

1974

RTI
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Research Triangle Institute

Research Triangle Institute
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**Social and Economic Systems
and Human Resources**

Physical and Life Sciences

**Engineering and
Environmental Sciences**

In school classrooms all across the nation, Research Triangle Institute survey specialists and interviewers administer exercises to hundreds of thousands of students in the National Assessment of Educational Progress. National Assessment is an unprecedented undertaking that uses scientific methods to determine how much America's school children know, and to measure how much they are learning.

The assessment is based on a series of exercises designed to measure achievement of specific educational objectives in various subjects. The exercises are administered in five-year cycles to students aged 9, 13, and 17, and to young out-of-school adults.

Research Triangle Institute designs the necessary statistical sample surveys, specifies procedures for identifying randomly selected individuals to be assessed, and is responsible for exercise administration in the field.



RTI also participates in a research consortium that provides educational assessment services tailored to the local needs and circumstances of states and communities. Other members of the consortium are the American Institutes for Research, Palo Alto, California, and the Measurement Research Center, Iowa City, Iowa.



Organization Operations Facilities and Staff

Research Triangle Institute is a separately operated, not-for-profit scientific research organization established by joint action of the three major universities of North Carolina's Research Triangle area—Duke University, the University of North Carolina at Chapel Hill, and North Carolina State University at Raleigh. Research operations began in 1959. The Institute is a self-supporting corporate entity under a Board of Governors that includes academic officials, university scientists, industrial research executives, and businessmen.

Institute research is performed on a contract basis for federal, state, and local government departments, public service agencies, foundations, regional and industrial associations, and industry clients ranging from small companies to international corporations. Contracts typically originate from exploratory discussions between the sponsor and RTI staff members. An Institute project team then prepares a research proposal that contains an outline of the work to be done, technical staff scheduling, project duration, and cost. When the proposal is accepted, a contract for the research is negotiated by RTI and the client.

Research Triangle Institute occupies nine laboratory and office buildings on a central campus of 200 acres in the Research Triangle Park. A 5,200-acre area near the center of a compact geographic triangle formed by the three universities and the cities of Raleigh, Durham, and Chapel Hill, the Park has been developed by the Research Triangle Foundation of North Carolina. Buildings on the RTI campus contain 170,000 square feet, an excellent complement of laboratory equipment, and many special purpose items, including a research computer and direct access terminals to the IBM 370/165 operated by the Triangle Universities Computation Center and located near RTI in the Research Triangle Park.

The Institute employs a permanent, full-time staff that has grown to 500 personnel. Approximately sixty per cent of the staff is professionally trained, with about one-third of this number holding Ph.D. degrees and another one-third Master's degrees. More than 50 different degree fields are represented. Most professional staff members have experience in industrial or government organizations, or in university research and teaching.

RTI annual contract revenues reached a 1974 level of approximately \$12 million.





Research Triangle Institute's steady growth has been marked by a flexibility that enables us to respond to increasing research needs with expanding and increasingly varied research capabilities. In perhaps the most dynamic and innovative of industries, these qualities have brought recognition to RTI as an established member of the nation's scientific community.

Our research managers and their associates offer high standards of ability and leadership in helping to meet the planning and problem-solving goals of the Institute's clients. The talents and energies of our staff are the sole basis for RTI's recorded accomplishments, as well as for those that lie ahead.

During the 15 years since RTI's first project work began in early 1959, national priorities have shifted to social and behavioral problems, environmental protection, urban growth, education, and regional economic development, with continued emphasis on medical and health-related programs.

Research Triangle Institute organization and operations as described in the following pages reflect this change. Approximately three-quarters of Institute effort is now directed to subjects dealing with concerns of human existence and well being. Other areas of prominent interest include civil defense, polymer science, engineering systems, and a wide range of research and technical services for industry.

This publication reports a sampling of RTI's diverse research programs. Current activities within our centers and divisions reflect the commitment of the Institute and its staff to assist in the attainment of the objectives of public and private enterprise, and to contribute towards a more satisfying quality of life for all.



President

RTI research for industry and government is inseparable from real-world contexts and human concerns. In meeting the problem-solving and planning goals of its clients, the Institute's approach calls for an intermingling of professional capabilities that cuts across organizational lines to combine the talents and experience of staff members of many skills and backgrounds.

As a result, most RTI programs are multidisciplinary both in purpose and in execution. They cover social and economic systems and human resources, the physical and life sciences, and environmental science and engineering.

Social and Economic Systems and Human Resources

Center for the Study of Social Behavior

Statistics Research Division

Center for Population Research and Services

Center for Health Studies

Center for Educational Research and Evaluation

Center for Development and Resource Planning

RESEARCH BRIEFS

Statistical design, analysis, and interpretation of experimental data for industrial and scientific purposes.

Census evaluation and vital rates analysis; estimation of birth rates and population changes from sample surveys.

Cost effectiveness, production control, process optimization, and quality assurance programs for business and industry.

Projections of long-term trends in revenues, expenditures, population, employment, and income levels to provide data bases for state and regional government planning strategies.

Analysis of the cost effectiveness of alternative strategies for disseminating oral contraceptives, and of factors affecting acceptance of the IUD.

Statistical sampling services for industrial assembly line inspection and testing.

Evaluation of the planning and decision-making processes in programs for improving employment and educational opportunities, health care services, and income growth potential in rural areas; development of a national index of the relative economic status of rural families.

Analyses of the effects of nutritional supplements and health services on family planning programs; surveys of the social and economic correlates of family fertility.

Surveys and informational analyses on problems related to alcohol abuse and alcoholism.

Refinement and application of randomized response, an interview technique for obtaining accurate information about even the most sensitive personal subjects while guaranteeing complete confidentiality of the answers given by those being questioned.

Development of a national registry of kidney disease patients suffering from chronic uremia and undergoing dialysis treatment.

External audits and sample designs of public school testing programs.

Comparison of the traditional fee-for-service system with alternative billing and reimbursement methods for the delivery of health care services.

Analysis of response errors in household interview surveys.

Surveys of the use of television programming in classroom instruction.

Computer simulations of current and future demand for hospital services and health manpower.

Sampling methodology for selecting, testing, and grading the raw materials used in manufacturing.



Gosh! It's great to be alive today!



CRP:
 "You don't think so?"
 "I had a good time last night, right? And now you've got a little headache."
 "Some other people had a good time last night too, but they don't have headaches."
 "They're dead."
 "We're going to be talking to you about this on a little while. About drinking some French wine."
 "But my man's brother you work at hotel."
 "For some reason. Enjoy the first day of this new year."
 "And we'll get together with you when you're feeling better."

