurement as applied to public and private purchasing operations as well as general theory on productivity measurement; (2) conducted extensive case studies at three states, four cities, and one county, and short studies at one state and two counties; and (3) conducted a nationwide survey of approximately two hundred counties, cities, and states concerning purchasing activities performed, staffing, performance expectations, current methods of measuring productivity, and values for factors needed to compute selected measures. Presented are discussions on the state-of-the-art for productivity measurement, the design and development of a productivity measurement system, pilot testing and findings, and recommendations for measuring purchasing productivity.

773. Health Manpower Licensing, California's Demonstration Projects
Council of State Governments
Howard D, Roederer RD
April 1978 50p ISP7716111
NSF/RA-780193 PB284899/NKS

The California Health Manpower Pilot Projects Program, administered by the Office of Health Professions Development within the California Department of Health, is reviewed and evaluated. In response to the realization that licensed nurses were functioning in health care roles beyond the scope of existing licensing legislation, the program permits the Department of Health to exempt authorized training projects from applicable healing arts laws during the specified time of the health manpower demonstration. By authorizing numerous nurse training programs, the state was able to place a legal umbrella over nurses' expanded duties until a law could be passed and new licensure regulations promulgated. The program applies, in addition to nurse training programs, to medical auxiliaries, mid-level dentistry professionals, pharmacy auxiliaries, and a small number of mental health professionals. An additonal benefit of the program has been its usefulness as a method for gathering information for determining licensure and training necessary for the protection of the public's health and safety. This report is one of a series of similar reports documenting case examples of innovations in the policy process, administrative management, and program operations of state governments.

774. Georgia's Residential Restitution Centers
Council of State Governments
Weber JR
May 1978 26p IRS7521176
NSF/RA-780194 PB284802

The experience and potential of Georgia's program of residential restitution centers is reviewed. The Georgia centers are offender-focused rather than victim-focused, thus differing from state victim compensation programs. Ten centers serve designated judicial districts. They represent an alternative to prison incarceration, not probation supervision. Georgia's centers have relieved prison overcrowding. The preferred method of selection is to interview sentenced offenders in the county jail while they await transportation to the state prison. If the center's staff members believe the program would be appropriate, it is recommended to the sentencing judge that the sentence be modified for placement of the offender in a center as a condition of probation. Centers operate 24 hours a day seven days a week. Offenders are employed and relinquish their paychecks to center staff members for division

according to a contract. Restitution includes monetary payment for damages and public service activities. A typical participant in the program is a 19-year-old offender convicted of a property offense, with an average length of stay of four months. This report is one of a series of similar reports documenting case examples of innovations in the policy process, administrative management, and program operations of state governments.

Applied Physical, Mathematical, and Biological Sciences and Engineering

Physical, Mathematical, and Engineering Applications

775. Experimental Hydrodynamic Study of Innovative Trawl Board Designs, Report on Phase I, Research on a Low Drag Trawl Board (October 1, 1977 - March 31, 1978)
Sea Otter Trawl Gear
Goudey CA
March 1978 86p APR7719702
NSF/RA-780040 PB278919/NKS

This study addresses the poor hydrodynamic qualities of the trawl boards commonly used by United States fishermen--a major source of trawl system inefficiency. A family of trawl board configurations was developed consisting of 24 different models. All designs were low aspect ratio, untapered, asymmetric foils made up of flat or constant radius surfaces. Variations of sectional shape, aspect ratio, planform and slot location were studied. Water tunnel tests were conducted at Reynolds Numbers of 1×10^6 with the model in contact with a splitter plate to simulate the hydrodynamic effect of trawl board contact with the seabed. Implications beyond the configurations tested were made and a rough analysis of the economic effect of trawl board efficiency is presented. All the models tested were found superior hydrodynamically to the board presently used. Reduced drag coefficients and the smaller size would provide as much as a 66% decrease in board resistance. The adoption of such a low drag trawl board would have a significant effect on the economics and productivity of trawling. Fuel savings of up to 20% or increases in catch size of 34% seem feasible.

776. Fragment Formation and Damage Penetration During Machining of Ceramics
Ceramic Finishing Company
Kirchner HP, Gruver RM, Richard D
March 1978 67p APR7719818
NSF/RA-780042 PB278709/NKS

Mechanisms of fragment formation and damage penetration during abrasive machining of ceramics are studied. Methodology includes applying the techniques and theory of indentation fracture mechanics to the study of abrasive machining. Specimens of glass and hot pressed silicon nitride were damaged by controlled scratching and single point diamond grinding. Vertical and horizontal forces acting on the material were measured for various diamond shapes, set depths, and wheel speeds. The damage was characterized by optical and scanning electron microscopy. The various types of cracks that were formed were identified and found to be similar to those formed by static contact and particle impact. The vertical forces were correlated with the extent of damage and the results were found to be consistent with those expected based on the theory of indentation fracture mechanics. Initially, the penetration of damage was analyzed in terms of contact loading, and resulted in improved understanding of the effect of diamond shape on the variation of the forces and damage penetration manifested by variations in the dimensionless contact constant X. Next, the results were analyzed in terms of line contact loading, which allowed the results for hot pressed silicon nitride and various diamond shapes to be represented by a single value of X.

777. Techniques for Dynamic Fracture Toughness Measurements
University of Maryland, Department of Mechanical Engineering, Photomechanics Laboratory
Der VK, Holloway DC, Kobayashi T
January 1978 60p APR7705171
NSF/RA-780045 PB280083/NKS

The dynamic stress intensity factor K_D is generally understood to depend upon crack velocity and is an important property in the study of dynamic failure. This report addresses the problem of experimentally determining K_D as a function of crack velocity for brittle opaque materials in the range from K_a to K_b. A number of techniques were investigated for measuring the dynamic stress intensity factor. The first used a birefringent coating bonded to the material, dynamic reflective photoelasticity, and a high speed framing camera. The resulting isochromatic fringes (contours of constant principal stress differences) were analyzed to obtain K_D. The second technique employed dynamic holographic interferometry from which isopachic fringes

(contours of constant principal stress sums) were generated to determine K_D values. A third technique referred to as the static equivalent method was used for estimating the dynamic stress intensity factor based on static measurements and correction factors for crack velocity effects and dynamic conditions. All were employed in the testing of a birefringent polyester material, Homalite 100, and the results were compared with those obtained using conventional dynamic photoelasticity. All three techniques are directly applicable to testing non-birefringent opaque materials, but only the static equivalent method was found to be useful for testing of rock. This method was applied to pink Westerly granite and an estimate of crack velocity vs. K_D was obtained.

778. Physical and Chemical Phenomena Responsible for Odor Formation in Diesel Engines, Interim Progress Report (June 1977 - December 1977)
Drexel University, Environmental Studies Institute; Drexel University, Mechanical Engineering and Mechanics Department
Cernansky NP, Savery CW, Suffet IH, et al
January 1978 77p AER7619752
NSF/RA-780046 PB280544/NKS

A single cylinder CFR diesel engine test facility has been modified and instrumented for studying the formation and control of odors in light duty diesel engines. Also, an air aspirated spray burner facility has been redesigned. Odor sampling and analysis techniques and procedures have been developed and are being refined. Exploratory odor samples (about 400) from both the engine and burner have been collected and analyzed. Supportive theoretical and modeling work has also been undertaken. Evaluation of the Diesel Odor Analysis System (DOAS) indicates that sample volume and sampling rate have a significant effect on measured odor and that significant odor breakthrough can and does occur in the odor sampling traps. Steady-state odor mapping of the engine system indicates that odor emissions are relatively insensitive to speed and injection angle but that load, compression ratio, ignition delay, and fuel factors can have a significant effect on odor production. Transient engine operation studies also have been initiated. The bench scale burner studies indicate that high odor production occurs when the burner is operated near its lean blowoff limit and is a strong function of stoichiometry. Significant aerodynamic, quenching, and fuel effects have also been observed.

779. Study of High Pressure Water Jets for Highway Surface Maintenance, Final Report
Illinois Institute of Technology
Labus TJ, Hilaris JA
April 1978 198p ISP7612230
NSF/RA-780054 PB284617/NKS

The objective of this program was to develop the performance data needed to determine the feasibility of using high pressure water jets as a tool for rapid pavement repairs. The various jet parameters and materials properties that effect the cutting and breakage capabilities of high pressure fluid jets have been investigated and are described in this report. Two types of water jets were studied in the laboratory and field investigations: continuous jetting and pulsed jetting. The results of this work were compared to conventional cutting techniques. Plain concrete, reinforced concrete, and asphalt concrete pavements were tested to determine the limitations and applications of the jetting process. Results of the program indicate that the pulsed jet system must be further improved to increase the power output, reduce the size and weight, and simplify the operation and maintenance. Cutting data using the continuous jetting system, using an economic analysis as the means of comparison with conventional systems, shows that continuous water jetting is superior to conventional methods of cutting and removal of concrete.

780. Research on Hydraulic Bursting of Concrete and Rock, Final Report on Phase 1
Terraspace Inc.
Cooley WC
March 1978 41p APR7719804
NSF/RA-780058 PB283896/NKS

This research demonstrates the feasibility and optimizes the process of hydraulic bursting of concrete and rock. The project has demonstrated a new method for safely and efficiently disintegrating concrete and rock with low noise and low dust, for potential application in demolition or excavation in urban areas where blasting may not be allowed. The method involves drilling holes approximately 1.5 inches (38mm) in diameter to depths of about 6 inches (150mm) into the face, inserting a packer-injector unit and injecting water at pressures of 1000 to 2200 psi (6.9 to 15.2MN/m^2) which causes the brittle material to fail in tension. Splitting of sandstone and Indiana limestone parallel to the drillhole was achieved. It was found that cracks could be initiated transverse to the drillhole and cones of concrete removed by applying a tension force to the packer prior to water injection. This conical failure mode is also attainable by tension alone on a rock anchor. A design concept for a tension fracture system is presented.

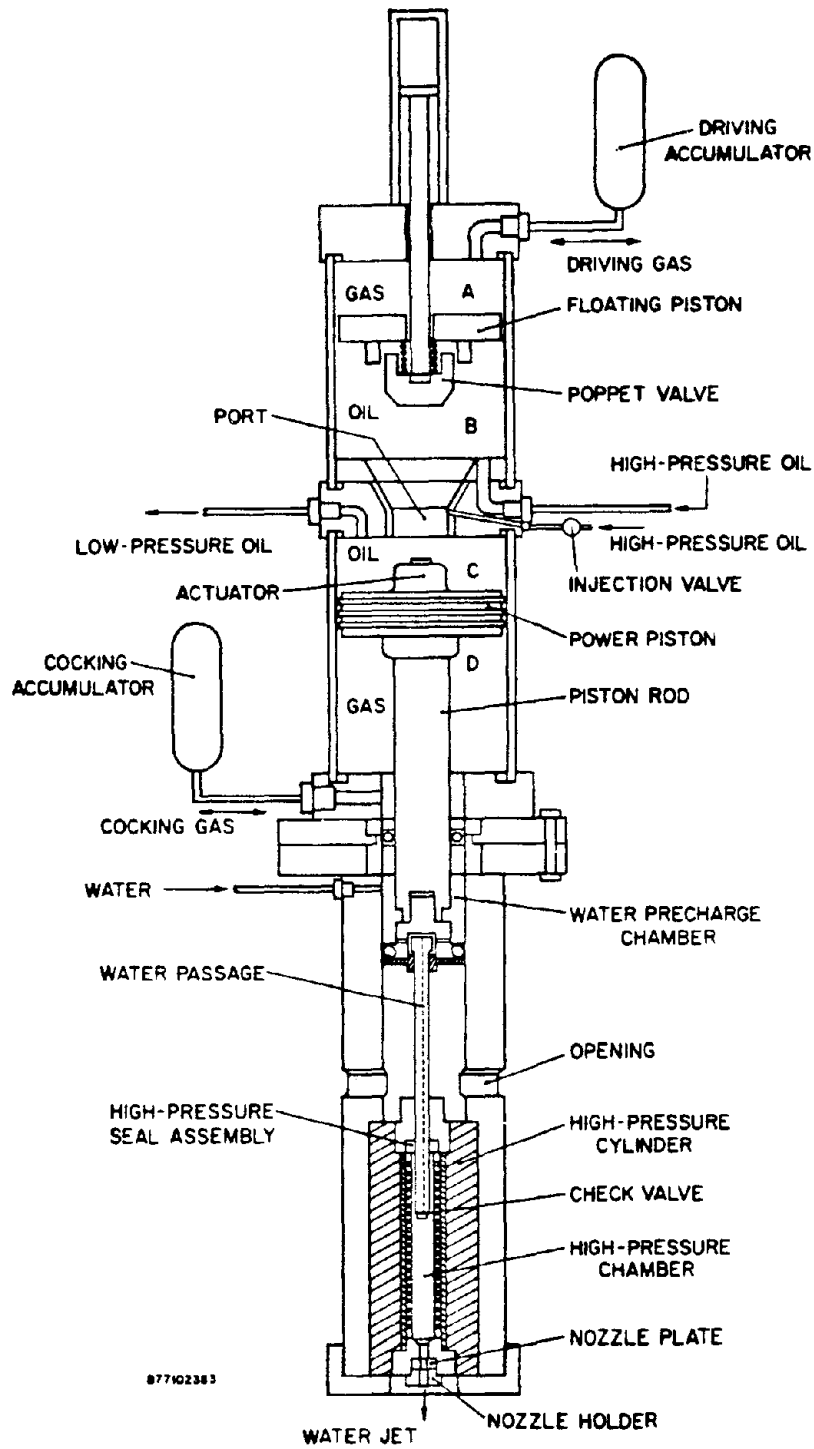


Figure 1.20 Internal Design of the Pulsed-Jet Intensifier

See Entry 779

781. SlideStore Large Capacity Information Storage, Final Report
Precision Instrument Company
Kaczorowski EM, Taylor DF, Shen LYL
1978 71p APR7719528
NSF/RA-780067 PB284479/NKS

This study evaluates prospects in areas key to the development of a large capacity optical storage system which records information by forming submicron holes in a thin metal film. A survey of commercially available microscope objectives found that 500 hole fields were an upper limit in performance and could be used with A-O deflected beams for Reading and Writing. A high performance objective lens was designed having a field of 2,000 submicron points. With such a lens, desired data rates could be achieved with mechanical scanners. The output characteristics of several laser diodes were examined. Tests using a micro-cylindrical lens to confine the highly asymmetric beam revealed extreme sensitivity to lens positioning and modulation caused by feedback of reflected light into the lasing cavity. A Read/Write Subsystem was built to make quantitative measurements of media sensitivity and defect rate. A variety of metal films were tested as recording media. The threshold energy was measured for film thickness, composition, substrate material, and pulse duration to characterize the operating domain for this recording mechanism. Films were produced in which interference enhanced the media sensitivity. Theoretical calculations were made of threshold energy and a bibliography compiled of related publications.

