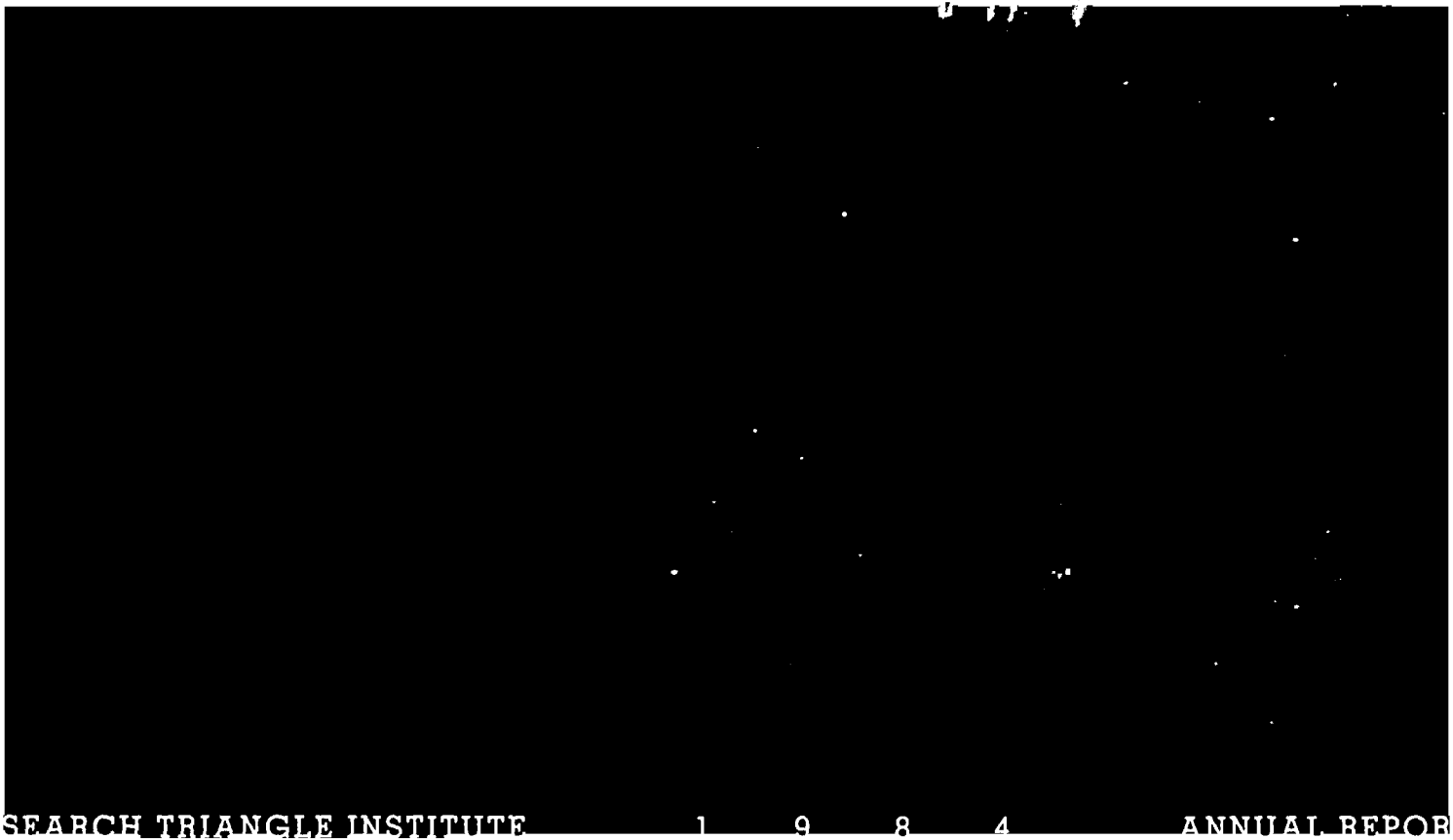
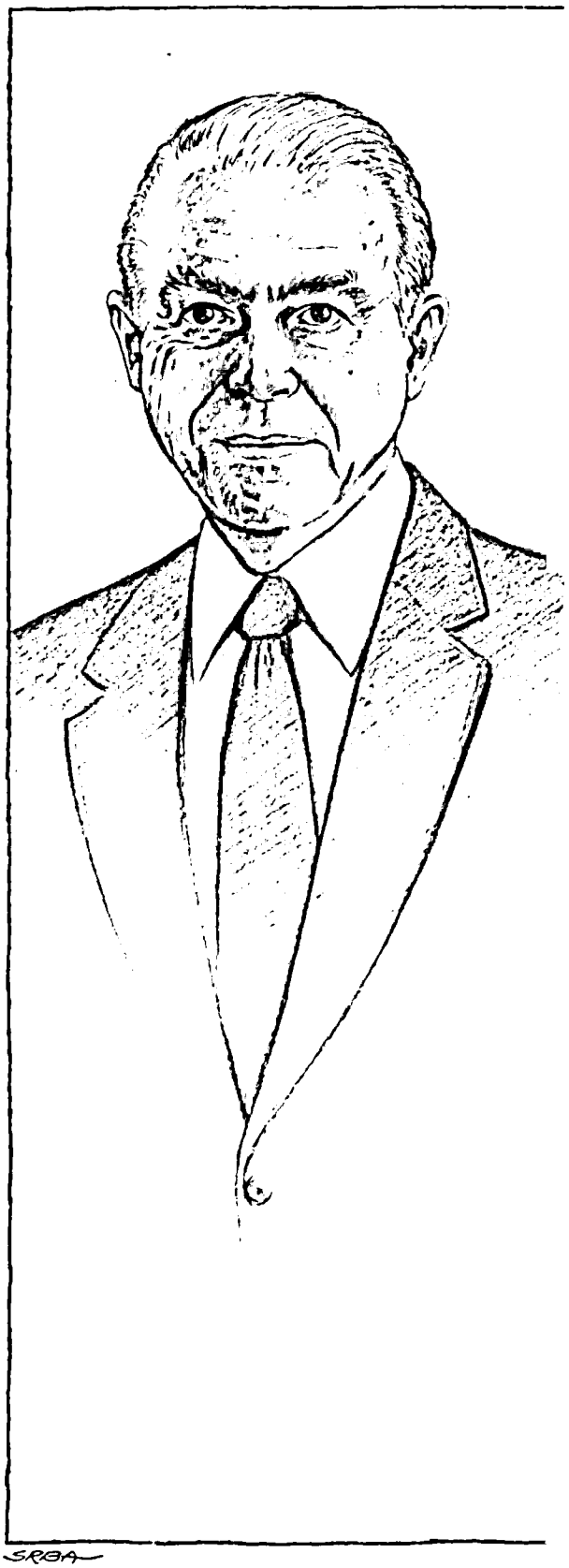