- 1 Statistical analysis of the effects of nitrogen oxides on human respiratory infections is part of an RTI community health evaluation and surveillance system.
- 2 Survey research at RTI combines advances in experimental design, sampling, statistical theory, and field interview methods. Major emphasis is given to sample surveys in education, health, employment and manpower, family planning, and census evaluation.
- 3 With arrestees at the central jail intakes of six major U.S. cities, RTI researchers conducted interviews and obtained urine samples in an exhaustive study of the relationship between drug usage and serious crime.
- 4 Economic trends, natural resource development, manpower utilization, industrial growth, and public investment priorities are analyzed by RTI in studies for multi-state regions, individual states, groups of counties and communities.
- 5 RTI population research ranges from the analysis of women's labor force participation and fertility, to economic development, health care and family planning services in Africa, the Near East, and South Asia.
- 6&7 Breathalyzer tests, newspaper and television advertising, roadside and household surveys, and stepped-up law enforcement are some of the methods analyzed in RTI's 42-month evaluation of drinking-driving countermeasures.

Physical and Life Sciences

Chemistry and Life Sciences Division

RESEARCH BRIEFS

Basic research in drug metabolism, natural products chemistry, synthetic organic chemistry, analytical chemistry, biochemistry, and pharmacology.

Investigations of biologically active compounds with emphasis on isolation, structure determination, synthesis, distribution, and mode of action.

Investigations on the *in vitro* and *in vivo* metabolism of oral contraceptives, anticancer agents, active constituents of marijuana, antimalarials, analgesics, and barbiturates, including studies on the interaction of drugs and drug metabolizing enzyme systems.

Laboratory experimentation to determine the effects of contraceptive steroids and their interaction with other drugs.

Methodological and clinical approaches to the quantitative identification

of cannabinoids and their metabolites in body fluids.

Synthesis of radiolabeled drugs for use in metabolic studies of contraceptive agents, marijuana, and general drug metabolism.

Synthesis and testing of silicon substituted steroids, prostaglandin analogs, and isoflavonoids as potential antifertility agents.

Instrumental, biochemical, and pharmacological techniques for the analysis of steroidal contraceptive agents and such nonsteroids as barbiturates, analgesics, and antiarrhythmic drugs.

Preparation of organometallic derivatives of gallium for experimental use in cancer chemotherapy.

Analytical forensic chemistry assistance to state law enforcement agencies, including evaluation of the Duquenois-Levine color test as a means for detecting marijuana.

Isolation, structure elucidation, and synthesis

of strigol, the potent germination stimulant of the parasitic witchweed that attacks crops in the eastern Carolinas. Agricultural studies also involve the relationship of saponins to pest resistance in alfalfa.

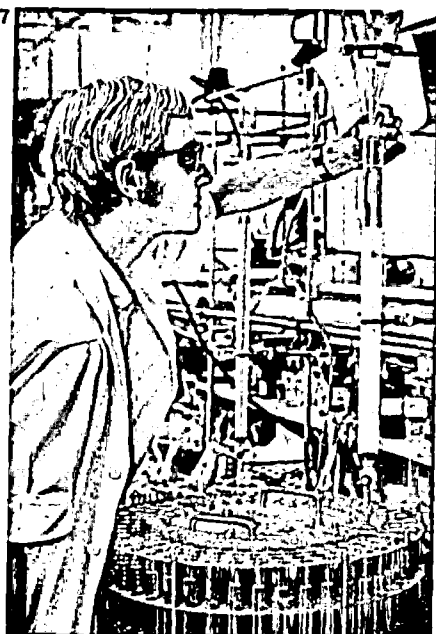
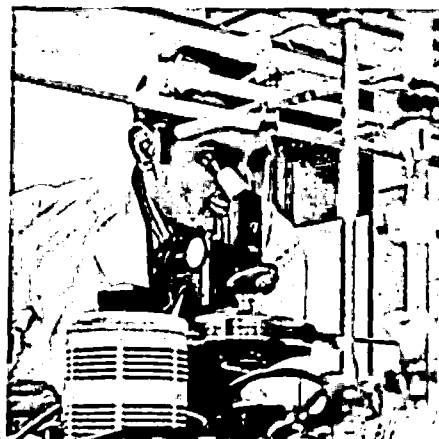
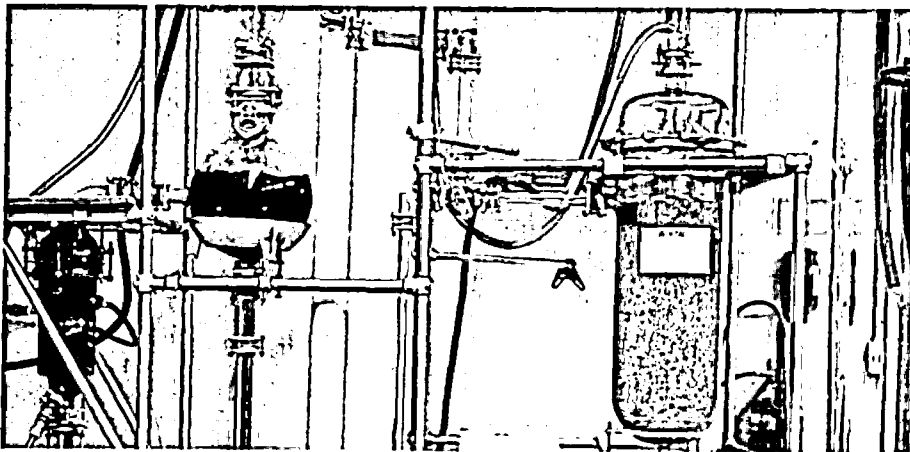
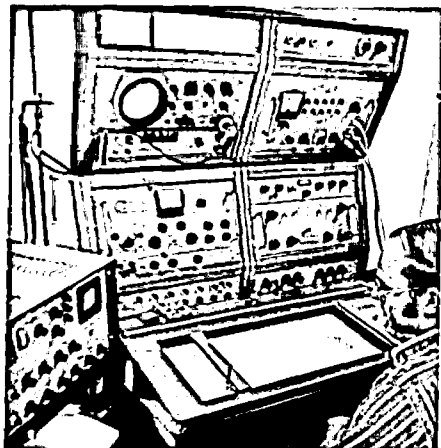
Design and synthesis of antiradiation compounds which have unique structures and properties.

Synthesis, characterization, and pharmacological evaluation of optically pure isomers of barbiturates and other drugs.

Fractionation, isolation, and characterization of antitumor and antileukemia substances from natural products.

Synthesis of novel compounds for treating malaria and preventing its recurrence.

Application of advanced analytical and instrumental techniques in industry, including development of new methods in mass spectral data processing.