782. Mathematical Foundations of Constructive Solid Geometry, General Topology of Closed Regular Sets
University of Rochester, College of Engineering and Applied Science, Production Automation Project
Requicha AAG, Tilove RB
March 1978 35p APR7601034
NSF/RA-780069 PB286596/NKS

Constructive solid geometry is a scheme for modelling rigid solid objects as set-theoretical compositions of primitive solid "building blocks." Constructive solid geometry is based largely on modern Euclidean geometry and general (i.e., point-set) topology of subsets of E3 (Euclidean three-dimensional space). Certain elementary but specialized results of point-set topology which the authors have found useful in the study of geometric modelling are discussed. The document is written tersely and does not attempt to motivate fully or to discuss the application of the concepts and results described. Proofs of results not available in the cited references are included. The reader's knowledge of undergraduate topology is necessary.

783. Research on the Simplification of Methods for Measuring Fracture Toughness, Phase 1, Final Report
TerraTek, Inc.
Barker LM
April 1978 24p APR7719461
NSF/RA-780083 PB284113/NKS

This report examines new approaches to measuring the material property known as fracture toughness, with the aim of making fracture toughness measurements less expensive and exotic, and more economical and commonplace. A research program, initiated to simplify the methods of measuring fracture toughness in both brittle and ductile materials, is being directed toward the short rod method, which is simpler, yet more versatile, less costly, and at least as accurate as previous methods. An experimental compliance calibration of the short rod specimen configuration was performed, and an alternate specimen configuration was tested. Some experiments were performed in support of a new elastic-plastic theory which promises to drastically reduce the size and cost of most fracture toughness specimens. Research has demonstrated the feasibility of making valid fracture toughness measurements using greatly simplified procedures and much smaller, less costly specimens than are currently used.

784. Feasibility Study of Hydro-Mechanical Borehole Deviation Sensing, Final Report
TerraTek, Inc.
Shipman FH, Brest Van Kempen CJH
1978 43p APR7719526
NSF/RA-780084 PB284612/NKS

Presented are the results of a preliminary study and testing of a concept for a borehole deviation sensing system for use in long horizontal drilling applications. Considered were relevant problems, applications, and techniques currently encountered in the drilling industry, with emphasis placed on long-hole horizontal drilling. The concept of hydro-mechanical deviation sensing using drilling fluid is described and developed in detail. A design of a working model with which to ascertain a measurement of the important parameter of borehole straightness sensitivity is examined. Some of the more important uses of drilling small non-vertical holes in the earth are found in minerals exploration, mining applications, tunneling surveys, utilities emplacement, and safety. The greatest application in the near future is in providing channels for drainage, primarily methane, in coal mines. The approach presented detects, at a very high level of sensitivity, an incipient tendency of the drilled hole to deviate from a straight line. Preliminary test results using a model of the sensor indicate its straightness measurement sensitivity to be .003 in/ft of penetration.

785. Research Needs of the Automation Field (Report No. 8, Revised)
American Automatic Control Council, Automation Research Council
Dwyer SJ 3rd, Williams TJ
March 1978 245p APR7601002
NSF/RA-780089 PB286565/NKS

The Automation Research Council has reviewed, revised, and prioritized its previous recommendations concerning the research needs of the automation field for the next 20 year period. As a preliminary report the Council reiterates that research in the automation field is particularly needed in those aspects of the field generally included under the auspices of the title of system design and system engineering. Recommended research areas include: (1) basic manufacturing systems architectures; (2) geometric modelling; (3) data base design and operation; (4) hierarchical control including resource and production scheduling; (5) software-hardware interfaces between machines and between men and machines; (6) automated diagnosis, maintenance and related techniques; (7) fault tolerant, self-repair, and self-diagnostic techniques; (8) advanced software production techniques; (9) machine "vision" and other pattern recognition techniques; (10) transducers and smart sensors; and (11) economic analysis of automated systems. In addition to its work in defining the research needs of its field, the Council also feels strongly that additional work must be done on the socio-economic and socio-technical aspects of the field and on improving the educational institutions' response to the needs of industry for trained personnel. Recommendations are made for action in each of these areas.

786. Feasibility of Zero Aqueous Blowdown From Cooling Towers By Sidestream Softening, First Annual Report (May 15, 1977 - May 15 1978)
University of Houston, Cullen College of Engineering, Environmental Engineering Program
Matson JV
May 1978 81p AGN7706504
NSF/RA-780119 PB285988/NKS

The purpose of this paper is to outline the technical feasibility of sidestream softening of cooling water to eliminate blowdown, a major environmental problem. Heat, toxic chemicals, organic and inorganic materials are contained in the blowdown. The author defined a methodology for preliminary design upon which estimates of equipment sizes and chemical needs can be made, based only on knowledge of the makeup water quality and certain cooling water system parameters. In addition to sections on cooling water systems, cooling water chemistry and softening chemistry, the author presents design examples and a recarbonation option. Of the processes under most active

consideration (lime-soda softening, reverse osmosis, brine concentrators, thermal softening, ion exchanges, and electrodialysis) it appears that only the lime-soda method is economically feasible. Operating on a sidestream, this process removes the principal corrosive and scale-forming agents (calcium, magnesium, and silica) from the cooling water. Pilot studies have achieved zero cooling water discharge by this method of sidestream softening. However, until more extensive tests on a pilot facility are completed, the model should be restricted to design of an onsite pilot facility or for cost estimating purposes.

787. Use of Deicing Salts in Minnesota, A Review of Snow and Ice Removal Management Practices, Salt Use Effects, and Alternatives
Minnesota House Committee
Reagan PL
April 1978 220p ISP7602379
NSF/RA-780177 PB284539/NKS

This study was undertaken with the objective of replacing or significantly reducing the negative effects of salt on vehicles and the environment. Reducing salt use and improving salt storage practices can help mitigate these factors. A survey was conducted to evaluate snow and ice removal practices on state, county, and municipal levels, and results indicated that management practices for snow and ice removal were lax in most instances. Recommendations are made for improved management practices that would considerably reduce salt use, and alternative chemicals are suggested. The report also offers recommendations for salt application guidelines, salt management and control practices, environmental studies, and accident prevention techniques.

Biological and Ecological Applications

788. Report of the Public Meeting on Genetic Engineering for Nitrogen Fixation
Associated Universities, Inc.
Hollaender A
October 1977 127p AER7705338
NSF/RA-780004 PB279687/NKS

This conference and the previous one held last March focused on genetic engineering and nitrogen fixation. The objectives of the first conference, held at the Brookhaven National Laboratory, were to review the current state of genetic engineering with regard to nitrogen fixation and to define and assess the opportunities and limitations of this technique for enhancing net

nitrogen biosynthesis. In addition, discussions of health, legal, economic, environmental, and social issues were initiated. A preliminary examination of the relevancy of the current National Institutes of Health (NIH) guidelines on recombinant DNA research to nitrogen fixation and plant research was also conducted. The objectives of the meeting in Washington were to summarize and update the discussions of the Brookhaven meeting and to inform a wider group of individuals in both the public and private sectors of the needs and implications of this research area. Equally important, the Washington meeting provided an opportunity for interested parties from the nonscientific sector to comment and express opinions.

789. Application of Technology-Directed Methods to Reduce Solid Waste and Conserve Resources in the Packaging of Non-Fluid Foods
Franklin Associates, Ltd.
Hunt RG, Shobe FD, Trewolla JC, et al
1978 356p C7620055
NSF/RA-780007SET PB282898/NKS

Packaging materials are discarded after use to solid waste streams or recovered for reuse, recycling, or energy recovery. Materials which are disposed of by landfill or incineration represent a significant loss of the nation's finite resources and contribute substantially to solid waste problems. The focus of attention concerning the problems of packaging material disposal has been on governmental regulatory approaches. In this study, the impact of technological innovation in non-fluid food packaging is analyzed. Historical trends and case studies indicate that technological innovation has resulted in substantial reduction of packaging per unit of food. The savings have ranged from one to 90 percent for specific cases. However, growth in foods that require more packaging per unit has resulted in no net gain or loss of packaging per unit over the 16-year period--1960 to 1975. Governmental regulatory activity aimed at packaging in general will impact on non-fluid food packaging as a part of the whole packaging sector, and benefits and/or liabilities will occur. Volume 1 presents the analysis and summary results of the study. Volume 2 contains four appendices which include the data and calculations gathered from 1960 to 1975. The User Handbook contains a brief summary of the results, and a discussion of relevant government policy issues.

790. Application of Technology-Directed Methods to Reduce Solid Waste and Conserve Resources in the Packaging of Non-Fluid Foods, Final Report, Volume 1, Summary
Franklin Associates, Ltd.
Hunt RG, Shobe FD, Trewolla JC, et al
February 1978 70p C7620055
NSF/RA-780005 PB282899/NKS

See entry 789 for abstract.

791. Application of Technology-Directed Methods to Reduce Solid Waste and Conserve Resources in the Packaging of Non-Fluid Foods, Final Report, Volume 2, Data and Calculations
Franklin Associates, Ltd.
Shobe FD, Trewolla JC, Bider WL, et al
December 1977 269p C7620055
NSF/RA-780006 PB282900/NKS

See entry 789 for abstract.

792. Application of Technology-Directed Methods to Reduce Solid Waste and Conserve Resources in the Packaging of Non-Fluid Foods, Final Report, User Handbook for Government Officials
Franklin Associates, Ltd.
Hunt RG, Shobe FD, Trewolla JC, et al
February 1978 17p C7620055
NSF/RA-780007 PB282901/NKS

See entry 789 for abstract.

793. Assessment of Controlled Environment Agriculture Technology, Final Report
International Research and Technology Corporation
DeBivort LH, Taylor TB, Fontes M
February 1978 476p C1026
NSF/RA-780024 PB279211/NKS

Assessment of the economic, environmental, social, and other impacts of large scale use of technology for growing food inside enclosures, Controlled Environment Agriculture (CEA), was initiated to alleviate the agro-food problems of environmental degradation; shortages of arable land, water, and fertilizers; and unreliable production. Primary conclusions were: (1) large scale use could alleviate these problems; (2) costs of present systems are too high for agronomic crops, but acceptable for some high value fresh vegetables; (3) new systems can be made at lower costs and less total energy consumption; (4) there is a need to link R&D to open field agriculture, solar

energy systems, water management, and low cost structures; and (5) CEA should be used with solar energy and water management systems for large communities. The study includes a conceptual analysis of future systems, cost evaluations, and a diffusion analysis of non-economic considerations. The primary effects of CEA on the agro-food system will be on farm production, location, size and numbers, balance sheet, ownership, employment, labor conditions, environment, and off-farm storage, transportation and processing. Secondary effects will be on changes in supply industry production levels, investment, national accounts, U.S. trade, land-use patterns, rural-urban development, the development of small scale, practically self-sufficient communities, and aesthetics.

794. Recovery, Reuse, and Reduction of Zinc Metal Waste in Zinc Rich Inorganic Primers, Progress Report
University of Louisville, Speed Scientific School
Plock EV, Conner DA
January 1978 137p AER7709449
NSF/RA-780047 PB280142/NKS

Progress on task objectives is reported as follows: (1) An electrostatic spray gun and process for spraying zinc rich primers was developed and demonstrated; (2) The parameters for reprocessing waste zinc for reuse in zinc rich primer were established by experiments; (3) The ability of the agricultural chemical industries to utilize waste zinc from zinc rich primers was established and two national models were initiated; (4) Experiments have proven that in the case of automatic zinc rich primer lines, spraying of shop primer to a 1 mil nominal thickness using S280 shot, in lieu of past conventional S330 shot, produces zinc savings; (5) Mid-task results indicate that Ferrophos (TM), an iron-phosphor by-product of the sodium industry, can be successfully utilized as diluent for zinc rich primers at concentrations defined in this project; (6) Initial work indicates that in the long term, zinc should be recovered from scrap iron both for recovery of zinc, and to make more scrap iron available; (7) Optimum zinc and zinc rich primer tests have been developed or identified; and (8) It has been estimated that if the waste recovery techniques developed are implemented, the domestic zinc recycle level could be approximately doubled.

