

1995

RTI

Advanced Technologies

Making a

Environmental Difference

Difference

Public Policy

With Experience

Health and Medicine

and Expertise

President's Statement

RTI Mission Statement

RTI is dedicated to improving the human condition through multidisciplinary research, development, and technical services that meet the highest standards of professional performance.



Scientific accomplishment, by itself, cannot satisfy the professional goals of RTI's staff. Our mission, after all, is to improve the human condition — a mission achieved only when research and development results are put to work in the real world.

That is why RTI's researchers work with businesses to turn data and laboratory results into products, services, and processes; with governments to turn health, environmental, and social research into cost-effective policies; and with state and local public service agencies to utilize and improve the state of the art in human services delivery.

When scientific accomplishments are applied in these ways, they become the kinds of achievements that make real contributions to solving our clients' problems. We frequently point to the talent and professionalism of our staff as RTI's greatest assets. But it is our staff's commitment to making a positive difference for our clients that defines RTI's unique character.

As evidence of this commitment, this annual report presents a small sample of our staff's achievements in 1995.

F Thomas Wooten

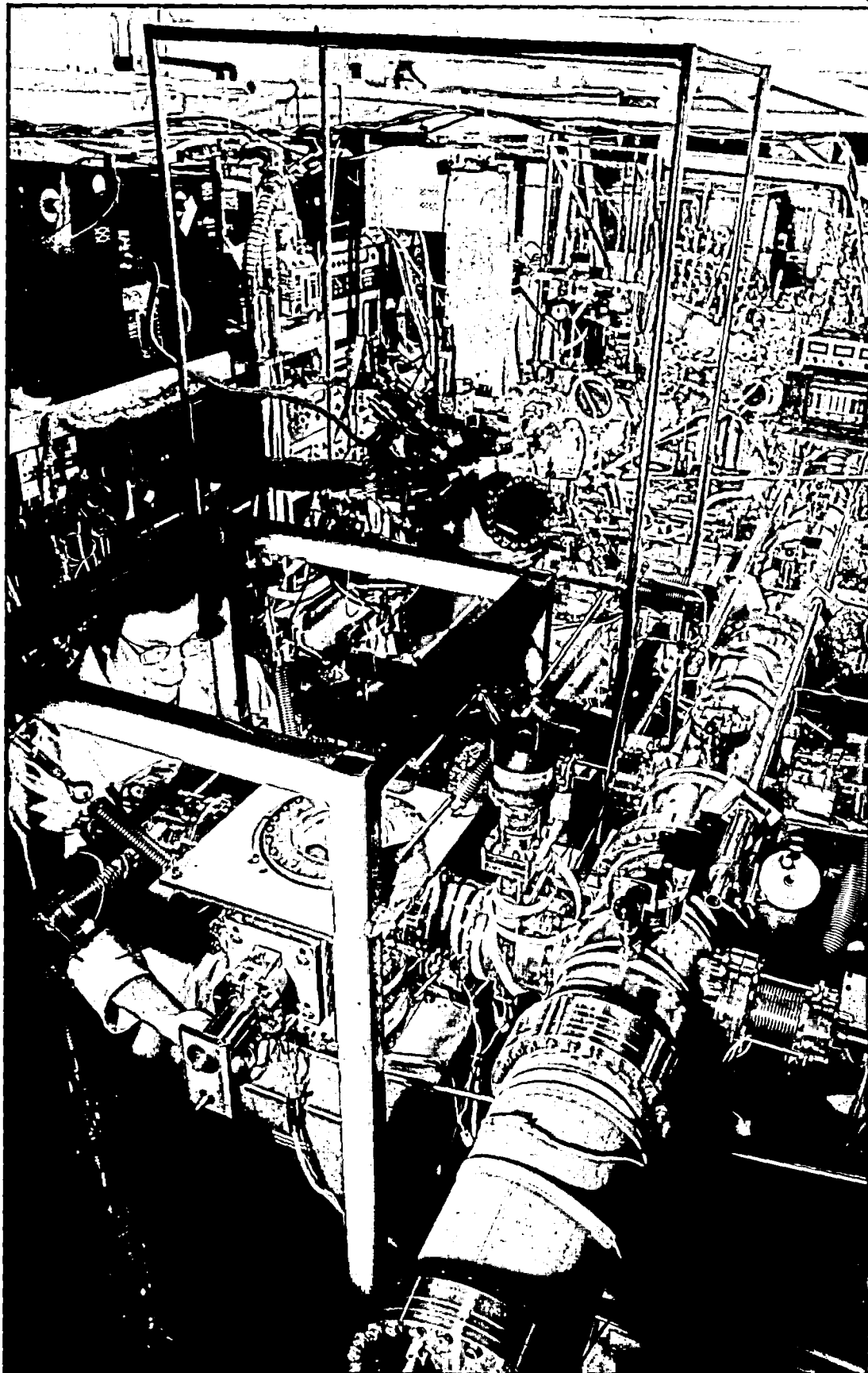
Tom Wooten
RTI President
January 1996

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Advanced Technologies

Technology-related engineering at RTI brings ideas out of the laboratory and into practical use. This is accomplished by outreach to industry, which provides the marketplace and manufacturing know-how to realize the promises of advanced technologies.



Engineer David Malta sets up an experiment in RTI's Integrated Processing Facility for semiconductor R&D (pages 6-7).

Contents



2 Advanced Technologies