1 Nuclear magnetic resonance systems with on-line computers enable RTI scientists to analyze microgram quantities of drug metabolites and natural products. RTI analytical equipment includes both proton NMR and pulsed fourier transform carbon-13 spectrometers. 2 Chemical compounds extracted from plant materials are screened and tested in RTI research on potentially active anticancer agents. 3 Gallium compounds from animal tissue are examined in RTI cancer chemotherapy research programs. 4 Gas chromatography plays an important role in RTI analyses of the active constituents of marihuana. 5 Medicinal chemistry programs at RTI include the synthesis of new antifertility steroids. 6 Animal antibodies are used in clinical pharmacology studies of oral contraceptives and their metabolites. 7 Separation techniques such as column chromatography support RTI research on synthetic antimalarial substances.

Engineering and Environmental Sciences

Center for Technology Applications
Environmental Studies Center
Engineering Division

RESEARCH BRIEFS

Baseline analyses of air quality and emission levels at existing or planned industrial locations.

Transfer of NASA technology to applications in medicine, air pollution control, law enforcement, and marine science.

Design and development of specialized electronic devices and instrumentation systems.

Technical services to assist local agencies in planning and implementing regional air quality standards, episode control procedures, and field abatement activities.

Develop improved radar techniques for aircraft collision avoidance and pilot warning systems; real-time simulation and analysis of air traffic control situations.

Forecast the economic impact of regulations to control particulate and gaseous emissions, and assess their effect on manufacturing costs and consumer prices.

Medical adaptation of an ear oximeter used for space flight simulation into a system that continuously monitors a patient's blood pressure to detect the onset of shock.

Applications of metals, semiconductors, and insulators as physical and chemical process sensors.

Evaluation of instruments for detecting, measuring, and monitoring air pollution concentrations at field locations.

Examination of alternative beverage container disposal policies to produce cost effective reductions in litter and solid waste.

Preparation of an air quality sampling network model for predicting air pollution concentrations in urban areas.

Development of continuous filtration waste processing techniques for water quality improvement.

Analyses of traffic flow, driver behavior, and vehicle and road conditions for highway safety and transportation system planning programs.

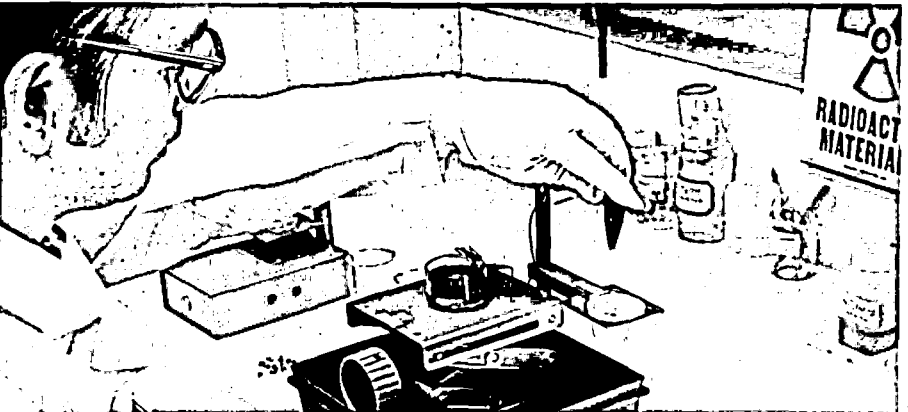
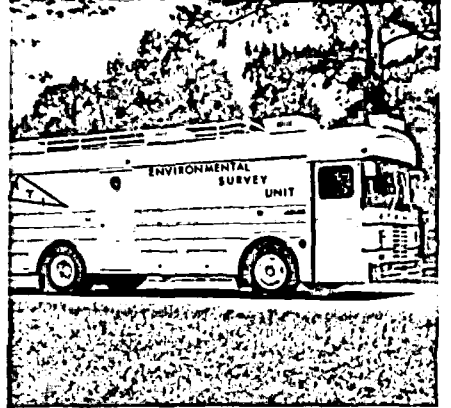
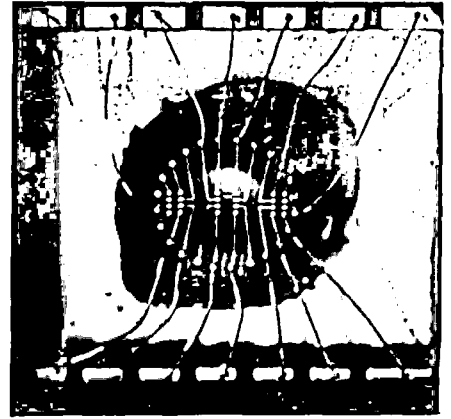
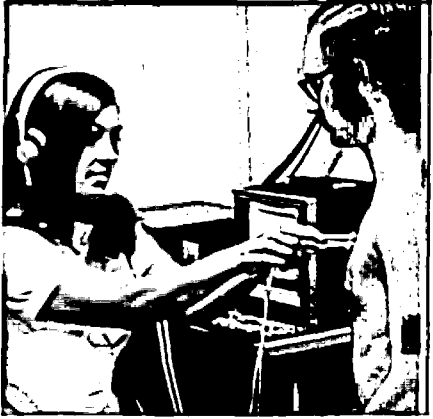
Compilation of engineering handbooks on environmental factors, system reliability, and silicon integrated devices.

Analysis and interpretation of air and surface data obtained in oceanographic and meteorological experiments.

Design and analysis of microwave sensors used for measuring geodetic and ocean surface characteristics in the SKYLAB and GEOS satellite programs; sea-surface temperature studies using satellite infrared data.

System analysis and engineering research for civil defense preparedness, including fallout shelter surveys, building design and construction, ventilation and radiation shielding techniques; planning and preparation for urban recovery following natural or nuclear disaster.

Computer simulations of geologic faults to investigate parameters of influence, techniques of prediction, and possible control methods.



1 Real-time frequency analysis is used in clinical research at Tulane University to produce a permanent visual record of pulmonary sounds. The system is the result of one of more than seventy technology transfers developed by an RTI Biomedical Applications Team under NASA's technology utilization program. 2 In an application of laser technology, an inspection system developed by RTI uses optical transform image enhancement to detect flaws and defects in inte-

grated circuits on the production line. 3 A prototype absolute pressure transducer developed by RTI reflects the Institute's capabilities in applying advanced microelectronics techniques to sensor and transducer problems. 4&5 Institute mobile environmental monitoring units include a fully instrumented trailer, left, and a motorized laboratory unit, both with on-line data acquisition equipment. They give RTI a comprehensive data collection capability for baseline surveys, field

evaluation of instruments, and for extended or short-term monitoring in urban and rural areas throughout the country. 6 Flight qualified pressure transducers being electroplated in an RTI engineering laboratory for the Asteroid Belt meteoroid experiment. 7 For measuring gaseous concentrations in air monitoring and surveillance programs, RTI engineers and chemists designed and built a chemiluminescent ozone meter.