SEARCH TRIANGLE INSTITUTE 1 9 8 4 ANNUAL REPOR

CONTENTS

President's Statement

Policies, plans, decisions, and goals in virtually every economic and social aspect of our national life rely increasingly on expert and innovative scientific research. During 1984, our 26th year, Research Triangle Institute reinforced its position in the mainstream of American research through advances in the disciplines and technologies described in this report.

RTI's strengths are many, beginning with the unique relationship we enjoy with our three founding institutions: the University of North Carolina at Chapel Hill, Duke University, and North Carolina State University. Our research resources are organized to meet the needs and opportunities of corporate and government clients, and our research is carried out by a staff that is recognized for its excellence, professionalism, and high ethical standards.



Research Operations

Research revenue of $44 million in 1984 was the third highest we have recorded, and the trend is upward. Sources of revenue (see chart, page 9) did not differ significantly from the previous year. While commercial activity was a slightly smaller percentage of a larger total revenue, we expect continued growth in research for industry and other private sector clients.

Research Facilities

During 1984 our 47,000-square-foot engineering sciences building was completed and occupied, bringing our total laboratory and office space to 391,000 square feet. For a new $13 million, five-year support contract with the National Toxicology Program, we are building a special 6,000-square-foot chemical preparation facility, and we also plan an addition to our animal colony structure.

Research Personnel

During 1984 our staff grew from 937 to 979. At the end of our September 30 fiscal year, professional research staff totalled 67 percent of all regular employees, a percentage that has changed very little over the years. The degree mix also remains essentially the same: Ph.D. degrees 32 percent, master's 32 percent, and bachelor's 36 percent.

By any measure, 1984 was an outstanding year. We experienced growth in research, added new staff members, and reached a new high in business acquisitions. These results reflect the efforts of a new management team working towards shared goals, of leadership from research directors and senior professionals, and of a dedicated and committed staff at all levels. It is my privilege to be associated with them.

George R. Herbert

Officers and Research Programs

George R. Herbert
President

Daniel G. Horvitz
Executive Vice-President

C. Edgar Cook Vice-President *Chemistry and life sciences*	Organic and Medicinal Chemistry Life Sciences and Toxicology Bioorganic Chemistry Physical Sciences
Edo D. Pellizzari Vice-President	Analytical and Chemical Sciences
James B. Tommerdahl Vice-President *Environmental sciences and engineering*	Environmental Measurements Environmental Quality Assurance Environmental Systems
Forest O. Mixon Vice-President *Chemical engineering*	Aerosol Technology Separation Processes Process Research Hazardous Materials
W. Kenneth Poole Vice-President *Statistical methodology and analysis*	Medical, Environmental and Energy Statistics Health Studies
James R. Chromy Vice-President *Survey and computing sciences*	Survey Research Survey Statistics Computer Applications
Alvin M. Cruze Vice-President *Economic and social systems*	Social Research and Policy Analysis Economics Research Educational Studies
Ronald W. Johnson Vice-President *Public policy and international development*	Population and Policy Studies Development Policy International Programs
James N. Brown, Jr. Vice-President	Technology Applications Biomedical Engineering Neuroscience Geosciences
F. Thomas Wooten Vice-President *Electronics and systems*	Semiconductors Digital Systems Systems Engineering Energy Systems Engineering Handbooks

Samuel C. Ashton
Corporate Vice-President

Grace C. Boddie
Vice-President, Contracts

William H. Perkins, Jr.
Vice-President, Treasurer

Executive Vice-President's Statement

1984 was the first full year in which Research Triangle Institute operated under the organizational structure shown on the opposite page. The experience has been notably successful, and promises continuing benefits to RTI and to our clients.