Technology-related engineering at RTI brings ideas out of the laboratory and into practical use. This is accomplished by outreach to industry, which provides the marketplace and manufacturing know-how to realize the promises of advanced technologies.

Product Planning by Virtual Reality and Conjoint Analysis

Virtual Reality Becomes a Practical Training Tool
A Renaissance in General Aviation

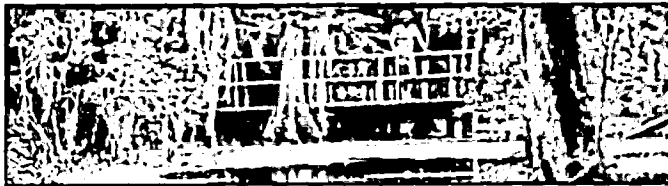
Digital Mammography Improves Cancer Diagnosis
"Middleware" Technology Moves from NASA to Local Health Agencies

Technology Transfer in Photovoltaics

Custom High-Performance Integrated Circuits

New Technology for Solid-State Cooling and Power Generation

Low-Cost Diamond Fabrication Technology



8 Environmental Protection

Environmental protection, as researched at RTI, seeks the greatest benefit for human health and the ecology with the least interference in the private economy.

RTI Demonstrates a New Energy Technology

Clean Coal for Long-Term Energy Needs

Producing Industrial Chemicals from Coal

Pollution Prevention Helps Industry

Restoring the Danube River

Software Provides Training in Waste Management

Improving the Indoor Atmosphere

Emission Measurements Protect Your Health

Multimedia Risk Assessment



14 Public Policy

Through analysis, demonstration projects, evaluations, and technical assistance, RTI translates research into effective policies that make positive differences in people's lives. RTI's staff are at work in education, public utilities, public health, and environmental protection, both in the United States and in developing countries.

Early Childhood Education and Intervention

Redesigning a State's Education System

Vocational Rehabilitation Sustains Productive Lifestyles

City Governments and Residents Working Together

Community Involvement in Managing Environmental Pollution

Strengthening Population and Health Policies



18 Health and Medicine

RTI focuses on helping government, industry, and the public identify and use the most cost effective approaches to preventing and treating problems arising from drug abuse, chronic disease, infectious disease, aging, violence, and other issues in human health.