795. Technology Assessment of Advanced Composite Materials, Phase 1, Final Report
Argos Associates, Inc.
Kayser R
April 1978 238p ERS7719467
NSF/RA-780053 PB283416/NKS

The principal high performance fibers currently used in advanced composites are graphite, aramid, and boron. In the future, these will be supplemented by other high strength fibers such as alumina, silicon carbide, and boron nitride. Organic matrix composites, which are evolutionary products of fiberglass reinforced plastics, predominate the technology. Carbon matrix composites, now mainly used in missile components and aircraft brakes, may find medical use as implantable substitutes for bone structures. Metal matrix composites are currently used in aerospace applications of a developmental nature. With further technical development, metal matrix composites, especially short fiber composites, may be used in specialty applications, particularly in energy conversion systems. The commercialization of advanced composites will result in impacts that will be similar to, and marginal to, those of fiberglass reinforced plastics. High performance fibers will be catalysts for increased consumption of glass fibers in reinforced plastics, but otherwise will not affect other basic materials. Areas of application of advanced composites that could result in significant secondary impacts are automotive equipment, general and commercial aviation, agriculture, and the industrialization of space. Advanced composites can be a major tool for petroleum energy conservation, especially in transportation.

796. Characteristics of Secondary Materials Markets and Their Implications for Resource Recovery Policy
Regional Science Research Institute
Coughlin RE, Plaut T, Steiker G
March 1978 183p AER7619115
NSF/RA-780077 PB286601/NKS

The regional econometric analysis of the wastepaper market and the interactive computer program for estimating potential supply of secondary materials are the two studies presented. The objective was to investigate the nature of supply and demand forces underlying scrapmarkets which determine the extent of resource recovery and the effectiveness of any public programs to encourage recycling industry. The paper industry, which has for many years included an important recycling component, provided the focus. An econometric analysis of the markets for scrap paper was completed which indicates the form of the relevant supply and demand relationships. This analysis is unique in that it is carried out at the regional level as well as at the

national level and because it includes the 1973-1976 time period which is noted as the time of an unprecedented peaking and subsequent decline in scrap paper prices. In addition, a simple-to-use interactive computer model was developed for estimating the potential scrap supply generated within a given area for which data are available on population and on economic structure and employment. Seven different kinds of scrap are identified: paper, wood, textile, rubber, glass, ferrous, non-ferrous, and other.

797. Management of Nitrogen in Irrigated Agriculture, Proceedings (May 1978, Sacramento, California)
University of California, Department of Soil and Environmental Science
Pratt PF
April 1978 444p ENV7610283
NSF/RA-780115 PB284692/NKS

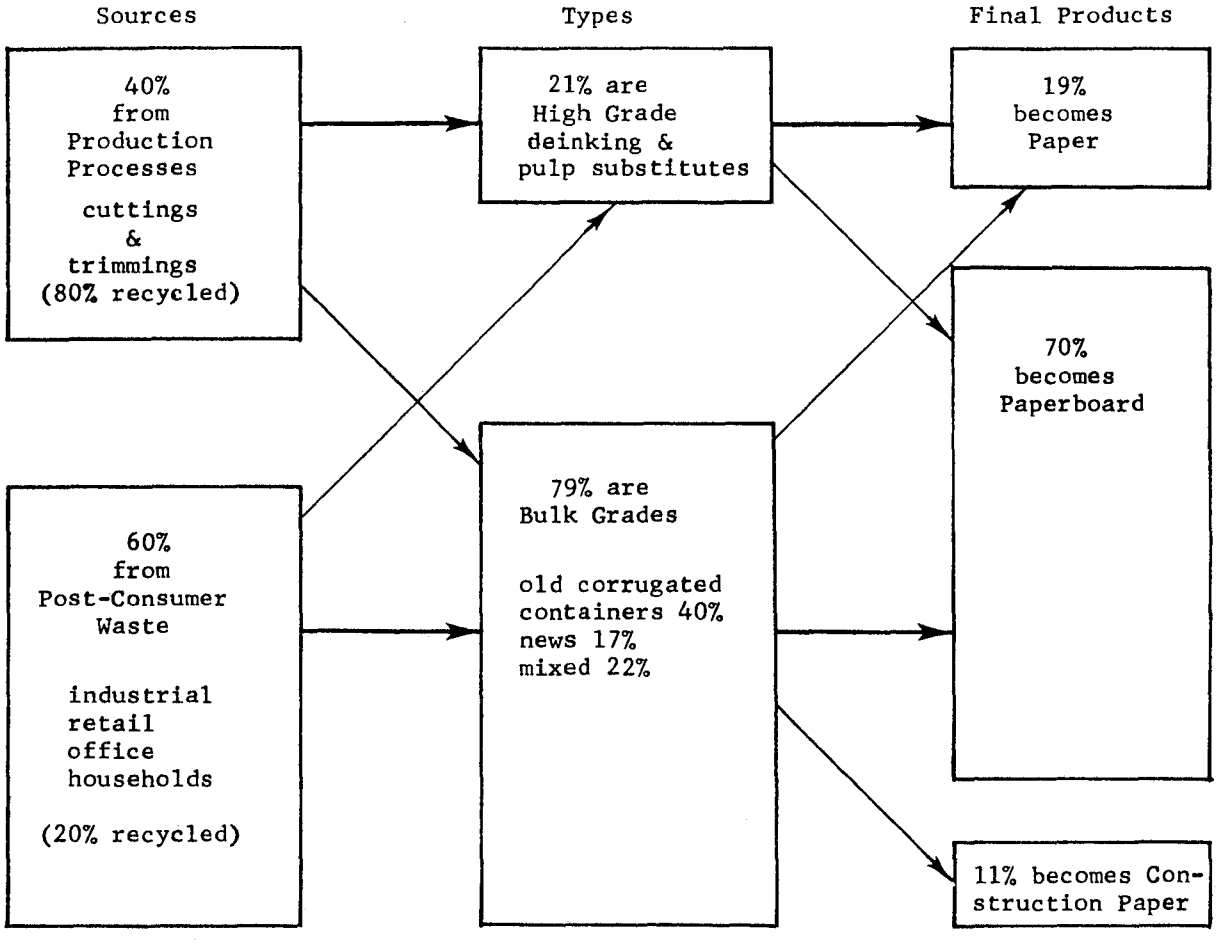
The purpose of this conference was to review the comprehensive national research effort currently being performed in the field of nitrogen management in irrigated agriculture. The National Science Foundation, the U.S. Enviornmental Protection Agency, and the University of California's Department of Soil and Enviornmental Sciences jointly sponsored the conference. The comprehensive research approach has proven successful in harmonizing conflicting projects where economy of production and the protection of environmental quality have come into opposition. The growth of public concern over nitrate pollution of water supplies has resulted in the government's increased encouragement, through Federal grants, of the agricultural and environmental aspects of soil nitrate research. Research topics presented at the conference included nitrogen's role in agricultural production, its relation to water quality, crop utilization, removal by irrigated crops, nitrate leaching from soils, economic impacts and methodology, case studies, mathematical studies, and diagnostic identification techniques for nitrogen fertilization.

Geophysical and Environmental Applications

798. Investment in the Copper Industry 1950 - 1975, Final Report
Pennsylvania State University, College of Earth and Mineral Sciences
Monzon PG, Vogely WA
July 1978 272p AER7505003
NSF/RA-780134 PB286031/NKS

This study examines the copper industry from 1950 to 1975 and evaluates the forces responsible for new investment capacity.

Figure 1-1
SOURCES, TYPES AND FINAL PRODUCTS OF WASTEPAPER



See Entry 796

Its main objective is to establish for the copper industry the major determinants of investment during this period. The report is divided into six areas: (1) copper demand; (2) organization of the copper industry; (3) the supply of copper; (4) investment in the copper industry; (5) investment in mineral development in copper producing countries; and (6) the impact of pollution costs on the U.S. copper industry. Analyses are presented of the wide swings in capacity relative to demand, fluctuations in price, and variations in investment behavior that have occurred during the last quarter century. The U.S. is a major producer and government policy influences investment behavior. Because copper facilities have been nationalized by governments of major foreign producers, investment behavior is considered in relation to nationalization and a combination of nationalized and private enterprise. It was suggested that in order to insure the availability of copper to the industrial world, continued investing in the development of existing and new sources of copper is essential. An appendix describes investment criteria for individual projects.

Earthquake Hazards Mitigation

Design

799. Structural Walls in Earthquake-Resistant Buildings, Dynamic Analysis of Isolated Structural Walls, Parametric Studies
Portland Cement Association, Construction Technology Laboratories, Research and Development
Derecho AT, Ghosh SK, Iqbal M, et al
March 1978 233p ENV7414766
NSF/RA-780085 PB283705/NKS

The results of a parametric study to identify the most significant structural and ground motions parameters, as these affect the dynamic inelastic response of isolated structural walls, is presented. The parameters examined include intensity, duration, and frequency content of the ground motion and the following variables relating to the structure: fundamental period, yield level in flexure, yield stiffness ratio, unloading and reloading parameters characterizing the decreasing stiffness hysteretic loop assumed for the model, damping, stiffness and strength taper along height of structure, and base fixity condition. Results are presented in the form of maximum response envelopes for horizontal and interstory displacements, bending moment, shear, rotational ductility and cumulative plastic hinge rotations as well as time-history plots of response. Results of the study indicate that the most important parameters are the fundamental period, yield load, and the earthquake intensity.

Chemical Threats to Man and the Environment

800. Acoustic Sounder Array for Application to Air Pollution, Final Report, Volumes 1-3
SRI International
Russell PB, Uthe EE, Maughan RA, et al
February 1978 195p AEN7302918
NSF/RA-780031SET PB282063/NKS

A 3-year study was conducted to demonstrate the applicability of sodar (accoustic radar) techniques to San Francisco Bay Area air pollution problems. A major goal of the study was to

produce a representative, smog-season data set on mixing depth and stability patterns, in a format that could easily be used by numerical air quality models. Field studies using 1, 3, and 13 sodars were conducted in successive years. Extensive comparisons between mixing depths inferred from sodar and from other techniques (balloon, airplane, tower, lidar) demonstrated that, on average in the Bay Area, sodar performs as well as any other single technique for indicating mixing depth. This conclusion derives partly from the Bay Area's special meteorology (which is very favorable to sodar measurements) and partly from the shortcomings (data ambiguities, small practicable sampling rates) of other techniques. Filming and digitizing techniques were developed to reduce the large (about 1,000 site-day) data set acquired in the final year to hourly mixing depth and stability indicators. This digital data set, which can easily be input to computerized air quality models, is listed in Volume III and is available on cards to interested users. Time-dependent mixing depth and stability maps derived from these data show a readily comprehensible picture of the marked spatial and temporal variations in Bay Area boundary layer behavior. Two case studies demonstrate the use of the sodar data in connection with air pollution incidents.

801. Acoustic Sounder Array for Application to Air Pollution, Final Report, Volume 1, Executive Summary and User Guide
SRI International
Russell PB, Uthe EE
February 1978 27p AEN7302918
NSF/RA-780031 PB282064/NKS

See entry 800 for abstract.

802. Acoustic Sounder Array for Application to Air Pollution, Final Report, Volume 2, Case Studies and Other Appendices
SRI International
Russell PB, Uthe EE, Ludwig FL
February 1978 125p AEN7302918
NSF/RA-780032 PB282065/NKS

See entry 800 for abstract.

803. Acoustic Sounder Array for Application to Air Pollution, Final Report, Volume 3, Hourly Digital Mixing Depth and Stability Data
SRI International
Russell PB, Maughan RA, Smith AH, Uthe EE
February 1978 51p AEN7302918
NSF/RA-780033 PB282066/NKS

See entry 800 for abstract.