Our primary objectives in establishing the present form of research management were, first, to recognize the growth in diversity of the Institute's research programs and the need for more effective leadership, and, second, to recognize the potential for enhancing our research quality through cooperative, multidisciplinary undertakings. Such undertakings are by no means new to RTI. What is new is an operating mode specifically designed to foster our institutional and individual commitments to them.

Each of our ten research vice-presidents is a specialist of distinction in his field, and each possesses clear leadership qualities and managerial skills. Moreover, they average 18 years as RTI staff members, a cumulative experience that brings with it a knowledge of, and sensitivity to, shared resources and shared goals.

In addition to managing a significant component of the Institute's staff, each vice-president is responsible for the research programs of his unit, providing leadership and guidance to the staff in obtaining support for those programs, in acquiring the resources needed to carry them out, and in setting performance standards for research and the research process.

The staff under the research vice-presidents has been organized into 32 research centers and programs. The directors of these centers and programs (see page 16) have been RTI professionals for an average of 12 years. In addition to developing and managing their research programs, the directors in 1984 were challenged to become more aware of the scientific interests, technical capabilities, and program development goals of their colleagues in the other RTI units. They responded to this challenge very well, resulting in even more effective Institute research proposals and projects through multicenter cooperative efforts.

The following few pages contain our research vice-presidents' statements of 1984 operating highlights. Even in their brevity, the statements reflect and emphasize the variety and quality of accomplishment that RTI achieves through its staff. The accomplishments of the research staff are indicated further by the 55 papers published in scientific journals and the 179 papers presented at seminars and professional society meetings during 1984.

Chemistry and life sciences

C. Edgar Cook, Vice-President

Capronor, developed by RTI as a biodegradable subdermal implant which will provide contraception for one year, showed no toxicity in extensive animal studies and will undergo Phase II clinical trials.

The first practical total synthesis of unnatural isomers of opiates such as morphine, codeine and thebaine was completed by RTI in collaboration with scientists at the National Institutes of Health. These compounds have useful medicinal properties without the narcotic effects of natural opiates.

A mouse strain with a genetic defect like that in human β-thalassemia (Cooley's anemia) was developed here and sent to researchers all over the country. It is now supplied by a commercial breeder, and is being used to test possible treatments.

Research in contraceptive steroid development led to a patent on "Progestationally Active Steroids". A new program to develop antiprogestational compounds is under way.

A major program on the pharmacokinetics and metabolism of drugs of abuse was completed for the National Institute on Drug Abuse. RTI is a national resource for small amounts of cannabinoids and other drugs of abuse for use in research and as analytical standards in military and industrial drug detection programs.

Our internationally recognized expertise in natural products chemistry led to a National Cancer Institute grant on cancer chemopreventive agents to identify chemicals in food plants which help prevent the occurrence of cancer.

Drug delivery research was expanded by the award of two new industrial programs, a grant from NIH, and the submission of a patent application on porous polymers. The number of RTI patents in this field is now three.

A joint patent with North Carolina State University and Racon, Inc., entitled "Refrigeration Liquids with Blue Leak Indicator and Process Using Same" was obtained and assigned to Racon.

Patent applications on a novel group of artificial sweeteners with a pure sweet taste, and on novel retinoids were submitted to the U.S. Patent Office.

Industrial interest in plasma polymers increased, with contracts signed by two companies. Work for the National Science Foundation led to methods for producing metal-containing polymers which have novel electronic properties.

The mammalian mutagenesis program has developed several mutant mice, including some which may also be experimental models for human disease.

A joint proposal with other RTI research units led to a $12.7 million National Institute of Environmental Health Sciences contract for chemical support for toxicology. A sophisticated facility for safe handling of potentially toxic chemicals is being constructed.

Research for commercial clients was expanded in 1984. One-third of our unit's research contracts were in the private sector.

Unit scientists contributed 23 publications to the scientific literature. Another 14 manuscripts are in press and eight more have been submitted. Several staff scientists were requested to serve on NIH review groups.

Analytical and chemical sciences

Edo D. Pellizzari, Vice-President

Individually, collectively, and in collaboration with RTI statisticians, survey specialists, computer scientists, biomedical scientists, and engineers, our analytical chemists enjoyed many technical milestones. A major Environmental Protection Agency study on Total Exposure and Assessment Methodology (TEAM) continued research to determine human exposures to environmental pollutants in air and water for approximately 900 persons selected from urban and rural sites in four states. Working together to analyze and interpret data from this vast study, RTI scientists have discovered that the major contribution to human exposure comes from indoor air pollution. For a group of 22 chemicals studied, the indoor air levels are significantly higher than ambient levels for most chemicals.

Because of TEAM's contribution to a better understanding of the underlying origins and relative importance of environmental media, new major programs in indoor air pollution are being sponsored by federal and state governments. We are currently identifying and quantifying potentially hazardous compounds introduced into air spaces by building materials and consumer products used in public buildings and private residences. Methods are being developed to sample and analyze for indoor air pollutants.