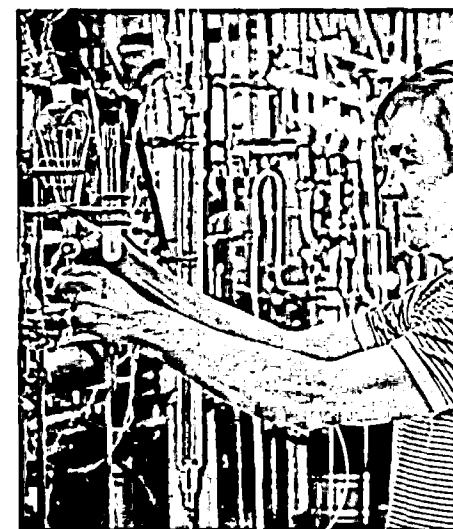
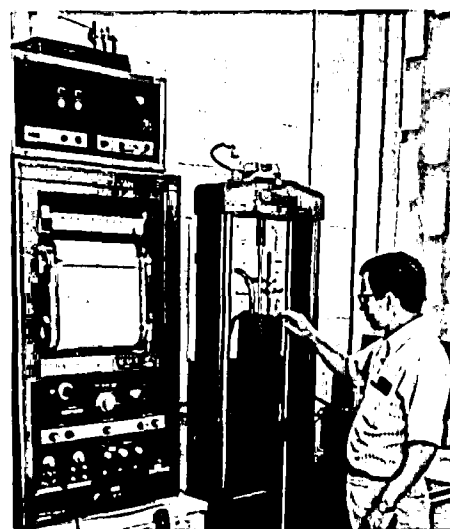
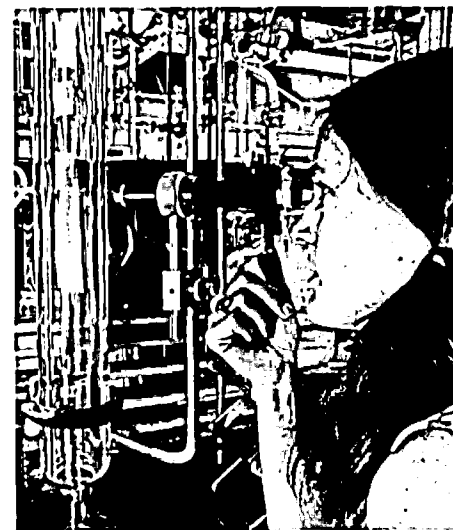
Physical and Life Sciences

Camille Dreyfus Laboratory for Polymer Research

Research Triangle Institute's Camille Dreyfus Laboratory is a research memorial to a pioneer in the man-made fibers, chemicals, and plastics industries. The Laboratory was established as an integral part of RTI with the assistance of a \$2.9 million grant from the Camille and Henry Dreyfus Foundation.

Together with continuing attention to fundamental studies of the theories, definitions, and techniques of basic polymer science, the Laboratory has increasingly directed its broad range of skills and instrumentation resources toward applied research programs.

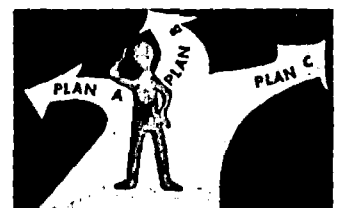
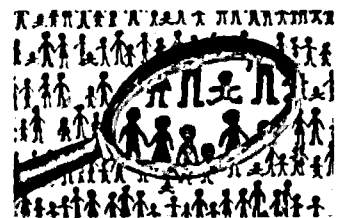
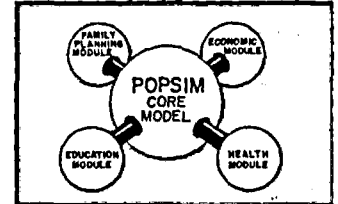
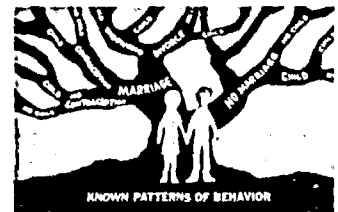
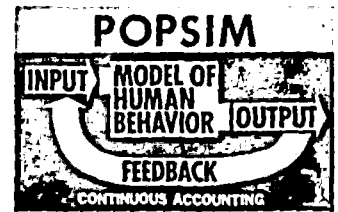
Applications of special interest in industrial research include the effects of various chemical treatments on textile fibers, polymer flammability, highly elastic polymers, semi-permeable membranes for water desalination, highly porous membranes, thin film coatings, rapidly drying wool fabrics, and degradable polymers. Health-related research covers blood compatible polymeric substances, improved hemodialysis membrane materials, hydrogel models of biological systems, and polymer toxicology.



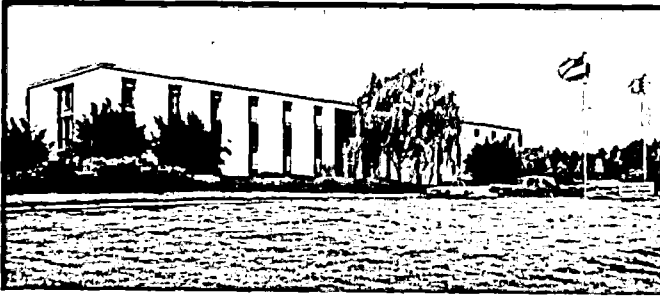
The broad scope and innovative aspects of RTI's population research are typified by a dynamic microsimulation computer model called POPSIM. Developed by the Institute in cooperation with the University of North Carolina and the National Center for Health Statistics, POPSIM absorbs into its processing functions the vital histories and other real-life events that occur among human societies and their subpopulations.

POPSIM works by establishing a small population of individuals identified by specific sets of attributes, including age, sex, color, marital status, education, income, residence, or other items of concern. The computer then considers each individual, and based upon that person's attributes and behavior it creates a history of events for the person: marriage, birth of child, divorce, illness, death, and so forth. At the end of set periods—a month, a year, or several years—the program summarizes the events for the entire population of individuals and reports these in terms of numbers, rates, and other descriptive statistics. POPSIM can be used, for example, to analyze fertility behavior and family planning programs, and to forecast the morbidity and mortality effects of public health measures, or the effects of educational manpower programs on employment and income levels.