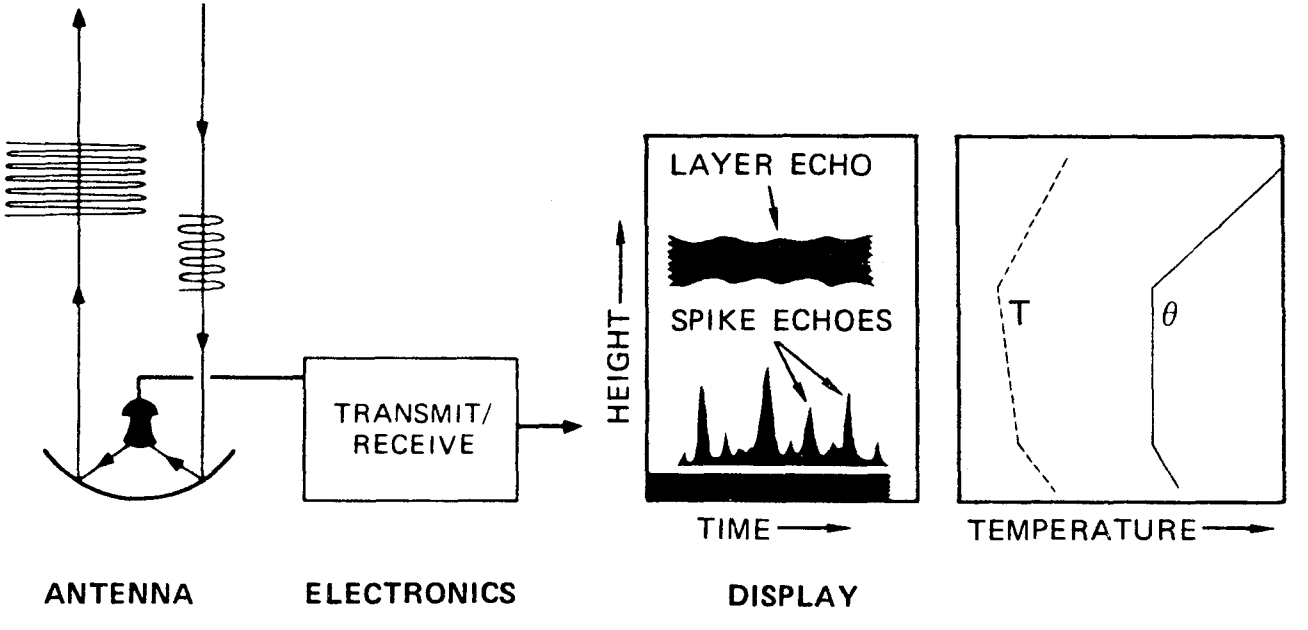


FIGURE 5 SCHEMATIC REPRESENTATION OF THE MONOSTATIC SODAR METHOD, EQUIPMENT, AND ECHO TYPES

Profiles of temperature, T, and potential temperature, θ, illustrate typical vertical gradients associated with each type of echo.

See Entry 801

804. Reactive Tapes for Automatic Environmental Analyses, Personnel Vapor Monitoring Badges for Industrial Workers, Final Report
Moleculon Research Corporation
Nichols LD
March 1978 29p AER7719771
NSF/RA-780039 PB280622/NKS

This project demonstrates that Poroplastic film, and related technology, can combine with colorimetric chemistry to provide prompt visual detection of hazardous vapors at real levels of interest, and that badges based on this technology would be a viable commercial product of major public benefit. Threshold and saturation color levels for phosgene and formaldehyde, two representative toxic vapors, have been examined using reagent-impregnated Poroplastic films. The results prove adequate for both acute, single time exposure limit (STEL) badges and chronic, time weighted average (TWA) badges based on present NIOSH guidelines. Detailed phosgene studies show that shelf-life, dose response, specificity, and resistance to desensitization by other vapors are good, and can be improved by appropriate additives and modified solvents. Similar improvement in post-exposure color stability has been demonstrated, and further improvement in this one area is all that is required for a fully satisfactory phosgene product.

805. Cypress Wetlands for Water Management, Recycling and Conservation, Fourth Annual Report (Final, December 16, 1976 - December 15, 1977)
University of Florida, Center for Wetlands, Phelps Laboratory
Odum HT, Ewel KC
March 1978 953p ENV7706013
NSF/RA-780061 PB282159/NKS

Recycling of treated sewage wastewaters into two cypress domes in Gainesville, Florida is in its fourth year with much accelerated growth of cypress trees and recharge of groundwater after removal of most of the nutrients and microbes by the natural filter mechanisms of the swamps. The cypress swamps through the shielding effect of their thin leaf cover and their leaf drop in dry season save water, as compared to open water storage. Extension of studies to a cypress strand at Waldo receiving sewage for 43 years showed the long-term stability of the ecosystem receiving the nutrients. Drawdown of superficial groundwaters was found to occur a half mile from canals in south Florida. Lowering the water tables reduced the productivity and temporarily reduced transpiration. However, drainage caused displacement of the cypress regimes by exotic vegetation with increased transpiration. Evaluations showed that cypress swamp substitution for technological tertiary treatment was feasible and directly and indirectly favorable to

the economy. Data from swamps were used to estimate the capacity of south Florida counties to receive wastewater and nutrients from human developed areas. Retention of cypress swamps for water management, recycling, and conservation is a major need in environmental planning in Florida.

806. Sulfur Isotope Studies of Biogenic Sulfur Emissions at Wallops Island, Virginia
Environmental Research and Technology, Inc.
Hitchcock DR, Black MS, Herbst RP
March 1978 204p ENV7616703
NSF/RA-780086 PB286556/NKS

This research attempts to determine whether it is possible to measure the stable sulfur isotope distributions of atmospheric particulate and gaseous sulphur and to use this information together with measurements of the ambient levels of sulfur gases and particulate sulfate and sodium in testing certain hypotheses. Sulfur dioxide and particulate sulfur samples were collected at a coastal marine location and their $\delta 34_S$ values were determined. These data were used together with sodium concentrations to determine the presence of biogenic sulfur and the identity of the biological processes producing it. Excess (non-seasalt) sulfate levels ranged from 2 to 26$\mu g\ m^{-3}$ and SO_2 SO_2 from 1 to 9 ppb. Analyses of air mass origins and lead concentrations indicate that some anthropogenic contaminants were present on all days, but the isotope data revealed that most of the atmospheric sulfur originated locally from the metabolism of bacterial sulfate reducers on all days, and that the atmospheric reactions leading to the production of sulfate from this biogenic sulfur source are extremely rapid. Del values of atmospheric sulfur dioxide correlated well with those of excess sulfate, and implied little or no sulfur isotope fractionation during the oxidation of sulfur gases to sulfate.

Alternative Biological Sources of Materials

807. Commercial Waste Food Recycling for Swine Production, Final Report
Tseng Enterprises Inc., Oriental Engineering and Supply Company
March 1978 122p ERS7719811
NSF/RA-780036 PB281566/NKS

The feasibility of commercial waste food recycling for swine production is examined. Large amounts of waste material from restaurants and food processing plants, suitable for swine or animal feed, are currently being wasted by their disposal in

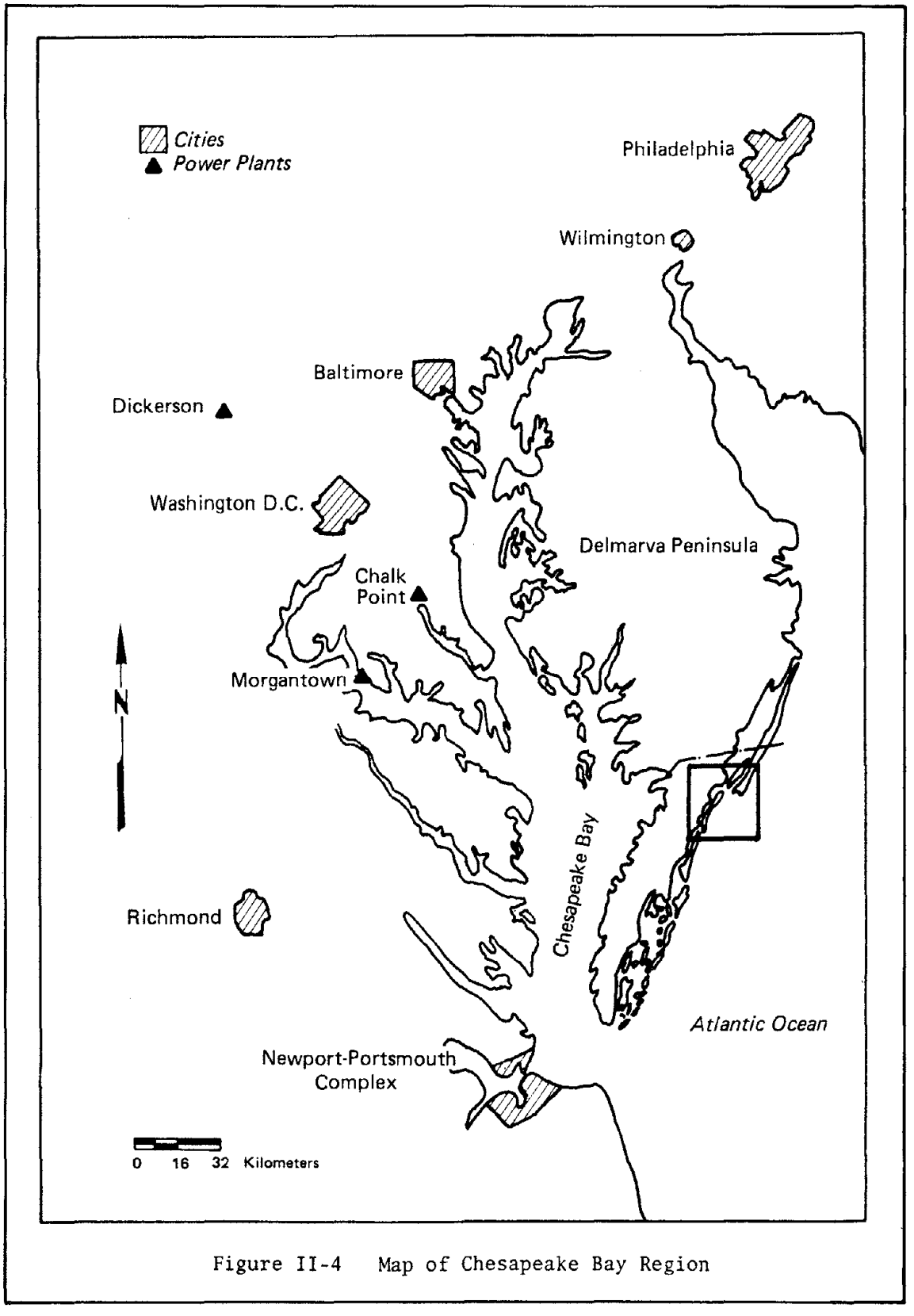


Figure II-4 Map of Chesapeake Bay Region

See Entry 806

land-fill operations or are sent to sewage plants causing treatment problems. A system devised for the economical recovery of this potential animal food material could serve to increase the available high protein food supply. Possibly, it could allow the production of high protein food (meat) at lower cost. Since most urban areas of the United States are finding it more and more difficult and expensive to dispose of waste material by land-fill, recycled restaurant and food processing wastes might alleviate the problems of land-fill disposal of urban waste material. This study encourages those now engaged in animal feeding to consider methane generation from animal wastes in order to add to the U.S. energy resources. The text is based on the model of collecting food wastes from San Francisco Chinatown restaurants, food processors, and grocery stores for use in swine feeding at the pig farms in the Bay Area. Special efforts have been made to identify the cultural backgrounds that will make the collection system, food waste composition, and social disciplines that are needed in order to make such a recycling system functional.

808. Bioconversion of Saline Water, Phase 1 Report
Biospherics, Inc.
March 1978 58p
NSF/RA-780066 PB283768/NKS

Experiments were conducted on the use of algae for removal of salt from water in an attempt to develop an economically feasible, low energy method for the conversion of saline water. Primary project objectives are: (1) to undertake a literature search; (2) to select and obtain algal cultures; (3) to culture algae in sufficiently large volumes for test purposes; (4) to determine suitable methods for evaluation of media and cellular sodium concentrations; and (5) to test various environmental factors for their effect on algal sodium uptake and excretion. The literature search was completed, stock algal cultures were obtained and grown in relatively large culture volumes. Techniques for monitoring cell sodium levels were evaluated for the most efficient means of removing external sodium and for digestion of the cells prior to sodium analysis. Environmental changes indicated in the literature search and which could be easily manipulated were made in attempts to induce uptake/release of sodium from algal cells. Factors selected for experimental manipulation were: pH, salinity, temperature, light vs. dark conditions, addition and depletion of energy sources, addition of toxic compound, and addition of sewage sludge. No significant uptake or excretion of sodium or chloride was obtained in the algal species studied when the selected environmental manipulations were made, with the exception of a possible uptake of sodium when the algal culture was studied in the presence of activated sewage sludge.

809. Technology Assessment of Vegetable Substitutes for Animal Protein in Human Food, Volume 1, The Study
Futures Group; Texas A&M University
Becker HS, Richmond R, Lusas EW, et al
March 1978 136p ERS7719549
NSF/RA-780070 PB284681/NKS

This report encompasses a detailed technology assessment of vegetable substitutes for animal protein in human food. Vegetable protein is being used in the United States as analogs, ingredients, and extenders of meat and dairy products. Studies have indicated that over the next 10-15 years, emphasis will be placed on using vegetable protein as a meat extender, rather than a direct analog. Several factors are involved in substituting vegetable protein, one of the most important of which is the form the substitution should take. In Volume 1, recommendation is made for a complete technology assessment, which should include all important technological and socio-economic factors. Volume 2 presents a discussion of metabolism, daily protein requirements and the impact of changes in protein intake. A "mini" technology assessment of the use of vegetable substitutes for animal protein as human food includes: (1) factors important to food-consumption patterns; (2) historic food-consumption patterns; (3) important future sources of vegetable protein, including the influence of technology, legislation, and other factors; (4) potential impact of vegetable substitutes; and (5) potential policy implications.

810. Technology Assessment of Vegetable Substitutes for Animal Protein in Human Food, Volume 2, Appendices
Futures Group; Texas A&M University
Becker HS, Richmond R, Lusas EW, et al
March 1978 72p ERS7719549
NSF/RA-780071 PB284682/NKS

See entry 809 for abstract.