RTI analytical chemists also continued specialty research in methods development and evaluation for the analysis of complex mixtures in water, sediments, soils, sludges, hazardous wastes, air, biological media, industrial products, and biota. Examples are:

- A master analytical scheme for organics in water.
- An evaluation of methods for priority pollutants in soils, sediments, and sludges.
- Determining hexavalent chromium in hazardous wastes.
- An evaluation of ignitability and flash point methods in hazardous wastes.
- Collaborative testing of a reactivity protocol for H_2S and HCN in hazardous wastes.
- Evaluation of a polarization resistance method for corrositivity of hazardous wastes.
- Development and standardization of methods for polychlorinated biphenyls (PCBs) in human sera and adipose tissue.
- Evaluation of SIMCA pattern recognition techniques for PCB data sets.
- Field evaluation of a collection and analysis method for organochlorine pesticides and PCBs in air.
- Determining the chemicals responsible for mutagenicity in marijuana smoke condensates.
- Evaluation of interpretative methods used on pollution data obtained by gas chromatography/mass spectrometry analysis.
- Acquisition of Fourier transform-infrared library reference spectra for hazardous and toxic chemicals of environmental importance.

The many research areas yielded quality publications providing national and international peer recognition for our staff members and for RTI.

Our analytical chemists have formulated and initiated new program development concepts in chemical surface analysis and miniature sensors, and plans are under way to develop immobilization techniques for biological catalysts which may be used as sensing devices in biotechnology and other applications.

In addition to its traditional support from the Environmental Protection Agency and certain sectors of the National Institutes of Health, our client base in 1984 grew to include other federal and state agencies, and increased private sector support from the pharmaceutical, agricultural and electronic industries.

Environmental sciences and engineering

James B. Tommerdahl, Vice-President

The Center for Environmental Measurements initiated major programs for industry in gasoline vapor analysis and for the Environmental Protection Agency in acidic deposition methods development, played a major role in indoor air quality studies, and developed new capabilities in hydrogeological sciences and optical mineralogy.

Major accomplishments included installation restoration and hazardous waste research at several Air Force bases; analysis of fugitive gasoline vapors (55 constituents) for the petroleum industry; methods development for EPA Method 25 (Volatile Organic Carbon), carbon monoxide in stack emissions, asbestos in air and source media, and acidic deposition measurements. Asbestos monitoring procedures and abatement guidelines were developed for public buildings and schools, our Air and Industrial Hygiene Laboratory was reaccredited, and we evaluated emission control technologies for Space Shuttle fuel transfer operations.

New capabilities in hydrogeological sciences will allow us to execute ground-water related projects, collect and evaluate hydrogeological data, provide soil, sediment, surface water and ground-water sampling/analytical services, conduct research in ground-water contamination, plume dispersion, and modeling areas, and provide support to other Centers.

The Center for Environmental Quality Assurance provided a total of 20-person years of technical quality assurance support in 1984 to the EPA's Quality Assurance Management Staff (QAMS) located in Washington, D.C., and to the quality assurance programs of the Health Effects Research Laboratory, the Air and Energy Engineering Research Laboratory, and the Environmental Monitoring Systems Laboratory, all in the Research Triangle Park.

Major accomplishments in support of QAMS included working with the Agency's 42 offices to develop quantitative and qualitative data quality objectives for all monitoring programs, and collecting and assessing performance information for all measurement methods for inclusion in a computerized data base. Other support included systems and performance audits, laboratory-specific QA guidelines, analysis and interpretation of QA data, coordination of interlaboratory studies of biological and chemical measurement procedures, and development of QA training material for new measurement methods.

Wasteload allocation is a water quality management tool to prevent wastewater discharges from exceeding the assimilative capacity of a river and killing fish or other organisms. Under a new EPA contract, RTI's Center for Environmental Systems, with subcontractor assistance, is refining the classical assimilative capacity models, and is developing new models based on the toxicity of whole effluents for aquatic organisms. A major accomplishment under this contract is documentation of a 1984 survey of the Ten Mile River in Massachusetts, which was a pioneering effort in the use of chemical-specific models and whole effluent toxicity in a wasteload allocation.

Chemical engineering

Forest O. Mixon, Vice-President

Chemical engineering can report research accomplishment in several contexts: theory of operation of electrostatic precipitators for cleaning particulate emissions, new experimental data on particulate contamination in clean rooms, biotechnical process analysis, and hazardous materials control.

Research for the U.S. Environmental Protection Agency developed a new electrostatic precipitator computer model that allows calculation of electrical conditions for a wide range of designs. In addition, joint work with the University of Wallongong in Australia has discovered new phenomena associated with the onset of corona discharge. This work is expected to greatly facilitate the design and evaluation of new electrostatic precipitators.

Microcontamination research has been an area of intense activity. New data were obtained and published describing the aerosol size distribution in clean rooms. Preliminary data showing the emissions of particles from equipment found in clean rooms have also been reported, and may have significant impact on monitoring and operating clean rooms.

In biological process research, the extraction of oxygen from fluids and the oxidation of trace wastewater contaminants by biological organisms have been studied. A mathematical model developed for the Duke Marine Biomedical Center and Aquanautics, Inc., describes the transport of oxygen from various fluids across a polymer interface to an oxygen-receiving liquid which uses hemoglobin analogs to bind oxygen in much the same way as human blood. This model has been used to interpret experimental results and to determine the engineering feasibility of larger systems.