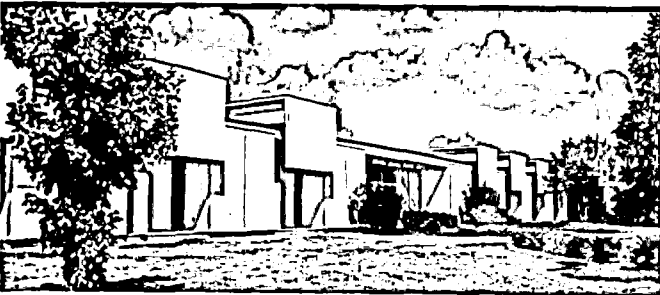
Such results are particularly useful because they allow the behavior of special population groups to be observed through time, and permit demographers and other analysts to examine in advance the potential consequences of proposed policies and practices.



RTI Facilities



Robert M. Hanes Memorial Building



Camille Dreyfus Laboratory



Buildings 3, 5, 6, 7, and 9



William Trent Ragland Building



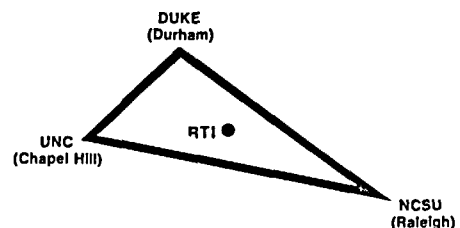
Chemistry and Life Sciences Laboratory

RTI and the Triangle Universities

Research Triangle Institute's relationship with its founding universities is the most distinctive feature of RTI operations and one of its greatest assets. Created by the three schools as a separate research affiliate, the Institute's place in the university family is recognized through a variety of formal and informal relationships. They range from corporate ownership and cooperative contract research, to the sharing of physical facilities and the exchange of information at many levels.

RTI and its clients benefit particularly from project participation by university specialists who supplement the capabilities of the Institute's permanent staff in executing research assignments. Over 200 active consulting agreements exist between RTI and faculty members of many disciplines and departments.

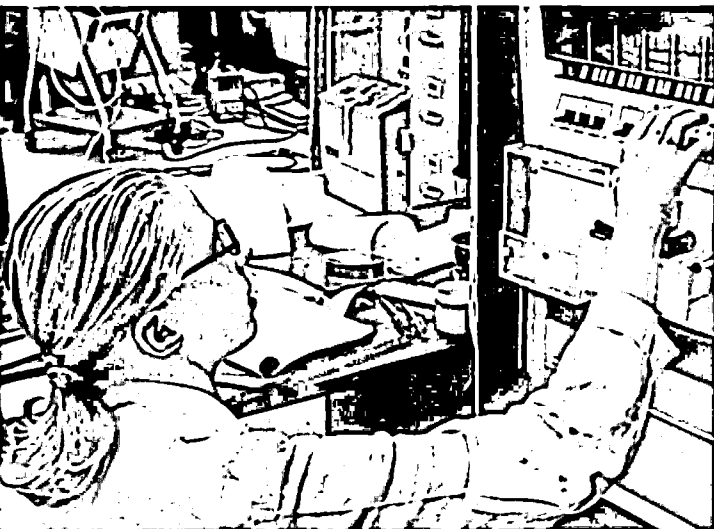
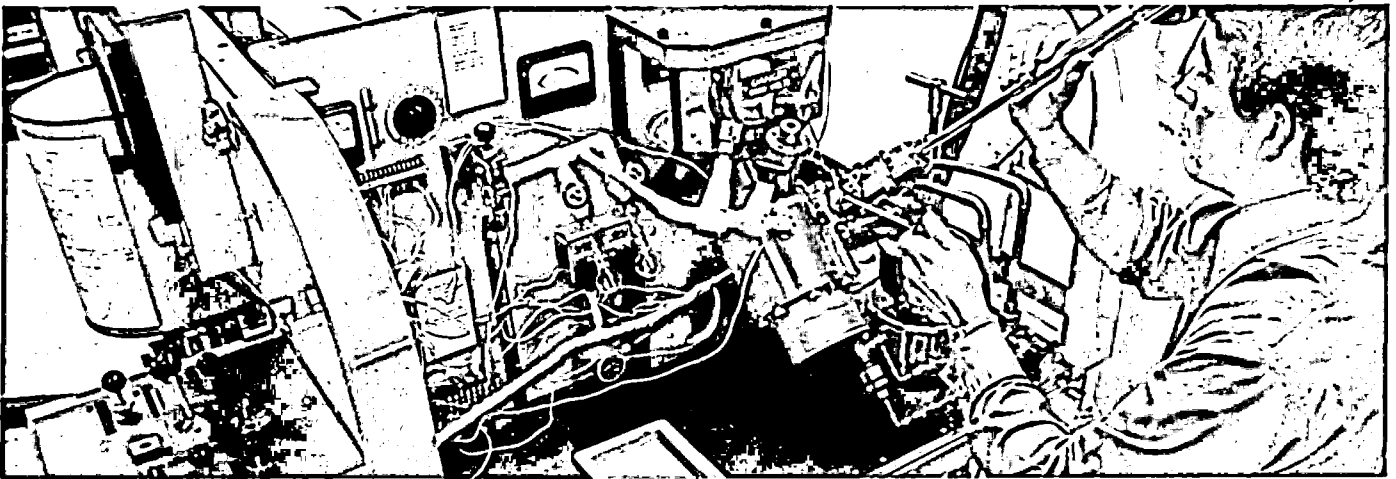
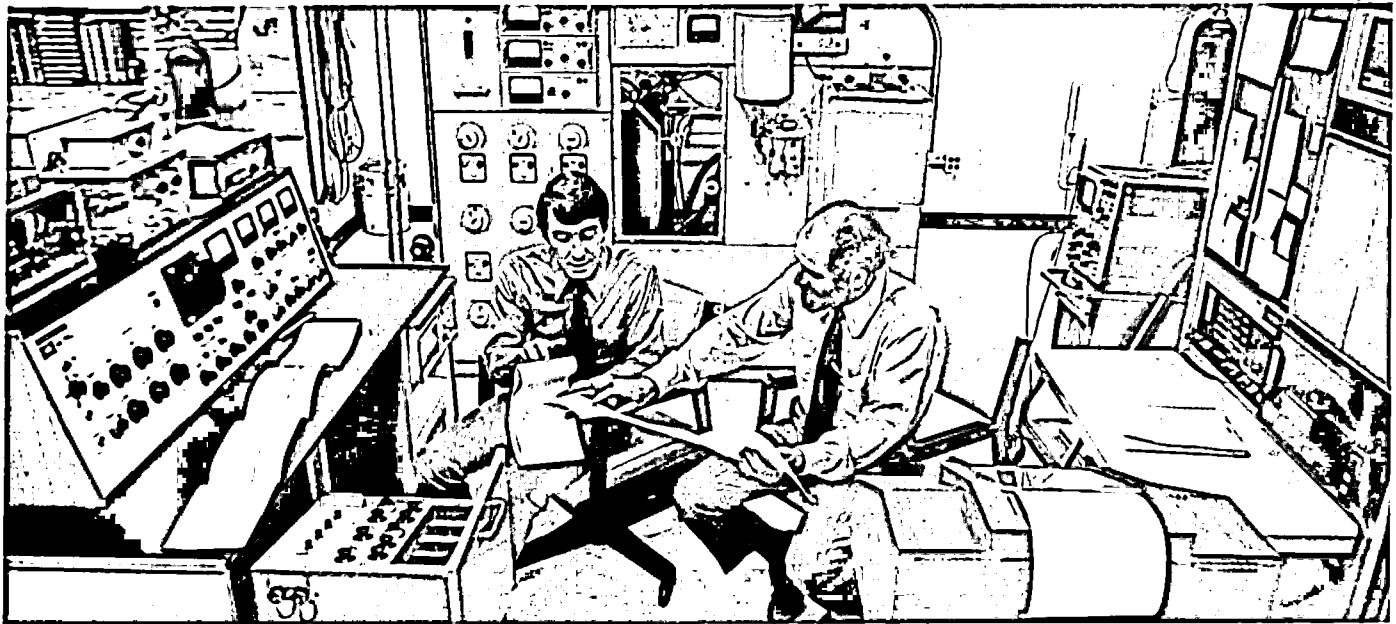
The convenience of consulting assistance, mutual research programs, joint staff appointments, and other RTI-university contacts is emphasized by the ease of communication among the four institutions. The campuses of Duke University in Durham, the University of North Carolina at Chapel Hill, and North Carolina State University at Raleigh are all within a 20-minute drive of the Institute.