811. Parameters for Legislative Consideration of Bioconversion Technologies
Minnesota Legislature, Science and Technology Project
February 1978 45p ISP7602379
NSF/RA-780196 PB284742/NKS

Included in this report and the minibrief which accompanies it are conclusions and recommendations that evolved from the examination of various models of biomass production of non-petroleum fuels. This included the Nebraska Grain and Alcohol Program but, it was determined that it was neither economically nor energetically wise at this time for Minnesota to commit

Table B.4

RELATIVE IMPORTANCE* OF VEGETABLE PROTEIN SOURCES
IN POTENTIAL ABILITY TO CONTRIBUTE TO THE DIET

	United States	Worldwide
Soy	8.5	6.8
Wheat	5.4	5.6
Peanuts	5.0	5.5
Glandless Cotton Seed	4.3	5.5
Corn	3.5	3.4
Potatoes	3.1	4.2
Rice	3.0	5.7
Oats	2.1	2.0
Sorghum	1.7	3.1
Sunflower	1.2	3.1
Rapeseed	.5	2.7

*10 equals maximum importance, nothing more important
5 equals moderate importance
0 equals no importance

See Entry 810

itself to a "gasohol" program modelled after Nebraska's program. Instead of adopting the single source, large-scale Nebraska model, it was concluded that Minnesota should be the pilot and demonstration plant for the production of ethanol on the small scale (farm or local co-op size), and should encourage the utilization of a variety of feedstocks such as, sugar beets, grains, and cellulosic residues.

Science and Technology to Aid the Physically Handicapped

812. Visual Feedback Speech Training for the Deaf, a Feasibility Report
Integrated Sciences Corporation
Gish WC
March 1978 56p APR7719883
NSF/RA-780043 PB281139/NKS

This report proposes a new visual feedback training system for the deaf. This new aid would use a sophisticated multi-step process for the extraction of a meaningful visual representation of speech. The overall approach is shown to be feasible and further research aimed at developing the necessary signal processing algorithms is recommended. The report discusses several visual feedback aids that are representative of past and present devices and shows that their lack of success is primarily a result of inadequate feedback. A definition of adequate feedback and its justification is presented. The feasibility of providing this feedback was investigated and state-of-the-art signal processing techniques for extracting the acoustic features of the high pitched voices of women and children were found to be the primary stumbling block. Very recent research in speech and signal processing which has not yet been applied to the problem of visual feedback aids is the basis for the approach and is discussed in some detail. An extensive bibliography is included.

813. Microprocessor-Based Prosthetic Control, Phase 1, Final Report
Scientific Systems, Inc.
Gustafson DE, Doerschuk PC
April 1978 97p APR7719672
NSF/RA-780068 PB286652/NKS

The objectives of the present study have been to investigate the feasibility of using advanced signal processing and pattern recognition techniques in a multifunction prosthesis. The specific problem area addressed is industrial productivity, which is presently quite limited for people using prosthetic devices. It is felt that this limitation essentially is due to the problem

of fast and accurate detection of the person's intent, since once intent is known power assistance can be given using present state-of-the-art technology in actuators and motors. This study has been limited to a preliminary feasibility analysis of multifunction discrimination using myoelectric signals, a method which has not yet been reduced to practice. Present prostheses require many electrode pairs for multifunction control and thus are subject to limitations and restrictions which appear undesirable. The present approach specifically is designed to ameliorate these difficulties and uses a newly-developed pattern recognition technique which offers great speed and has desirable statistical optimality properties. Results presented are thought to demonstrate concept feasibility.

814. Guidelines to Improve Existing Parks and Playgrounds for All People Through Planned Revisions, An Interim Report to the Community
Rochester Engineering Society, Inc.
April 1978 31p ISP7624661
NSF/RA-780141 PB283598/NKS

The objective of this project was to produce a set of guidelines that could be used by park and playground planners to determine if revisions to a park will increase that park's usability by handicapped citizens, and also to determine if such changes will increase the park's safety. The Rehabilitation Act of 1973, Section 504 prohibits the exclusion of handicapped citizens from any program or facility solely because of their handicap. Structures built after 1973 must be built in compliance with Section 504 guidelines. This interim report has been distributed to potential volunteers and city and county officials for comments before final guidelines are drawn. Accessability of parking areas, walkways, sidewalks, entrance ramps, buildings, shelters, rest rooms, and pool/bathing areas is discussed. Guidelines for indoor facilities include gymnasiums, game rooms, recreation rooms, exercise rooms and food services. Also considered is the design of outdoor facilities such as sports fields, picnic areas, stationary play equipment, moving play equipment, and pool/bathing areas.

DIVISION OF INTERGOVERNMENTAL SCIENCE AND RESEARCH AND DEVELOPMENT INCENTIVES

Intergovernmental Program

Local Government

815. City of Seattle Overall City Technology Process, Annual Report
City of Seattle
March 1978 77p ISP7617065
NSF/RA-780144 PB283270/NKS

The Overall City Technology Process (OCTP) established a formal technology process model in the city of Seattle and a list of recommended City projects to be implemented during the 1978 budget year. This phase focused on: (1) development of a realistic and practical mechanism for technology assessment, transfer, and utilization within the City, initially integrated into the ongoing budget process; (2) selection and recommendation of those high-priority departmental projects that are technically and economically feasible to implement, have attractive benefit/cost ratios, and are acceptable in terms of City-wide support; (3) establishment of a central point in the City for collecting, disseminating, and coordinating major technological program information vital to the implementation of departmental projects requiring technical assistance; and (4) a formal system designed to evaluate any technical/scientific/engineering product, technique or system that can help improve the efficiency, productivity, cost effectiveness, and performance of current City functions.

816. California Innovation Group, Final Reports, Summary of Completed Project
California Innovation Group
April 1978 71p ISP7624667
NSF/RA-780145 PB283357/NKS

The California Innovation Group (CIG) attempts to establish the role of science and technology in local government. The CIG team consists of local governments, industrial firms, a full-time representative from the League of California Cities, and individual Science Advisors. The Federal Laboratory Consortium (FLC) made up of major federal laboratories, has assembled a Far-West Regional Consortium of laboratories to work with the

local governments as coordinated by CIG. Participating local governments range in size from approximately 25,000 to over 700,000. CIG holds that an environment must be created within the city whereby existing technology can be effectively used and evaluated. This final report presents the program description and objectives, and short discussions on the dissemination and transfer of innovations and CIG project selection. Forming the bulk of this document are appendices which include a working paper on federal incentives for innovation.

817. Emergency Medical Services, A Technical Guide for State and Local Governments
Public Technology, Inc.
1978 173p ISP7684564
NSF/RA-780146 PB285453/NKS

The purpose of an emergency medical service system is to help the victim of an accident or a sudden illness to survive and recover from the emergency by providing prompt emergency medical care. The problems associated with responding effectively to medical emergencies vary from one community to another. However, there are numerous ways that a city or county government can participate in an emergency medical services program. This report introduces local government officials to the field of emergency medical services (EMS) and provides a framework for training, communications, transportation, hospital facilities, financing, and evaluation. Three appendices are included: (1) The Emergency Medical Services Systems Act (1973); (2) Ambulance Resource Management; and (3) Sources of Federal Funding. Also included is an executive summary of the policy-related issues of EMS, and a management report written for chief executives, fire and police chiefs, and other officials.

818. Technology Acquisition Unit, Summary of Completed Project and Final Technical Report
Delmarva Advisory Council
Tolbert RC, Rienerth TE
March 1978 58p ISP7609362
NSF/RA-780151 PB283995/NKS

Primary objectives of the program are (1) to provide a technology transfer network and management structure to serve the needs of regional and local authorities for technical knowledge and resource application; (2) to explore and work toward business expansion and specifically job creation through adaption of newly developed technologies within the business community; and (3) to develop a model program and/or management structure applicable to other rural regions in the country. The

Technology Acquisition Unit established linkage with the Federal Laboratory Consortium, developed a technology-oriented college consortium, made local and state government officials on Delmarva aware of this program and Federal R & D resources, established itself as a center of information on innovative technologies, and published a monthly newsletter. Visits were made to Federal labs to learn about specific technologies applicable to Delmarva's rural area. TAU disseminated these technologies at meetings held with the college consortium, state and local government officials, DAC Citizen Committees, high schools, energy seminars, civic organizations and at the Delmarva Mayors' Council meeting. Two programs that were implemented during the year were Remote Sensing and Project Conserve. Both were applied in the State of Delaware through the college consortium.

State Government

819. Directory of Growth Policy Research Capabilities in Southern Universities
Southern Growth Policies Board
Godschalk DR
January 1978 112p ISPC775347
NSF/RA-780143 PB284355/NKS

This directory has been compiled to facilitate communications among those interested in the development of growth policy for southern states. Its purpose is to provide a systematic framework for identifying institutions, studies, and people able to contribute to the solutions of state growth problems. For each institution, information is provided on growth policy studies completed in the past three years or in progress, and on research personnel and their interest areas. Institutions are listed alphabetically by state. Some selected materials related to the general topic of university-government relations and the provision of public services by the academic community are contained in a final bibliographic section. The best way for a state government official to use this directory would be to contact researchers directly. Another possible use could be to suggest potential collaborative arrangements for the conduct of research. This compilation has demonstrated that there is in the universities of the South an increasingly large body of researchers interested and experienced in growth policy research.

820. Colorado Executive Office State Science, Engineering, and Technology Development Study, Final Report
University of Colorado at Denver
Mann F
April 1978 232p ISP7725866
NSF/RA-780175 PB284586/NKS

This report focuses on ways to strengthen and review the capacity of the Executive Branch of the Colorado State Government in terms of using scientific and technical resources in its policy formation and decision making process. Since the institutional arrangements for providing science advice had recently been reorganized, effort was placed on ways to improve the existing mechanism, as there is no immediate need to overhaul the current structure. The present structure, processes and procedures, and different means of identifying the Executive Branch's need for information are explored. Twelve principal issues relating to the need for information are identified, described, and given a priority level. The report notes that financial support is needed to give the existing mechanism a thorough test by working on a number of problems simultaneously. A schematic for showing seven different types of studies, which promises to be helpful in clarifying the problems in linking science and decision making, is discussed. As work on the problem of linking knowledge needs and resources continues, policy makers will need to learn how to integrate their efforts. Work done to create and launch a task force on the Health Effects of Air Pollution is described.

821. Rhode Island Legislative State Science, Engineering and Technology Project, Final Report (October 1977 - June 1978)
Joint Committee on Legislative Affairs of the General Assembly of the State of Rhode Island
Reenstra R, Kumekawa G
June 1978 72p ISP7725879
NSF/RA-780176 PB284374/NKS

The Rhode Island Legislative State Science, Engineering and Technology (SSET) project has undertaken an evaluation of the Legislature's need for scientific and technical information specifically, and for background, policy-oriented information in general. The mechanisms that might be useful in linking the supply side to the demand schedule were also studied. It was determined that there is a need for a system enabling the legislature to have access to scientific and technical information as it is required. Analysis indicated that an effective capability to gather background data does not exist at this time, and that a need for assistance in health, the environment, corporations, and transportation is required. It was determined that the legislature needs to focus on the substance side of its activities,

including the establishment of an in-house capability for handling information and translating it into policy options. To maximize the effectiveness of the information flow, a central location within the legislative structure is needed to act as an information clearinghouse for the legislature. In addition, a capacity within that location is necessary to translate the information into a form which addresses legislative concerns.

822. Establishment of a State Science, Engineering, and Technology Program for Connecticut
Connecticut Academy of Science and Engineering
July 1978 38p
NSF/RA-780183 PB284747/NKS

A science and technology information system for Connecticut for the purpose of improving the access of state policy makers to S&T information is proposed. While S&T information has long been available to state policy makers, access to that information has been largely informal and random. The proposed approach is based on the proposition that there are three components in any attempt to provide policy makers with useful scientific information, the inquiry, the scientific answer, and the intermediary role of defining the question, locating an answer, and rendering the answer in terms useful to the decision maker. A distinctive feature of the proposed system is its emphasis on the role of individuals who can assist policy makers in these areas. The proposed plan avoids the creation of new agencies and instead concentrates on locating the capacity for supply S&T information in places where decision makers are accustomed to looking. The proposal is based on an analysis of the difficulties inherent to the provision of S&T information, and the present procedures being used in Connecticut and other states. Specific recommendations for the implementation of proposals, along with estimated costs, are made.

823. Increasing the Capacity of State Governments to Access and Use Scientific Engineering, and Technical Resources, An Assessment of the Study Phase of the National Science Foundation's State Science, Engineering, and Technology Program
SRI International
Gollub JO, King JR, Malek R
August 1978 84p
NSF/RA-780195 PB285755/NKS

This report is an assessment of Federal efforts to assist state governments in strengthening their capacity to access and make use of scientific and technical resources in developing and administering policy. Findings indicate that there is a high level of commitment to the objectives of the State Science,

Engineering and Technology (SSET) Program by both executive and legislative branches of state government, and that several states have already benefited from the improved policy coordination on cross-cutting issues and increased awareness of the needs for scientific and technical resources. Analysis of grant documents and interviews provided several lessons, including the fact that SSET mechanisms operate best when they are part of the gubernatorial or legislative policy process, and states are planning mechanisms to access and use scientific and technical information and expertise that reflect their existing institutional settings. The report concludes that momentum exists in the SSET Program and should be capitalized upon, and offers a series of recommendations on basic program and administrative options for its continuation.