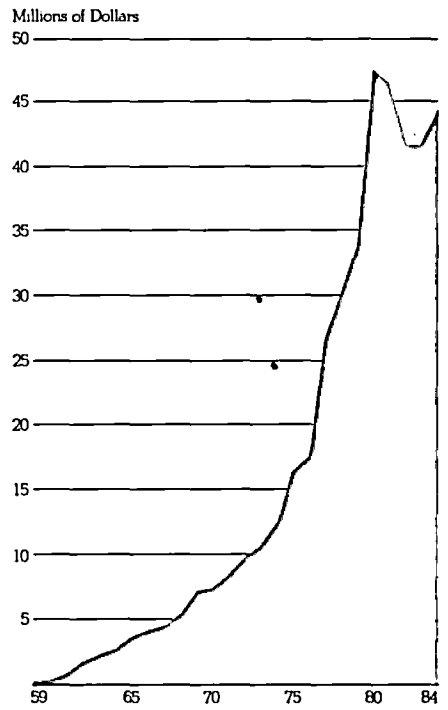
An experimental study of the extent to which naturally occurring microorganisms oxidize trace organic wastewater contaminants in cooling towers will help determine the extent of the emissions of these contaminants to the environment.

Hazardous materials control in both air and groundwater has been the focus of an incineration study in which a significant fraction of the fuel used at two commercially operating cement production plants was replaced with a combustible hazardous waste. All materials going into and leaving the operation were carefully analyzed at each of several operating conditions to determine if product quality was maintained and the waste effectively destroyed. Thorough analysis of the data indicates that certain hazardous wastes can be profitably utilized in an environmentally safe manner.

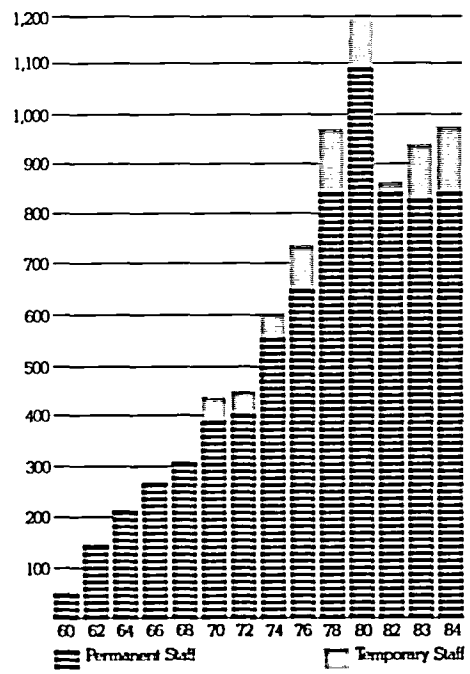
Under joint sponsorship of the EPA and the Air Force, a team of engineers and chemists evaluated a process for groundwater cleanup at the Wurtsmith Air Force Base in Michigan. The groundwater was found to be contaminated with several volatile organic species. An intensive pilot plant operation obtained engineering data using an air stripping column packed with different types of packing materials. The results showed air stripping to be a feasible control technology. A carbon column will be needed to remove the organics from the resulting air streams.

A book entitled *Fabric Filtration in Combustion Sources,* to be published by Marcel Dekker, was written by physicist Robert P. Donovan. A chapter on "Electrostatic Filtration" for the *Encyclopedia of Fluid Mechanics* is by Douglas VanOsdell and Mr. Donovan.

Research Revenue



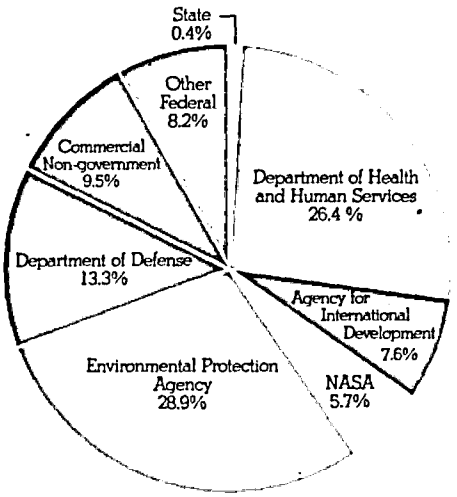
Staff



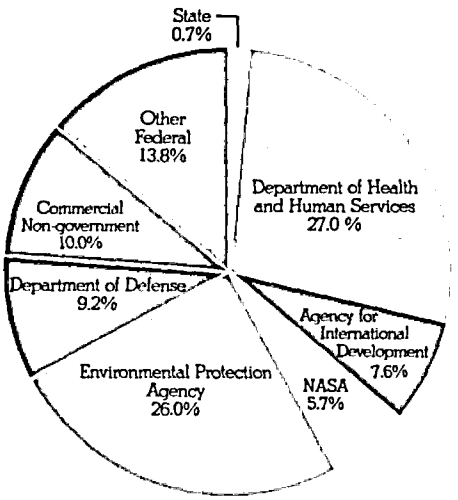
Revenue	
Direct Research Costs	
Operating Expense	
Net Revenue	
Facilities:	
Property and Equipment	
Less Depreciation	
Total Facilities	
Net Worth	
Total Staff at September 30	

	Fiscal Year 1984	Fiscal Year 1983
	$44,298,036	$40,745,972
	26,030,719	23,568,524
	17,409,786	16,456,274
	$857,531	$721,174
	34,740,477	30,635,869
	(14,140,918)	(12,627,021)
	$20,599,559	$18,008,848
	$17,655,844	$16,794,000
	979	937

Sources of Revenue



Fiscal Year 1984



Fiscal Year 1983

Statistical methodology and analysis

W. Kenneth Poole, Vice-President

Our two centers support health program evaluations, clinical studies, and clinical trials for units of the Department of Health and Human Services and other clients.