A number of RTI senior staff members hold university adjunct professorships and teaching appointments in their fields of specialty.

The libraries of the Triangle universities are an invaluable resource for the Institute. Cross-indexed and readily available to RTI staff members, their combined collections total five million volumes. In addition, access is provided to many of the special research facilities maintained by the schools.

RTI ties with the academic community also include a summer program of research internships for students at North Carolina Central University in Durham.



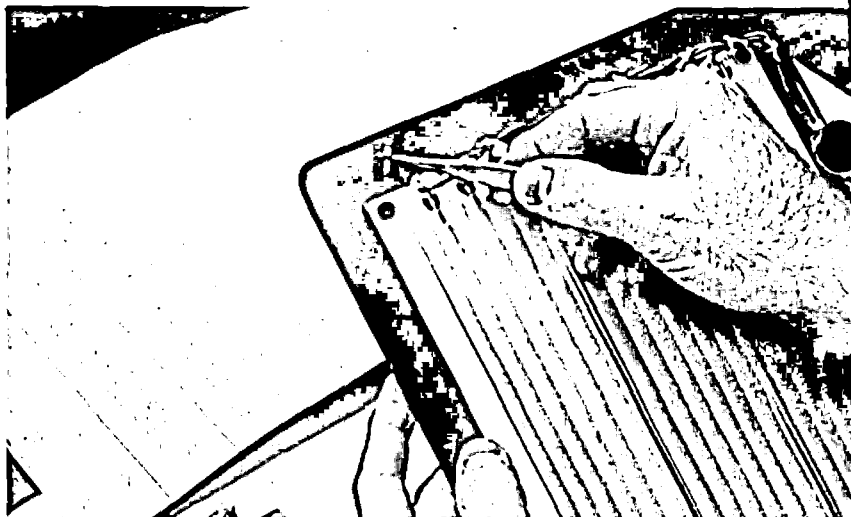
Under major grants from the Biotechnology Resources Branch of the National Institutes of Health's Division of Research Resources, RTI operates a regional mass spectrometry center. The center was established in conjunction with the Triangle universities.

Mass spectrometry is so sensitive an analytical technique that any organic compound can be identified by the unique fingerprint pattern each possesses, even using samples as small as a millionth of a gram.

RTI's regional center includes an MS-902 high resolution, double-focusing mass spectrometer with an on-line computer system that is fully integrated with the IBM 370/165 at the Triangle Universities Computation Center. A new, computerized gas chromatograph-mass spectrometer is an integral part of the center. Other mass spectrometry facilities at RTI are supported by the National Institute of General Medical Sciences.

Research Triangle Institute engineers are credited by NASA with characterizing a gas pressure-sensor concept for measuring the spatial density of microsized dust particles in the Pioneer 10 and Pioneer 11 Asteroid Belt meteoroid experiments.

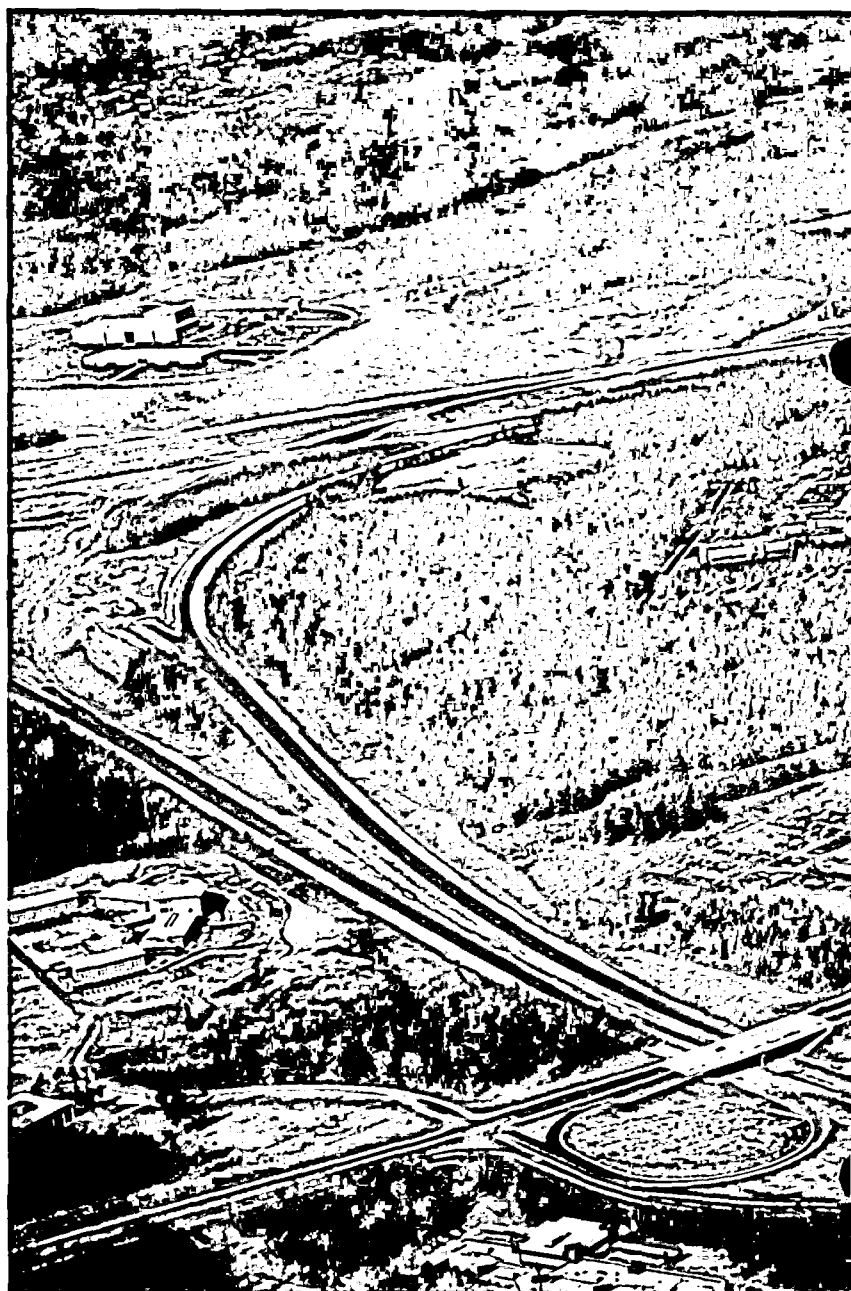
Thirteen detector panels are mounted on the spacecrafts' outer surfaces to record the frequency and impact of meteoroids striking the vehicles during their flights across the 150-million-mile-wide Asteroid Belt between Mars and Jupiter. The panels consist of 18 narrow cells, each containing a mixture of argon and nitrogen gases and an electroplated miniature pressure transducer. When a spacedust particle penetrates a cell the gas escapes, and the resulting loss of pressure is sensed by the transducer and recorded as a meteoroid hit.