Note: See also entries 773, 774, 779, 787, 811, 814, 837, 840, 841, and 843.

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RESEARCH REPORTS FROM PREVIOUSLY SUPPORTED RESEARCH APPLICATIONS PROGRAMS

Energy Systems

824. Ground Water and Energy Supply Situation for Great Plains Irrigation
Washington University, Center for the Biology of Natural Systems
Sanghi AK, Johnson D
April 1978 43p AER7717031
NSF/RA-780018 PB286002/NKS

This report assesses the energy supply and groundwater situations for irrigation in Texas, Oklahoma, Kansas, and Nebraska. The highly seasonal distribution of electricity demand for irrigation creates a peak load problem for electricity cooperatives in the region. This problem is most serious in Nebraska, where it has led to restrictions or delays in new irrigation hookups. A survey of available data on saturated thickness of the aquifer, depth to water table, and annual rate of decline (or rise) in the water table was conducted for counties in the four states overlying the Ogallala Formation. The most serious problems are in Texas, which has the greatest average depth to the water table, the greatest average yearly water table decline, and the lowest average saturated thickness.

Exploratory Research and Technology Assessment

825. Agenda for Technology Assessment in the Materials Field, Volume 1, Principal Findings
Battelle Corporation, Columbus Laboratories
Christakis A, Globe S, Kawamura K, et al
March 1978 64p ERS7717735
NSF/RA-780025 PB278639/NKS

An agenda for technology assessment in the field of materials was developed through a process of dialogue using a procedure known as a "science forum." The first forum synthesized the views of materials scientists and materials technologists ("S+T" experts) to produce a forecast of materials technologies for the ensuing two decades. The second science forum developed a set of 11 societal criteria by which to rate the urgency of full-scale technology assessment of the TA Candidates. Ratings were assigned to each TA Candidate for each of the criteria. Agreement between the experts reflected the degree of synthesis developed at the second science forum. Presented in Volume 1 are the topics selected as meriting highest priority for full technology assessment. These are: biodegradable plastics; conversion of coal to cleaner fuels; electric power generation and transmission; materials for nuclear systems; and mining of ocean nodules. Volume 2 contains a discussion

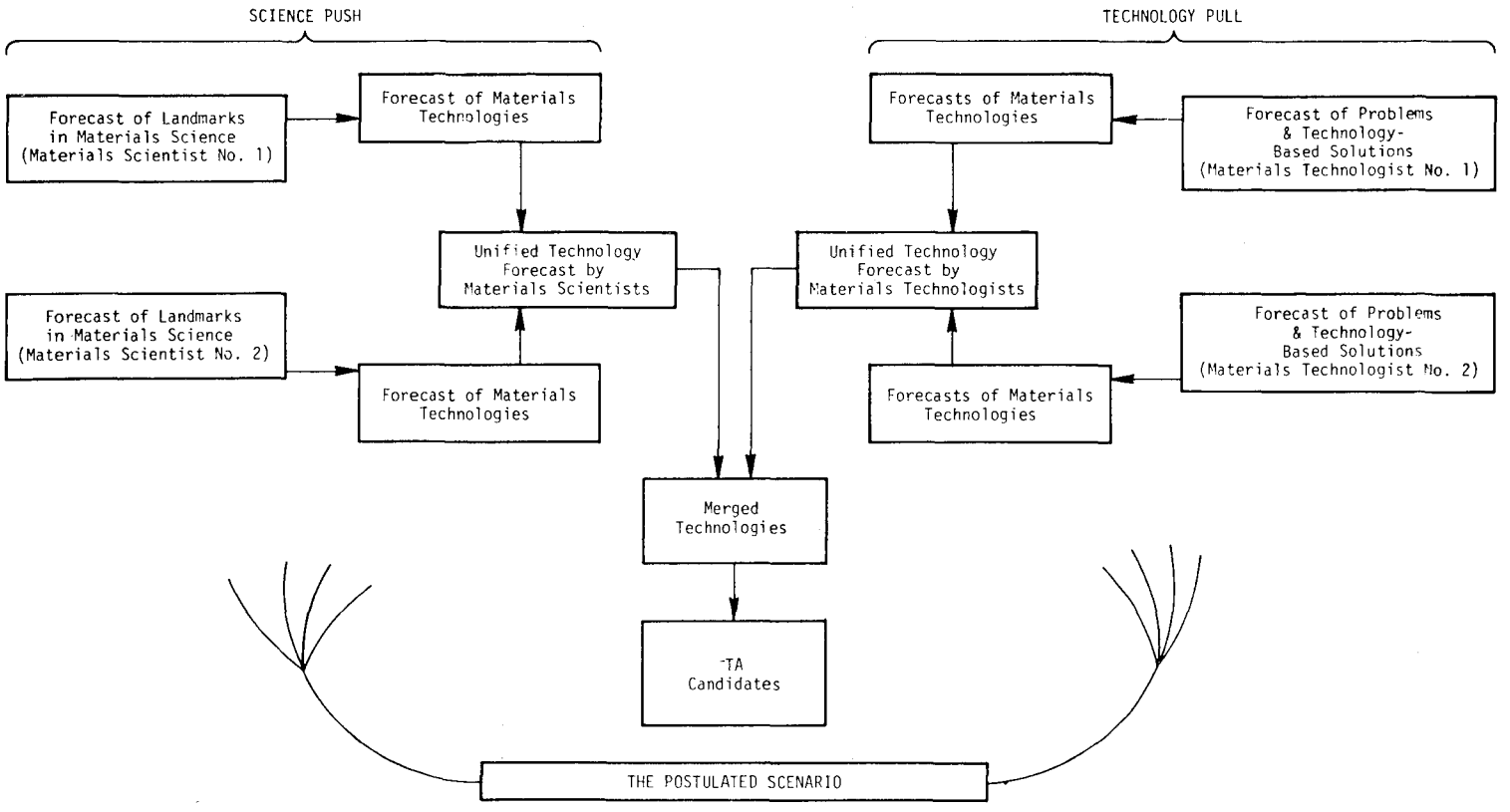

FIGURE 5. DEVELOPING THE TA CANDIDATES FROM THE TWO PERSPECTIVES

See Entry 825

of the constrained economy context and scenario; a glossary of terms; constrained economy bibliographical references; materials science forecasts; materials technology forecasts; a discussion of the interaction of technologies and TA Candidates; biographical sketches of experts; and a Science Forum II evaluation sheet.

826. Agenda for Technology Assessment in the Materials Field, Volume 2, Appendices
Battelle Corporation, Columbus Laboratories
Christakis A, Globe S, Kawamura K
March 1978 180p ERS7717735
NSF/RA-780026 PB278640/NKS

See entry 825 for abstract.

Non-Renewable Resources--Fossil Energy

827. Management of Environmental Risk, A Limited Integrated Assessment of the Waste Oil Rerefining Industry, Final Report
Teknekron, Inc., Resource Management Division
Liroff SD, Hoffman M, Sessler G, et al
March 1978 282p AEN7517302
NSF/RA-780062 PB283719/NKS

This report is based on a review of the waste oil rerefining industry. The analysis assesses the industry's current health, and glimpses into the future by looking at five different issue areas critical to the industry and useful to environmental policy-making as well. These five areas include: (1) an inventory and assessment of several rerefining technologies; (2) a financial analysis of several rerefining technologies; (3) an analysis of alternative futures of the rerefining industry; (4) the disposal of acid sludge; and (5) state and local governments as a future market for rerefined waste oil. Results of the analysis show the potential impacts of the Resource Conservation and Recovery Act (RCRA) of 1976 (PL 94-580) on the industry, and the ability of the industry to cope with RCRA by analyzing several industry alternatives in the face of potential RCRA regulations. Finally, the potential for establishing recycled oil programs is evaluated for each of the 48 continental United States.

Regional Environmental Management

828. Regional Environmental Systems, Assessment of RANN Projects
University of Washington, Department of Civil Engineering
Mar B, Houck MH, Wright J, et al
1978 413p ENV7604273
NSF/RA-780076 PB282154/NKS

Representatives of 18 Regional Environmental Systems (RES) projects funded by RANN met for a workshop to review their results. This report is presented in three volumes. Volume 1, "Workshop Report," includes goals of the workshop and reports from the following research groups: information systems; economic, population and land-use analysis; resources and residual management; ecosystem analysis; and transfer and utilization. Volume 2, "Assessments of Methodologies," presents the following papers: (1) Information System Support of Regional Environmental Analysis; (2) Population, Economic, Employment, and Land Use models; (3) Engineering, Planning and Resource Utilization Models; (4) Ecosystem and Resource Capability Models; (5) Thoughts on Model Evaluation (Software); (6) Assessment of RES Experiences; (7) Analytical Methods for Environmental Assessment and Decision Making; and (8) Citizen Participation. Volume 3, "Project Summaries," presents overviews of the 18 projects funded.

829. Principles for Local Environmental Management
Southwest Center for Urban Research; Rice Center for Community Design and Research
Rowe PG, Mixon J, Smith BA, et al
1978 293p ENV7307880
NSF/RA-780275

This handbook is the result of an interdisciplinary approach to solving problems associated with the consumption of scarce natural resources, the generation of environmental impacts, and the constant need for improved environmental quality. It was written to assist government and community leaders with environmental management from a local perspective. Elements of environmental science, economics, law, planning and political science are combined to establish principles for environmental decision making. The book contains information, methods, and techniques used for identifying the nature of problems facing policymakers and offers practical approaches to many of the technical tasks involved in local environmental management. The need for a federal system including both natural and state government is demonstrated in addressing environmental management issues. The concluding chapter outlines guidelines for

local government participation. A complete documentation of an environmental impact assessment case study is presented in the appendix.

Note: Available from Ballinger Publishing Company, 16 Dunster Street, Cambridge, Massachusetts 02138. Price, $16.50.

Renewable Resources--Crops

830. Determination of Optimal Well Capacities for Continuous Irrigation Programs
Washington University, Center for the Biology of Natural Systems
Sanghi AK, Johnson D, Kuepper G
January 1978 55p AER7717031
NSF/RA-780017 PB282349/NKS

This report applies a model of crop response to irrigation to corn production in the Great Plains under center pivot irrigation. Net revenue is calculated for various well output levels chosen in accordance with the crop's water requirements during various critical growth periods. The effect of water deficit on crop yield is calculated in terms of the water holding capacity of the soil, the amount and timing of water applications, and pan evaporation rate.

831. Feasibility of Introducing Food Crops Better Adapted to Environmental Stress, Volume 1
Soil and Land Use Technology, Inc.
Theisen AA, Knox EG, Mann FL
March 1978 113p AER7719462
NSF/RA-780037 PB280030/NKS

The primary objectives of the study are: (1) evaluation of plant species identified and suggested as potential new crops for the U.S.; (2) selection of at least 15 promising species for further testing; (3) evaluation of available information about these species; and (4) formulation of detailed plans for a Phase II study. Suggestions regarding new crops were solicited from more than 100 experts in the U.S. and abroad. Fifty-four crops of interest were selected and detailed information regarding botanical, stress adaptation, agronomic and economic characteristics was collected. This information is presented in tabular form in Volume I. Twenty of the more promising crops were singled out for closer economic and feasibility and impact studies. Most of the industrial crops, possibly three pulses and several grain and speciality crops, show promise in terms of individual producer advantages, marketing and processing

benefits, and benefits to the national economy, including judicious usage of land, water, and energy. The feasibility of introducing a new crop depends not only on solutions to technical agronomic and economic problems, but on the availability of a functioning production-marketing-consumption system. Volume 2 presents individual crop reports concerning the 54 selected crops.

832. Feasibility of Introducing Food Crops Better Adapted to Environmental Stress, Individual Crop Reports, Volume 2
Soil and Land Use Technology, Inc.
Theisen AA, Knox EG, Mann FL, et al
March 1978 213p AER7719462
NSF/RA-780038 PB281369/NKS

See entry 831 for abstract.

Renewable Resources--Solar Energy

833. Overcoming Legal Uncertainties About Use of Solar Energy Systems
American Bar Foundation
Thomas WA, Miller AS, Robbins RL
1978 90p APR7421034
NSF/RA-780029 PB283250/NKS

In 1974 the American Bar Foundation initiated an assessment of legal issues related to the use of solar energy systems for heating and cooling. As a result of a workshop and a series of public lectures on solar energy and the law, many inquiries were received from people concerned with drafting legislation about solar energy systems. In response to the inquiries, an overview of the legal issues and 33 suggested statutes was drafted by the American Bar Foundation. Reviews by experts suggested that these statutes could be consolidated to the four which are presented in this report as follows: (1) an act to establish a solar energy development commission (SS 100); (2) an act to authorize solar-skyspace easements (SS 200); (3) an act to encourage the use of solar energy systems (SS 300); and (4) an act to provide real property tax and income tax incentives for use of solar energy (SS 400). The relevant legal issues considered include the regulation of building materials, financing and marketing arrangements, the role of public utilities, land-use planning, and access to sunlight.