Center for Health Research

In addition to continuation of our large Medicaid Competition Demonstration Evaluation, work began on several projects. The largest was phase two of the Water and Sanitation for Health (WASH) project, for which we are a U.S. Agency for International Development subcontractor. Others are a needs assessment of allied health personnel for Southwestern Technical College, a clinical evaluation of a drug for a commercial firm, an evaluation of projection models for licensed nurses, a study of the relationship between education for and the practice of public health nursing, and evaluations of manpower in environmental toxicology, and of the national cause-of-death data.

Center research expanded in health policy, health manpower, health services research, and in clinical evaluations of drugs and devices. Program development in long-term care and needs of the aged was initiated.

Center for Medical, Environmental and Energy Statistics

New projects dealt with the prevalence and effectiveness of workplace health enhancement programs, a clinical trial of prevention of prematurity by detection and treatment of gestational genitourinary infections, a clinical trial of high frequency ventilation in premature infants, and statistical and computer support services to Tennessee Valley Authority energy projects.

The center was heavily involved in several tasks for a new three-year Environmental Protection Agency project of analytical support to EPA's statistical policy staff. In this project, our staff took primary responsibility for a tolerance assessment system, a dietary exposure analysis for ethylene dibromide, a statistical investigation of percent recovery and limit of detection methodology, and a study of reliability of experimental studies for predicting human health hazards from systemic toxicants.

On-going projects included a clinical trial dealing with the limitation of infarct size, a trial assessing ultrasonic β-scan imaging, a study of carbon monoxide exposure of Washington, D.C. residents, and an examination of environmental and human exposure to toxic substances (the TEAM study, see page 5).

Center staff were also active in maintaining and developing new software for weighted analysis of sample survey data.

Notable among our professional presentations and publications were six papers at an International Conference on Indoor Air Quality and Climate, held in Stockholm; a paper for the Air Pollution Control Association on carbon monoxide exposures of Washington, D.C. residents; an *Archives of Environmental Health* paper describing results from RTI's smelter study; and several medical journal abstracts and papers dealing with clinical trials of the limitation of infarct size and the efficacy of antenatal steroid therapy in preventing neonatal respiratory distress syndrome.

Continuing efforts involve clinical trials, evaluation of work site health promotion, environmental risk assessment, indoor air quality, environmental exposure, and tolerance assessment.

Survey and computing sciences

James R. Chromy, Vice-President

Survey and computing sciences' general missions are to provide statistical, computing, and survey support to RTI clients and to other Institute units, and to advance the state-of-the-art in statistics, survey methodology, computer science, and data management.

Enhanced Capabilities

Capability enhancement in 1984 included computer assisted telephone interviewing (CATI), computer program development in the highly structured Ada computer language, and development of survey analysis procedures and of capabilities for epidemiological support studies.

CATI capabilities were enhanced by additional central computing facilities that support in excess of 20 simultaneous interviews. Staff experience in CATI questionnaire development, interviewer training, and CATI operations increased substantially through participation in the Youth Attitude Tracking Study for the Department of Defense (DoD), pretests of the Veteran's Health Survey for the Centers for Disease Control (CDC), and the family questionnaire portion of the National Center for Health Statistics' national nursing home study.

RTI's Telesoft Ada Compiler is on an in-house computer. Ada is a DoD general purpose language that RTI is applying to industrial hygiene, occupational medicine, and environmental protection data management systems for the Air Force.

Correct analysis of survey data requires computer software which properly accounts for the probability structure of the sample design used. RTI has pioneered the development of such software for general purpose use. Most programs operate as Statistical Analysis System procedures on IBM mainframe computers. In 1984, the Environmental Protection Agency funded the addition of a logistic regression of survey data, and we began to modify the procedures to run on DEC VAX equipment.

Research Programs

Our project mix continued to shift to environmental applications, with emphasis on health-related studies. It included epidemiological survey support, and research concerning the physical, mental, and economic well-being of Vietnam-era veterans.

Major environment-related work with EPA included design of the National Dioxin Study, guidelines for describing uncertainty in exposure assessments, evaluating indoor air monitoring protocols, automating the Tolerance Assessment System for the Office of Pesticide Programs, processing and analysis of data on pesticide usage by nurseries and horticultural specialty firms, design and selection of a sample of hospitals for a national survey of antimicrobial usage, and evaluating statistical methodologies used in acid precipitation studies.

In support of epidemiologic studies, RTI completed the activities preliminary to a national survey of scoliosis for the National Cancer Institute. An epidemiologic catchment area survey conducted for the National Institute of Mental Health by Duke University and RTI was also completed. New projects were a follow-up of patients treated for hyperthyroidism, establishment of a population for epidemiologic studies of elderly black people, and a large scale mental health survey of Colorado's population.