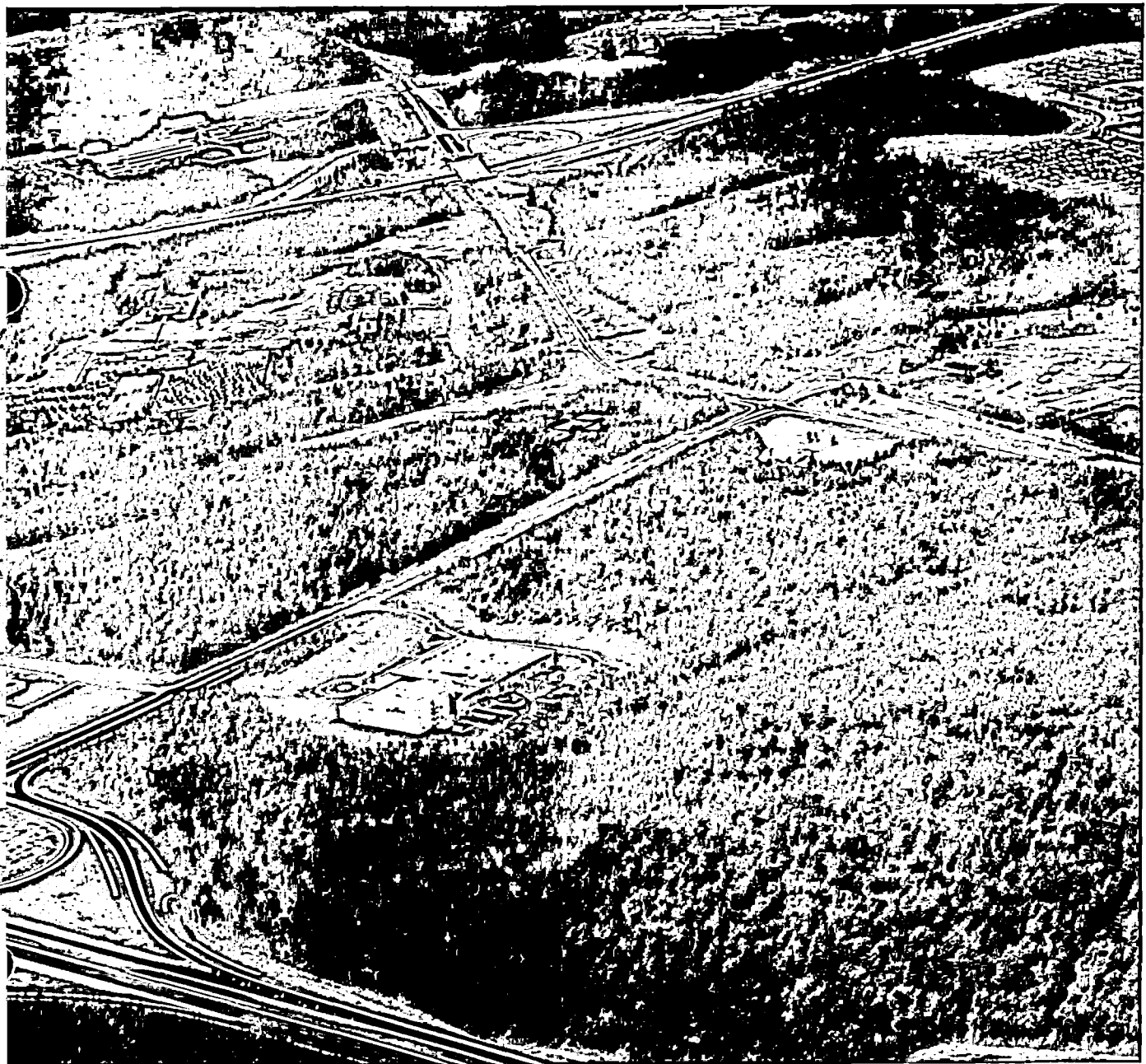
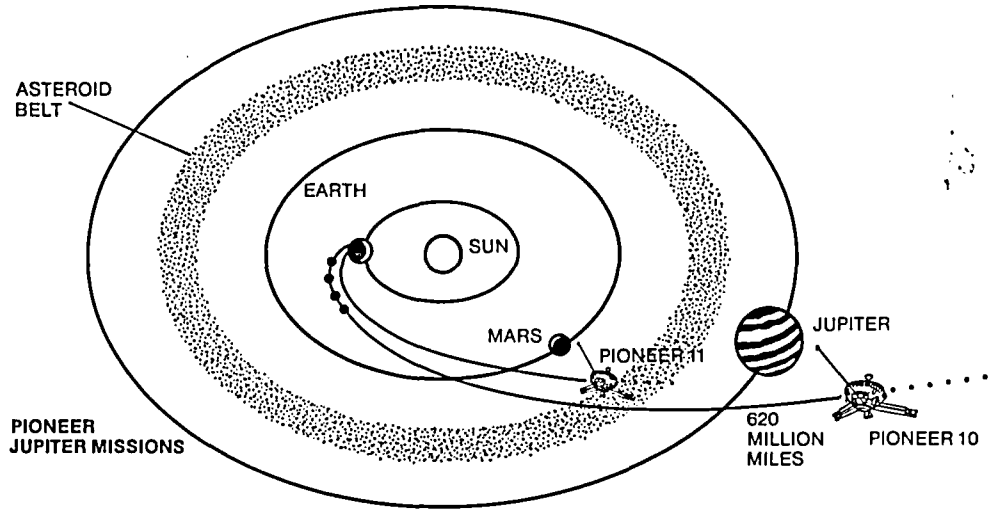


Research Triangle Institute's campus and buildings, center, and several neighboring organizations in the Research Triangle Park.