834. Biological Solar Energy Conversion, Approaches to Overcome Yield, Stability, and Product Limitations, Progress Report No. 6 (October 1, 1977 - March 31, 1978)
Martin Marietta Corporation, Martin Marietta Laboratories
Kok B, Fowler CF, Radmer RJ, et al
1978 37p AER7303291
NSF/RA-780065 PB284823/NKS

A series of experiments were performed in which the authors monitored chlorophyll fluorescence in parallel with the mass spectrometer gas exchange measurements. It was observed that the fluorescence yield is not significantly altered when O_2, rather than CO_2, was the terminal electron acceptor, and it was concluded that the state of the photosynthetic apparatus is not strongly affected by a changeover from CO_2 fixation to O_2 reduction, or vice-versa. The study of photosynthetic activities in chloroplasts and particles of corn leaves was continued. Improved rates of photosystem I sheath particles were obtained. The feasibility of measuring the relative contents of system I and system II photocenters in spinach and maize chloroplasts has been examined. Measurements at 430nm with detergent-treated material indicate that the bundle sheath chloroplasts have 70% more system I than do spinach chloroplasts. To measure system II content, two methods have been used. In one, the flash-induced trans-membrane electrical field is used as a probe. Another method measures "C-550" to indicate Q, the primary acceptor of system II. The second method appears more reliable than the first and indicates that bundle sheath chloroplasts contain 40% less system II than spinach chloroplasts.

Societal Response to Natural Hazards

835. Interactive Modeling System for Disaster Policy Analysis (Program on Technology, Environment and Man, Monograph No. 26)
University of Colorado, Institute of Behavioral Science
Kunreuther H, Lepore J, Miller L, et al
1978 151p ENV7612370
NSF/RA-780293

The Community Disaster Modeling System was developed for studying the relative costs and benefits of alternative hazard mitigation and recovery programs. The system is capable of dealing with sets of individual homeowners and businesses enabling users to construct representations of hazard-prone communities, and to examine impacts of mitigation and recovery programs on residents of a community as well as on local, state, and federal agencies. This system was designed to provide a high degree of flexibility so that it is possible for the user to

make substantial modifications without having to invest large amounts of time and skill or risk confusion in reprogramming. These features are illustrated by the construction of the hypothetical community of River City and a demonstration of how the system's damage and financial submodels are explicitly utilized in evaluating the impacts of floods as a function of alternative scenarios and policies. It is pointed out that users must make the commitment to experiment with the system to ascertain its value as a meaningful tool for policy analysis.

Note: Available from University of Colorado, Institute of Behavioral Sciences, Boulder, Colorado 80302. Price, $6.00.

Weather Modification

836. Assessment of Synoptic Criteria for Ice Multiplication in Convective Clouds, Final Report
University of Nevada, Desert Research Institute, Atmospheric Sciences Center
Chang J, Scott WT, Hallett J
March 1978 35p ENV7614519
NSF/RA-780034 PB281079/NKS

A theoretical method is developed to predict the drop spectrum formed by cloud condensation nucleus (CCN) spectrum at a certain level in convective clouds and to assess its role in the ice crystal multiplication process. Hygroscopic particles will grow significantly as relative humidity rises beyond ~ 70% and form a drop spectrum as they surpass the saturation point. This level is defined as cloud base. Further up in the cloud, subsequent drop growth continues by condensation processes and ultimately coalescence. Condensation is dominant in the initial drop growth process; coalescence can be neglected for drops with diameter less than 20 μm . The approach is to complete the drop spectrum by the condensation process at each level, leaving the influence of the coalescence process to be included later if necessary. The work undertaken is divided into two parts: drop condensation and the growth process; and the climatology of the temperature at convective cloud base, which determines broad features of the drop spectrum at the $-4^{\circ}C$ level.

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OTHER NSF/ASRA REPORTS

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837. Policy Dialogues, a Key to Solving the Problems We Face While Increasing America's Capacity for Self-Government
National Science Foundation, Applied Science and Research Applications, Division of Intergovernmental Science and Public Technology
Lamson R
1978 40p
NSF/RA-780050 PB282157/NKS

This paper suggests how research on and experimentation with dialogues for discussion of policy issues and options can help improve America's capacity for self-government. These dialogues, informed by research, could be implemented at all levels of government: international, national, state, region, city, and local community. The elements of policy dialogue include: people, important policy questions, interrelationships, social processes, technology, institutions, resources, evaluation, and utilization. The suggestions outlined could help to promote an increased capacity on the part of policymakers and citizens to define, consider and communicate about the problems which confront them, about the alternative solutions to the problems, and the impacts of the problems and alternatives. The suggestions could also help guide change in desired directions, based on a conception of the quality of life desired, and thereby help people to protect and promote self-government, freedom, well-being and quality of life.

838. Summary of Awards, Fiscal Year 1977, Research Applied to National Needs, Division of Advanced Environmental Research and Technology
National Science Foundation, Research Applied to National Needs
1977 124p
NSF/RA-780056 PB282974/NKS

This summary of awards presents brief descriptions of projects funded by Advanced Environmental Research and Technology (AENV) during Fiscal Year 1977. The summary is organized by program and program subelement. For each research project, the problem area is described and an attempt to indicate how the research may help to solve the problem is made. The program element "Managing the Natural Environment" aims to provide an economically and ecologically sound scientific basis for mitigating man-caused threats to natural environment in ways that are compatible with other social goals. Through its subelements, the program attempts to identify, understand, and contribute to the reduction of contamination problems arising from the manufacture and use of chemical products and the mining and processing of metal ores, and supports continued research on land use, urban hydrology, waste water

disinfection, and sludge management. The program element "Disasters and Natural Hazards" seeks methods and techniques that can provide the most cost-effective protection for man and his works from loss of life, injury, property damage, social dislocation, and economic and ecological disruption caused by natural hazards and disasters. An alphabetical listing of awards by Principal Investigator is included in an appendix.

839. Design and Pilot Testing of A "Utilization Tracking" Methodology, Final Report
CONSAD Research Corporation
January 1978 291p C7611438
NSF/RA-780057 PB284640/NKS

This study has undertaken the development of a reliable and valid capability to access the relatively long-range utilization of projects funded by the National Science Foundation, Research Applied to National Needs (NSF/RANN) program, in order to establish a comprehensive methodology to evaluate the performance of NSF/RANN, its programs, program elements, and projects. To facilitate the development of an acceptable long-range utilization assessment program, a data acquisition system, the "utilization tracking" system, was developed and pilot tested. The fully operational system of this type would maintain: (1) continuing, repeated surveys of principal investigators and program managers; (2) continuing, repeated surveys of designated users of projects research results; (3) "snowball expansion" of the samples of prospective users; and (4) development of analytic techniques to exploit the information obtained in these surveys. In addition to serving the important immediate purpose of providing the basis for the estimation of current levels of utilization of individual research projects, the preceding data acquisition capabilities will facilitate an enhanced understanding of the dynamics of the diffusion, adoption, and utilization of the products of projects funded by NSF/RANN.

840. Project Summaries, Fiscal Year 1977
National Science Foundation, Division of Intergovernmental Science and Public Technology, Intergovernmental Programs
February 1978 96p
NSF/RA-780073 PB283674/NKS

In 1975 the National Science Foundation announced the creation of the Division of Intergovernmental Science and Public Technology. Awards made fall into the following areas: Local Government, State Government (Executive), State Government (Legislative), Science and Technology Resources, and the State Science, Engineering, and Technology program (SSET). This

compilation of Intergovernmental Programs Project Summaries contains summary information on grant proposals that became awards during Fiscal Year 1977. Projects are arranged chronologically within each program subelement using the data appearing on the official NSF award notification. All projects listed have been given an Intergovernmental Programs identification number. Following the Project Summaries is an index in which projects are sorted according to the state of the grantee institution. A financial summary page precedes the body of the Project Summaries.

841. Intergovernmental Programs Awards List, Fiscal Year 1977
National Science Foundation, Division of Intergovernmental Science and Public Technology, Intergovernmental Programs
February 1978 45p
NSF/RA-780074 PB283460/NKS

In 1975 the National Science Foundation announced the creation of the Division of Intergovernmental Science and Public Technology. Awards made fall into the following areas: Local Government, State Government (Executive), State Government (Legislative), Science and Technology Resources, and the State Science, Engineering, and Technology program (SSET). This Intergovernmental Programs Awards List contains summary information on awards made during Fiscal Year 1977. Intergovernmental Programs are arranged chronologically within each Intergovernmental Program subelement using the data appearing on the official NSF award notification. All projects listed have been given an Intergovernmental Programs identification number for easy reference . A financial summary page precedes the body of the awards list.

842. Strategies for Applied Research Management
National Academy of Sciences, National Research Council
1978 124p NSF310
NSF/RA-780088 PB284741/NKS

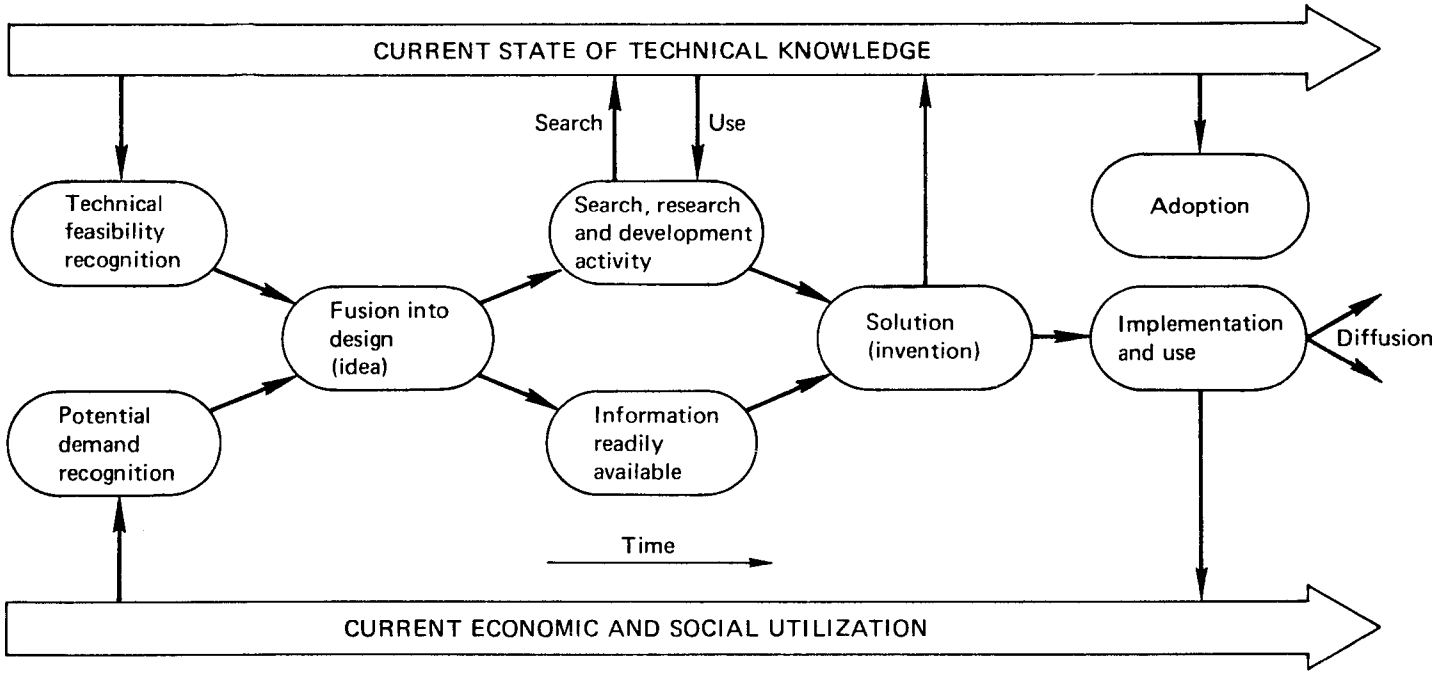
This report is a product of interviews, deliberations, reviews, and a workshop--all dedicated to the identification of alternate, workable management strategies for the effective use of RANN research results. Four case studies illustrating a range of RANN's interests in both the public and private sector provided the principal input for this study. One program within each of four divisions of RANN was chosen for study and analysis. The study was conducted through interviews and discussions with the respective division directors, personnel of other agencies, representatives of participating governmental units, universities and/or industrial firms, and even with representatives of withdrawn unsuccessful bidders. The cases,

which focused on the utilization process, were augmented by papers prepared by the committee staff and consultants. The four case study areas, detailed in this report, are: the delivery of public services to remote areas via telecommunications technology; the solar heating and cooling of buildings; trace contaminants in the environment from agricultural, mining, and manufacturing activities; and industrial productivity (automation). Examination of these cases, as exemplars of the range of RANN's programmatic activities, provided some general conclusions and recommended strategies with respect to RANN's overall applied research delivery system.

843. Panel Report on the National Science Foundation Intergovernmental Program
National Science Foundation
March 1978 71p ISPC7715347
NSF/RA-780120 PB283020/NKS

A specially selected panel of seven persons from various fields related to state or local governments met to review the activities of ten projects of the National Science Foundation's Intergovernmental Program. To facilitate this review, the panel met on three occassions, at which time information about the projects was presented and considered. The projects were designed to assist state and local governments in resources in their policy formulation, administration management, and program operations or in testing strategies for overcoming barriers to innovation. These projects included the following efforts: (1) a federal-state technology transfer mechanism; (2) a legislative office of technical assistance; (3) stimulating technology applications and utilization in smaller units of local governments; (4) increasing the use of technology in local government units in Oklahoma; (5) a regional approach to research and technology utilization; (6) the California Innovations Group; (7) the Urban Consortium for Technology Initiates; (8) using graduate students and research assistants in a state legislature; (9) State Legislatures' Science and Technology Project; and (10) creation and implementation of an executive science advisory mechanism.