Restoring Hearing with Cochlear Implants

Discovering New Treatments for Pain and Addiction

New Cancer Drugs from Natural Products

Helping State and Local Governments Assess Immunization

Quality and Cost-Effectiveness in Long-Term Care

Good Decisions Mean Good Health

Health and Social Outreach Programs

Helping States Cope with Substance Abuse

Quality Adds Value to Drug Abuse Treatment

Survey Research Helps New Nations Govern

Pioneering Methods for Collecting Sensitive Data

26 Operating Highlights

27 Governance and Corporate Officers

28 Research Organization

29 Research Programs

Product Planning by Virtual Reality and Conjoint Analysis

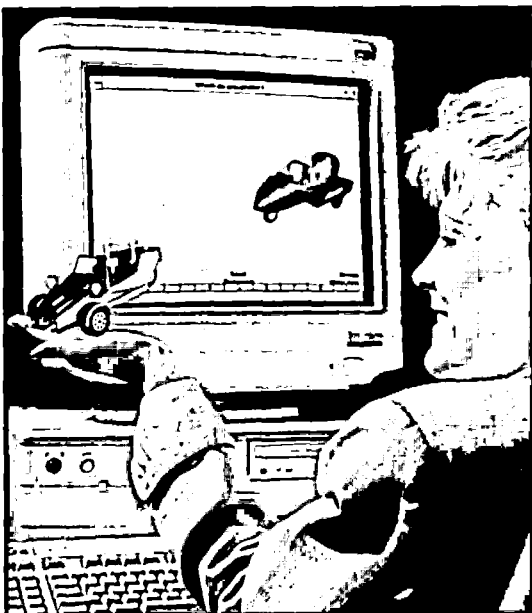
In 1995, RTI began working on a project for Volvo-GM Heavy Truck using a new software tool — TradeOff VR™ — that combines virtual reality with conjoint analysis. For this project, RTI first developed a customized, VR-based conjoint interview demonstration of a future vehicle possibility. In 1996, RTI and Volvo are collecting preference data from customers for use in product planning.

The conjoint interview part of the software poses a series of questions in which respondents are asked to trade off different features of potential new vehicles. When combined with VR, the interview allows respondents to both see and freely interact with the products they are evaluating.

To create three-dimensional models of both the interior and exterior of the proposed truck and its features, RTI used Volvo's CAD data.

This approach simulates the actual purchase experience more closely than does traditional conjoint interviewing.

Prototype development can be expensive, and RTI's TradeOff VR™ software tool provides an efficient, inexpensive, and innovative way to collect customer preference data.



Virtual Reality Becomes a Practical Training Tool

Following the successful integration of RTI's virtual tank system into a national guard training program in 1995, researchers have added a natural language interface, creating the Advanced Maintenance Assistant and Trainer (AMAT).

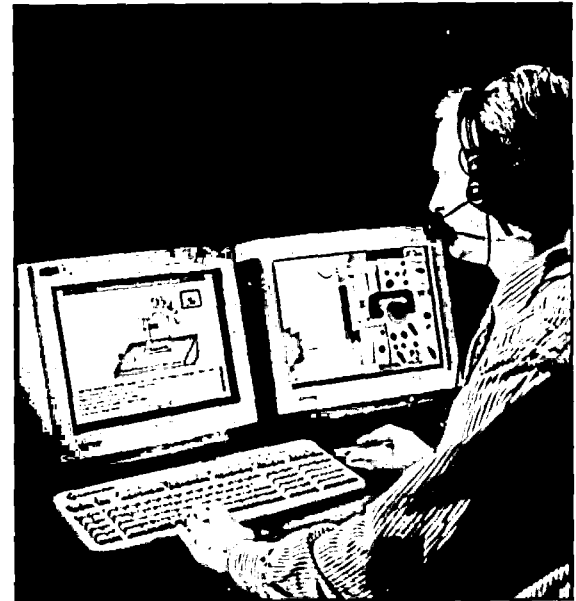
The goal is to enable mechanics to diagnose and remedy mechanical problems quickly and accurately (under difficult, cramped working conditions within a tank).

The challenge for RTI's staff has been to determine how best to use spoken language as a medium for communication between human and computer. Using off-the-shelf, PC-based speech synthesizers and speech recognizers, RTI developed the underlying technology to enable AMAT to communicate effectively with the user to assist in complex problem

solving. The system interprets the human voice by evaluating sounds, context, and closeness to standard English. If the human voice scores too low in any of these categories, then the system requests clarification. If AMAT understands, then it proceeds with its role as either a trainer — teaching the user to repair the tank through planned exercises — or an assistant — helping the user to repair the tank in the field.

With its flexibility and cost-effectiveness, AMAT is the precursor of more virtual reality training tools for maintenance and other classroom applications.

TradeOff VR™ puts customers in touch with virtual prototypes, helping companies make product decisions quickly and efficiently.



Curry Guinn, Ph.D., demonstrates natural language processing, which provides ready access to complex problem-solving information, even in cramped, hostile situations such as repairing a tank in the field.