Clockwise from upper left are Beaunit Corporation's fibers and textiles technical center, the Burroughs Wellcome Co., Monsanto Company's Chemstrand Research Center, International Business Machines Corporation, the N.C. Science and Technology Research Center and Triangle Universities Computation Center occupying the same building below RTI's campus, Hercules Incorporated, the National Center for Health Statistics, and Becton, Dickinson and Company's research center. The Governor's Inn in the Park Plaza service area is at far left.

Hidden in the trees or just out of camera range are the National Environmental Research Center, the National Institute of Environmental Health Sciences, the American Association of Textile Chemists and Colorists, the U.S. Forest Service Southeastern Experiment Station, and Troxler Electronic Laboratories, Inc.





Clients of the Research Triangle Institute

A partial list covering research in progress and completed projects. Because the proprietary nature of RTI's work for some of its industry clients makes it inappropriate to name them all, the list is not fully representative.

American College Testing Program
American Society for Testing and Materials
Association of Governing Boards of Colleges and Universities
Becton, Dickinson and Company
Bell Telephone Laboratories, Inc.
Blue Cross Association
Brick Association of North Carolina
Burlington Industries, Inc.
Burroughs Wellcome Co.
Carolina Population Center of the University of North Carolina at Chapel Hill
Carolina Power and Light Company
Celanese Corporation
Children's Television Workshop
Colt Industries of Fairbanks Morse, Inc.
Commonwealth of Virginia
Coordinating Research Council, Inc.
Cotton Incorporated
Crown Zellerbach Central Research
District of Columbia
Dixie Furniture Company, Inc.
Duke Power Company
Eli Lilly and Company
Ford Foundation
Gallaudet College
General Electric Company
Glen Alden Corporation
Hitachi, Ltd.
Jet Propulsion Laboratory
Johns-Manville Corporation
Keep America Beautiful, Inc.
Kimley Horn and Associates, Inc.
Liggett & Myers, Inc.
Mecklenburg County Commissioners
Monsanto Company (Chemstrand Research Center)
Montgomery County, Maryland

National Academy of Sciences
Highway Research Board
National Assessment of Educational Progress
National Driving Center
North Carolina Manpower Development Corporation
North Carolina Textile Manufacturers Association
Owens-Illinois, Inc.
Population Council
R.J. Reynolds Tobacco Company
Rockefeller University
Schering Corporation
G.D. Searle & Company
State of Florida
State of Illinois
State of Maine
State of Michigan
State of Minnesota

State of North Carolina

Board of Education
Department of Community Colleges
Department of Public Instruction
Department of Administration
Manpower Council
State Planning Division
Zoological Authority
Department of Human Resources
Board of Health
Department of Mental Health
Department of Social Services
Governor's Coordinating Council on Aging
Department of Natural and Economic Resources
Department of Conservation and Development
Department of Local Affairs
Department of Water and Air Resources
Wildlife Resources Commission
Department of Transportation and Highway Safety
Department of Motor Vehicles
Governor's Highway Safety Program
State Highway Commission
Employment Security Commission
State Bureau of Investigation

State of Ohio
State of Oregon
State of South Carolina
State of Tennessee
State of West Virginia
J.P. Stevens and Company, Inc.
Union Carbide Corporation

United States Government

Appalachian Regional Commission
Coastal Plains Regional Commission
Department of Agriculture
Department of Commerce
Bureau of the Census
National Bureau of Standards
National Oceanic and Atmospheric Administration
Department of Defense
Departments of Army, Navy, Air Force
Advanced Research Projects Agency
Defense Civil Preparedness Agency
Department of Health, Education and Welfare
Office of Education
Public Health Service
Alcohol, Drug Abuse, and Mental Health
Administration
National Institute on Alcohol Abuse
and Alcoholism
National Institute of Drug Abuse
National Institute of Mental Health
Center for Disease Control
National Institute for Occupational Safety and Health
Health Resources Administration
Bureau of Health Resources Development
National Center for Health Statistics
National Institutes of Health
Division of Research Resources
National Cancer Institute
National Heart and Lung Institute
National Institute of Arthritis, Metabolism
and Digestive Diseases
National Institute of Child Health and
Human Development
National Institute of Dental Research
National Institute of Environmental
Health Sciences
National Institute of Neurological
Diseases and Stroke
Social Security Administration

Department of the Interior
Geological Survey
Office of Saline Water
Office of Water Resources Research
Department of Justice
Drug Enforcement Agency
Law Enforcement Assistance Administration
National Institute of Law Enforcement
and Criminal Justice
Department of Labor
Bureau of Labor Statistics
Office of Manpower Policy, Evaluation and Research
Department of State
Agency for International Development
Department of Transportation
Bureau of Public Roads
Federal Highway Administration
National Highway Traffic Safety Administration
U.S. Coast Guard
Environmental Protection Agency
Advanced Waste Treatment Laboratory
Division of Resource Recovery
National Environmental Research Center
Office of Air Programs
Office of Planning and Evaluation
National Aeronautics and Space Administration
Office of Economic Opportunity

Virginia Beach Association
Virginia Electric Power Company
Wake County Community Health Care Task Force
Wake County Hospital System, Inc.
Westinghouse Electric Corporation
Wilbur Smith and Associates

Research Triangle Institute Board of Governors

***George Watts Hill**
Chairman, Board of Governors

Chairman of the Board
Central Carolina Bank and
Trust Company, Durham

***William F. Little**
Chairman, Executive Committee

Vice Chancellor for
Development and Public Service
University of North Carolina
at Chapel Hill

Robert T. Armstrong
Senior Vice President
Celanese Corporation
New York

***William W. Bates, Jr.**
Vice President and
Director of Research
Liggett & Myers, Inc.
Durham

John T. Caldwell
Chancellor
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