FIGURE 1 The Process of Technical Innovation



Recognition → Idea formulation → Problem solving → Solution → Utilization and diffusion

Source: Myers, B. and Marquis, D. *Successful Industrial Innovations.* National Science Foundation, 1969.

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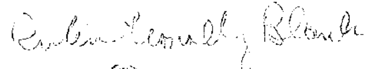

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APPENDIX A

ASRA PROGRAMS IN BRIEF

The following is a summary in brief of the major program elements, objectives, and specific examples of research planned for support in the Applied Science and Research Applications (ASRA) program of the National Science Foundation.

INTEGRATED BASIC RESEARCH

The Division of Integrated Basic Research (IBR) is the division within the Applied Science and Research Applications Directorate which provides support for basic research that has a high relevance to major problems. This support will provide for increased funding for selected topic areas in the basic research directorates. Projects that will be considered for funding by IBR are initiated through the Foundation's basic research directorates. (Proposals should be submitted to the basic research programs in accordance with *Grants for Scientific Research*, NSF 78-41).

The Division is responsible for: (1) defining topic areas and related basic research disciplines; (2) stimulating research on the selected topic areas; and (3) assuring that funds are used as an add-on and do not displace support previously provided by the basic research directorates. The Division provides a direct link between ASRA and the basic research directorates.

APPLIED RESEARCH

The Division of Applied Research (AR) will provide an improved scientific understanding of a range of technical, social, economic and policy problems and increase the rate of technological innovation growing out of significant discoveries in various fields of science and engineering. By working closely with the disciplinary basic research programs throughout the Foundation, with public and private user groups, and with the scientific and engineering communities to which the Foundation relates, the Applied Research Subactivity is in a position to encourage and accelerate the application of basic scientific knowledge to a wide range of potential users.

Applied Social and Behavioral Sciences

The objectives of the Applied Social and Behavioral Sciences program are to provide an improved understanding of a broad range of significant economic, social, and technical problem areas and to suggest alternative solutions to these problems.

Public Policy and Regulation:

The objective of this program is to provide more and better information on policy issues of national concern such as unemployment, international trade, regulation, telecommunications, inflation and the use of scientific and technical information in judicial and administrative decisionmaking.

Public Service Delivery and Urban Problems:

Research will be supported that provides Federal, State and local government policymakers and managers, public interest groups, and other public and private voluntary associations with improved information on: (1) the changing character of urban areas in the United States; (2) the changing demands for services; (3) alternative mechanisms for improving governmental responsiveness to service needs; (4) improvements in the effectiveness and equity of service delivery by both the public sector and private market.

Industrial Organizations and Markets:

The focus of this program will be to provide an improved understanding of public and private processes, organizational structures, and policies as they relate: (1) to industrial organization and performance; and (2) to the effective use of human, capital, and natural resources within

the American economic system. These studies will apply research findings and methodologies developed in anthropology, industrial sociology and psychology, political science, and economics to such things as analyses of markets for natural resources, and examinations of the impacts of innovation in the manufacturing, distribution, construction and extractive industries on the structure of work and work incentives.

Individual and Group Processes:

Research in this area seeks to identify and stimulate the development of new technologies and technical processes growing out of discoveries in the behavioral sciences. Such activities often involve multi-disciplinary research groups from various fields of engineering and computer science, along with behavioral scientists working on applications ranging from such things as new technologies for the blind or other sensory deprived individuals to new communication and control devices for industrial applications.

Applied Physical, Mathematical, and Biological Sciences and Engineering

The objectives of the Applied Physical, Mathematical, and Biological Sciences and Engineering program are to increase the rate of technological innovation growing out of discoveries in various fields of science and to accelerate the application and use of these technologies to improve the breadth and quality of long-range solutions to significant social, economic, and technical problems and policy issues which confront the United States.

Physical, Mathematical, and Engineering Applications:

Research will be supported that seeks to facilitate the rate of technological innovations which hold promise for long-run improvements in industrial processes, materials availability and handling, and increased efficiency. A coherent research area initiated in RANN which builds on developments of computer-based technologies to improve the efficiency of production and manufacturing will continue. In addition, this area will be receptive to applied research proposals from the scientific community which build on fundamental research in such areas as catalysis, laser chemistry, and mathematics.

Biological and Ecological Applications:

Research in this area seeks to accelerate the rate of technological innovation based on basic advances in the biological and ecological disciplines, including exploring the potential of genetic manipulations for the economical production of new materials, the use of protoplast fusion to speed tests of new plant materials, and the modeling and management of ecosystems as a way of increasing our effective use of land, energy, and water and our renewable resources capabilities. It also seeks to provide information on the links between ecosystems and economic and social systems as a way of improving the information base for formulating public policies which affect our national resource capability.

Geophysical and Environmental Applications:

Research will be supported to accelerate the rate of technological innovations based on advances in the oceanographic and earth sciences. These include methods for exploring ocean resources, techniques for utilizing coastal and estuary areas for resource production, and the improvement of techniques and sensing devices for exploration and extraction of minerals from land areas.

PROBLEM-FOCUSED RESEARCH APPLICATIONS

The goal of the Problem-Focused Research Applications (PFRA) program is to apply United States scientific and technological capabilities to selected societal problems of critical national importance to assist in their clarification or resolution.

The common objectives of the programs within the Problem-Focused Research Applications Subactivity are to concentrate research and proof-of-concept experiments on selected problem areas in order to:

- Facilitate the incorporation of science as a working tool for problem resolution in the public and private sectors;
- Provide support for problem-focused research that bridges from basic research discoveries to application; and,
- Enhance the capability and capacity of nontraditional research users to employ research results and methods.

Earthquake Hazards Mitigation:

The objectives of the Earthquake Hazards Mitigation program are to develop methods and techniques that can provide effective protection from man, his works, and institutions from life loss, personal injury, property damage, social dislocation, and economic and ecological disruption associated with potential or realized earthquake hazards. The program is organized in three component areas: Siting, Design, and Policy.

Siting

The specific objectives of this research program are to:

- Develop a comprehensive data base on the nature of earthquake motion at typical construction sites and for representative structures;
- Establish the physical basis for characterizing the nature of earthquake motions and the dynamic forces generated by such motions and by other natural hazards;
- Develop capabilities for prediction of the magnitude and frequencies of ground motion;
- Develop a methodology for qualitative and quantitative estimates of local or regional risk associated with earthquakes and other types of hazards and combined hazards;
- Develop a comprehensive and unified program to improve geotechnical engineering practices applicable to soil dynamics, foundation design, failure and instability, and other aspects of earthquake ground motion; and,
- Identify procedurs for integrating information on natural hazards into land use planning; urban and coastal zone planning, offshore engineering and siting procedures.

Design

The specific research objective of this program is to:

- Improve the characterization of earthquake and natural hazard loadings necessary for the economical design of structures subject to dynamic loading;
- Develop new methods of analysis and design of buildings and structures of all types which will take into account nonlinear and inelastic behavior of materials and structures;
- Develop methods to assess the hazard potential and risk assessments applicable to existing structures and facilities, and devise innovative methods for improving performance within economically acceptable bounds;
- Obtain information for engineering analysis and design by observing the damage of facilities following actual earthquakes, and incorporate this information into standard design practice;
- Develop improved computational capability for dynamic analysis of structures and facilities and improve user access to any computer software which is developed;
- Develop model standards and design criteria for design of structures and facilities subjected to earthquake and natural hazard loadings; and,
- Conduct detailed studies of the behavior of smaller nonengineered structures and secondary components of buildings to improve recommended minimum analysis and design guidelines.

Policy

The specific objectives of this research program are to:

- Expand the base of knowledge on alternative social adjustments to earthquakes;
- Identify the social, economic, political, legal and related factors which facilitate or hinder the adoption of both social and technological solutions to earthquake hazards;
- Facilitate the beneficial use of earthquake hazard mitigation measures by devising effective techniques for disseminating information to the public and to decisionmakers at the local, State and National levels; and,
- Investigate measures which will reduce possible negative social, economic and political consequences of earthquake predictions and warnings.

Chemical Threats to Man and the Environment:

The Chemical Threats to Man and the Environment program supports research to increase our scientific knowledge of man-made contaminants and naturally occurring toxicants and to make this knowledge available to appropriate users. The objectives of the program are to:

- Define the exposure of ecosystems and human populations to chemicals and their conversion products by determining chemical pathways and transformations in the environment;
- Accelerate the application of recent discoveries in the basic sciences to the identification and measurement of environmental contaminants;
- Develop methods to enable us to predict the toxicological effects of chemicals on humans based on animal tests and other laboratory data; and,
- Identify contaminant effects on living forms critical for the functioning of whole ecosystems.

Alternative Biological Sources of Materials

The program element is directed toward alleviating national dependence on selected scarce resources by making alternative biological sources of materials available in the United States. The objectives of the program are to:

- Determine which biological sources constitute promising alternatives;
- Develop biologically based processes needed to convert the sources to useful materials; and,
- Determine the socioeconomic, technical, and environmental impacts of various proposed biological alternative systems on the country.

Science and Technology to Aid the Physically Handicapped

The Foundation is currently planning a program to focus science and technology on the problems of the physically handicapped. The objectives will be:

- to improve sensory capabilities, locomotion, and manipulative ability to compensate for losses due to handicaps;
- to investigate the social, economic and institutional barriers which inhibit full participation of the handicapped in society; and
- to study mechanisms to improve the availability of technological aids to the handicapped.

A formal program announcement will be released at a later date. NSF anticipates participation of universities, industry, small business and nonprofit institutions in the program.

INTERGOVERNMENTAL SCIENCE AND RESEARCH AND DEVELOPMENT INCENTIVES

The objectives of this program are to:

- Facilitate the integration of scientific and technical resources into the policy formulation, management support, and program operation activities of State and local governments; and,
- Test and evaluate selected incentives which the Federal Government may use to increase R&D investment in the private sector of the economy and to stimulate the acclerated introduction of innovative technology into commercial use where new products, processes, or services are needed in the national interest.

Intergovernmental Program

The primary objective of the Intergovernmental program is to facilitate the integration of scientific and technical resources into the policy formulation, management support, and program operation activities in State and local governments. The Intergovernmental program seeks to strengthen the public management capacity and capability of individual local communities and States in order: (1) to further the understanding of issues with significant scientific and technical components, and (2) to capitalize on the contributions of scientific and technical resources in the resolution of such issues.

Local Government:

The objectives of the Local Government subprogram are threefold:

- Facilitate the establishment of scientific and technological systems in individual local jurisdictions to further the understanding of science and technology as a major resource for local government problem solving and, at the same time, serve as catalysts for regional innovation groups;
- Promote the establishment of regional innovation groups to provide synergistic approaches to solving common problems

with scientific and technical components; and

- Establish national innovation networks to facilitate the development of periodic local government research and development agendas, to enhance market aggregation, and to provide communication networks and linkage mechanisms for the regional innovation groups.

State Government:

The objectives of the State Government program are to:

- Strengthen the public management capacity and capability of individual States through new and improved structures, processes, and procedures for integrating scientific and technical resources into their policy development and management support activities;
- Foster interjurisdictional cooperation on a regional and national basis in order to assist individual States in their capacity building efforts and to address cooperatively common issues of critical concern; and,
- Develop improved intergovernmental cooperation in the planning and implementation of national research and development agendas in order to ensure their relevance to State needs and to enhance the probability that research and development activities will have an aggregated market and be utilized.

Science and Technology Resources:

The Science and Technology Resources subprogram focuses on increasing the potential of various scientific and technical organizations to serve the needs of State and local governments and to mobilize such resources for meeting more effectively these needs. It differs from the local and State Government subelement in that the emphasis is on fostering the exchange of experience and lessons learned by these resource organizations in their attempts to supply scientific and technical expertise in meeting public sector needs.

Industrial Program

The Industrial Program considers unsolicited proposals to test and evaluate selected incentives to increase technological innovation and R&D investment in the private sector where new technology is needed in the national interest. It also supports research involving joint proposals of small business and other organizations and institutions, such as universities, associations, or large businesses, and research relating to improving the science and technology capabilities of fragmented industries, such as those with large numbers of small firms or industries that traditionally spend little on R&D.

PROBLEM ANALYSIS

The goal of the Office of Problem Analysis (OPA) is to identify and analyze major national problems with significant scientific content to provide a preliminary assessment of the appropriate role of science and technology, the Federal Government and the NSF in their resolution. The Office will support analyses of a wide range of potential research topics and problem areas for use in selecting future research directions for the Directorate for Applied Science and Research Applications.

To fulfill this goal, OPA will draw upon a wide range of expertise from the research community, professional and scientific associations, private industry, State and local governments and other user communities to help define the problem and determine research priorities.

It is anticipated that most of the resources of OPA will be dispensed in a procurement mode. However, the Office will consider unsolicited proposals for projects to analyze problem areas to determine applied research needs. These proposals should address themselves to providing answers to the following questions:

- What is the nature of the problem and what issues are researchable?
- Will new or additional research have a potential high payoff either through a better understanding of the problem or the development of a technical base which will contribute to its solution?
- What research is currently underway on the subject and what are its sources of support?
- What is the size and capability of the research community to address the problem?
- What is the most appropriate organization for supporting any additional research? Is there a unique role for NSF and ASRA?