Three new projects deal with veterans: a survey for CDC of the health effects of Agent Orange, the National Vietnam Veterans Readjustment Study of post-traumatic stress disorder for the Veterans Administration, and an evaluation of the VA's emergency job training program.

Economic and social systems

Alvin M. Cruze, Vice-President

The economic and social systems unit significantly strengthened its research programs during 1984. An individual with extensive experience in the educational research community became director of the Center for Educational Studies; the Center for Social Research and Policy Analysis continued its nationally recognized substance abuse research program; and the Center for Economics Research improved its capabilities to conduct complex analyses of microeconomic issues associated with energy and environmental problems.

Under Marie Eldridge, former administrator of the National Center for Education Statistics, the Center for Educational Studies began to revitalize its research capabilities. Emphasis during the year included policy studies of service delivery systems for elementary and secondary students in special education programs; a survey for the National Science Foundation to investigate trends in science and mathematics education; and analyses of issues associated with potential mergers of public school systems. Higher education studies included an analysis of the impact that federal financial assistance has on developing colleges and universities.

Accomplishments in the Center for Social Research and Policy Analysis included a study of the economic costs to society of alcohol and drug abuse and mental illness, completion of a major contract with the National Institute on Drug Abuse to analyze the process and outcomes of drug abuse treatment programs, and initiation of NIDA-sponsored followup of clients who were admitted to federally-funded drug treatment programs in 1981. This project includes special emphasis on respondents with a high risk for developing Acquired Immune Deficiency Syndrome (AIDS), and is part of a coordinated federal research program to address this increasingly serious health problem. The Center also diversified its research program into the mental health problems of prisoners and of Vietnam-era veterans' psychological and social service needs, and into long-term health care concerns, represented by a study to analyze the organizational structure of the nation's nursing home industry.

The U.S. Environmental Protection Agency continued to be the major client of the Center for Economics Research. Center economists completed a major study of the benefits and costs of hazardous waste regulations, as well as a large-scale analysis of the impact of asbestos regulations, and of the price, cost, employment, and other potential economic impacts of several air quality regulations. These projects, combined with participation in many professional meetings, provided excellent opportunities for recognition of RTI's state-of-the-art analytical techniques for estimating benefits from environmental regulations.

Center staff continued their electric utility-sponsored collaboration with RTI engineering specialists in analyzing energy demand. Market research techniques employing advanced survey methods were used in a public utility-sponsored effort to predict customer acceptance of various residential electricity conservation programs. Finally, we completed a major study of recreational and related benefits from improved water quality, and initiated regional economic modeling to support analyses of water rights and demand issues for a western state.

Public policy and international development

Ronald W. Johnson, Vice-President

RTI's 1984 programs included international and domestic research, development, training, and technical assistance projects. Sponsors are U.S. agencies and private sector organizations, non-U.S. international agencies, and developing country national governments. Much of RTI's international work is characterized by the state-of-the-art microcomputer hardware and software applications.

International research in 1984 experienced its largest increase ever at RTI. Major research and technical assistance activities were carried out in the Agency for International Development's Integrated Population and Development Planning project (IPDP). Throughout the project's five years, we had significant involvement in training, planning-model development, and technical assistance in more than 20 countries. A three-year successor to the IPDP project began in October.

Urban management assistance focused on local and regional government financial management analysis and capacity building. In every region of the developing world we provided technical services to international assistance agencies, to national agencies, regional governments, and individual municipalities. The urban financial management program involved major development and implementation of microcomputer systems.

RTI staff provided training, technical, and evaluation assistance to host country governments and donor agencies in agricultural policy analysis, employment planning, farming systems, and agricultural marketing. Our major effort in alternative energy with the Kingdom of Morocco continued as a joint activity with RTI engineering research centers.

Among major domestic research activities were: population and demographic studies; analyses of social programs (including Aid for Dependent Children, Supplemental Food for Women, Infants and Children (WIC), and the Social Security system); and studies of housing financial markets. Studies were completed in land use planning for hazardous waste sites, analyses of uses of the Department of Labor's *Dictionary of Occupational Titles*, and the role of volunteers in providing services to the elderly.

Continuing studies include: measuring the efficiency of service delivery in several social service programs; individual and family-level analyses of major life events such as family formation and dissolution, childbearing, and aging; and participation in special education and school district consolidation studies. Projects began in 1984 on modeling divorce settlements, longitudinal analyses of changes in family structure, and analysis of information systems in WIC program small state agencies.

Other new and continuing research contributed to understanding demographic change in the United States; important policy-related analyses for the Food and Nutrition Service, Office of Family Assistance, Social Security Administration, Department of Labor, and the Office of Human Development Services; and analysis of mortgage markets for the Department of Housing and Urban Development and the private financial sector.

Technology applications, biomedical engineering, neuroscience, and geosciences

James N. Brown, Jr., Vice-President

Geosciences

A new image-processing system significantly extended RTI's ability to perform sophisticated oceanographic and meteorological research.

A NASA-funded project, "Evolution of Ozone in the Synoptic-Scale and It's Influence on the Global Tropospheric Ozone Cycles," was completed. Results indicate that a reservoir of ozone in the northern hemisphere mid-latitude boundary layer contributes significantly to the ozone content of the troposphere.

Studies of ocean currents in the Gulf of Mexico yielded new information on energy processes that shape ocean currents; specifically, the movements of loop currents. The capability to process and display satellite data is leading to increased opportunities for oceanographic research.

Technology Applications

RTI has been involved in NASA's program to transfer space-technology to nonspace applications in both the public and private sectors for about 20 years. As NASA's sole contractor to operate a Technology Applications Team, we are now responsible for the transfer of space technology in medicine, rehabilitation, and automation and materials in manufacturing.

Technology transfer projects are also being funded by the National Institutes of Health (NIH), the Veterans Administration, and the Department of Education. The University of North Carolina School of Medicine is funding the simulation of operations in radiology in order to plan and evaluate picture archiving and communications systems. The U.S. Air Force (through the Applied Physics Laboratory) is funding the simulation of automatic warehouses being developed by the aerospace industry.

Biomedical Engineering

Collaborative work with major medical institutions such as Duke University Medical Center and the UNC School of Medicine significantly extends our biomedical engineering program.

In 1984 Center staff concluded an extensive analysis of data acquired in a joint RTI/UNC/EPA/U.S. Army study of carboxyhemoglobin formation in man. We expect a follow-on agreement to continue for five years.

The Center also completed development of a wearable instrument for field monitoring of physiological parameters. The system contains two parts: a low-power microcomputer, and an electrical impedance cardiograph and electrocardiograph module integrated into the computer for preprocessing and recording cardiac function.

Neuroscience

The neuroscience program was created early in 1984. It is to a large extent the result of an RTI Professional Development Award to Blake Wilson.

The NIH funded a two-year research project to develop speech processors for multichannel auditory prostheses in collaboration with the University of California at San Francisco. Parallel tests at the Duke University Medical Center will use procedures identical to those at UCSF. Results will help to identify the best strategies for patients tested, and to guide future research.

A private company is funding development of a single-channel auditory prosthesis for infants and young children. Our objective is a useful device that does not invade the inner ear, and thus will not increase the risk of inner-ear infection.

Electronics and systems

F. Thomas Wooten, Vice-President

In 1984 our electronics and systems centers moved into the new George R. Herbert engineering sciences building, whose 47,000 square feet include a 6,000 sq. ft. general lab for high speed computers, and a 6,600 sq. ft. class 100 clean room for semiconductor research. Researchers have access from their offices to computers and networks including a Gould Power Node 9050, two VAX 11/750's, the ARPANET, the Microelectronics Center of North Carolina (MCNC) network, and two NASA computers. Semiconductor staff have one of the nation's finest labs for compound semiconductor research as well as access to the new silicon fabrication facility at MCNC.

Systems engineering staff accomplishments include: designed electronics for an airborne Nd:Yag laser to be used by NASA for aerosol measurements; designed and began development of an Automated Occupational Health Evaluation System to be used at over 100 Air Force bases worldwide; computerized the Air Force Hearing Registry; demonstrated the software system for the Advanced Display Evaluation Cockpit; and began research on network data management for the NASA Space Station.

Semiconductor staff accomplishments include: developed and demonstrated a state-of-the-art InGaAs MISFET transistor with excellent DC stability; continued pioneering work on cascade solar cells by demonstrating voltage addition in the AlGaAs/GaAs patterned tunnel junction cascade cell using a new low resistance Ge interconnect; provided a high performance OM-VPE (or MO-CVD) system to a commercial client; and designed and began construction on an advanced PE-CVD system capable of depositing insulators on semiconductor surfaces at low temperatures.

Energy systems staff accomplishments include: completed the first photovoltaic power source for a North Carolina electric utility; completed a demand-side analysis for an electric utility's three-year alternate energy study that recommends customer-based load management and conservation programs; completed an electric utility computer model which calculates effective load carrying capability for new generation technology such as photovoltaics, wind, and pumped hydrostorage; completed site selection and conceptual design for a 150 kw photovoltaic test facility to be constructed by an electric utility in 1985; and completed an analysis of performance and benefits of dual-fuel heat pumps in North Carolina.

Digital systems staff accomplishments include: developed and demonstrated a set of high level computer-assisted engineering tools, called Architecture Design and Assessment System (ADAS); developed new research areas including verification of Ada programs, range instrumentation studies, and optimization techniques for functional programming language code; designed and tested very large scale integrated (VLSI) chips for several commercial clients; developed, under a grant from MCNC, a design verification lab for VLSI test which will allow RTI to carry the VLSI design and fabrication process all the way to tested chips; implemented the NASA AIRLAB data base management system, and studied the Advanced Information Processing System architecture for Space Station; and evaluated Phase I test plans for the Department of Defense very high speed integrated circuit (VHSIC) program.

Engineering Handbook Office

Scientists throughout the country contribute to an Engineering Design Handbook series published by the Department of Defense and the Army Materiel Command. From manuscripts prepared at industrial and government laboratories, universities, and other scientific organizations, the handbooks provide fundamental design information and up-to-date records of advancing technologies. RTI is responsible for handbook editing and administration. During 1984 this independent office published three handbooks, 18 were in preparation, and 11 were in planning stages.

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