A Renaissance in General Aviation

RTI plays a critical role in an ambitious initiative to rejuvenate the U.S. general aviation industry. Despite a 15-year decline, this industry still provides more than 540,000 jobs, \$40 billion of economic output, and services to 120 million people annually.

The Advanced General Aviation Transportation Experiments (AGATE) program, a partnership between NASA, the FAA, and industry, focuses on single-pilot, light, all-weather transportation aircraft. The goal is to provide foundations for industry leadership in technologies for improved utility, safety, affordability, performance, and environmental compatibility in general aviation aircraft.

RTI works with AGATE members to provide the systems engineering capability needed to integrate the many technical efforts. RTI also conducted market research for the AGATE program and is facilitating statewide demonstrations of the AGATE-derived airplane and the infrastructure required to support its operation. Finally, RTI produces communications materials, such as the *AGATE Flier* newsletter, to share the goals and progress of the program.



Digital Mammography Improves Cancer Diagnosis

In 1995, RTI achieved new successes in its work to facilitate industry-government-university partnerships for NASA technologies. This technology transfer process matches markets that have particular needs with promising NASA technology, including industry partners that can commercialize the technology. One of the most successful efforts is leading to much-needed improvement in early detection of breast cancer. Working with the National Cancer Institute, RTI established partnerships with technical developers who are adapting aerospace- and defense-related imaging detector materials and devices for digital mammography systems.

Because digital detection offers significant improvement over current mammography technology in terms of contrast in the image, subtle changes in breast tissue can be detected months, possibly years, earlier. Clinical testing of digital mammography has started, and widespread availability is expected in coming years.

The same partnering and technology transfer skills are at work in a new effort to develop improved hearing aids. Working with various federal agencies,* RTI is developing opportunities to apply signal processing, artificial intelligence, and microelectronics technologies to enable development of hearing aids with improved speech intelligibility.

* NASA, NIH, Department of Veterans Affairs, and NIST.

RTI engineers are working to make general aviation aircraft easier to operate. This illustration shows proposed new cockpit concepts.

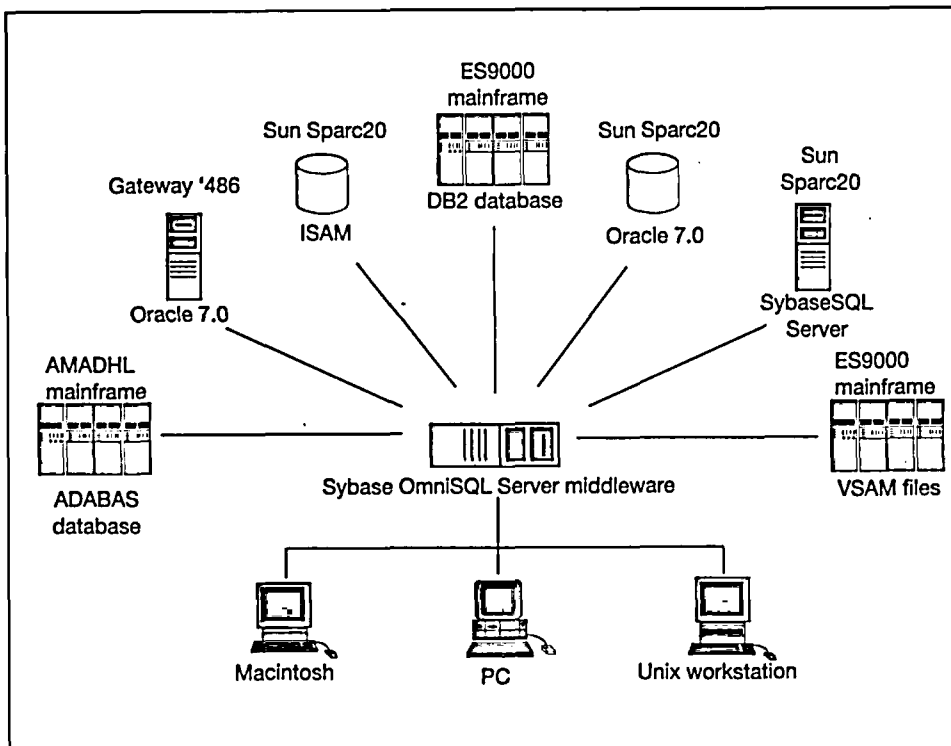
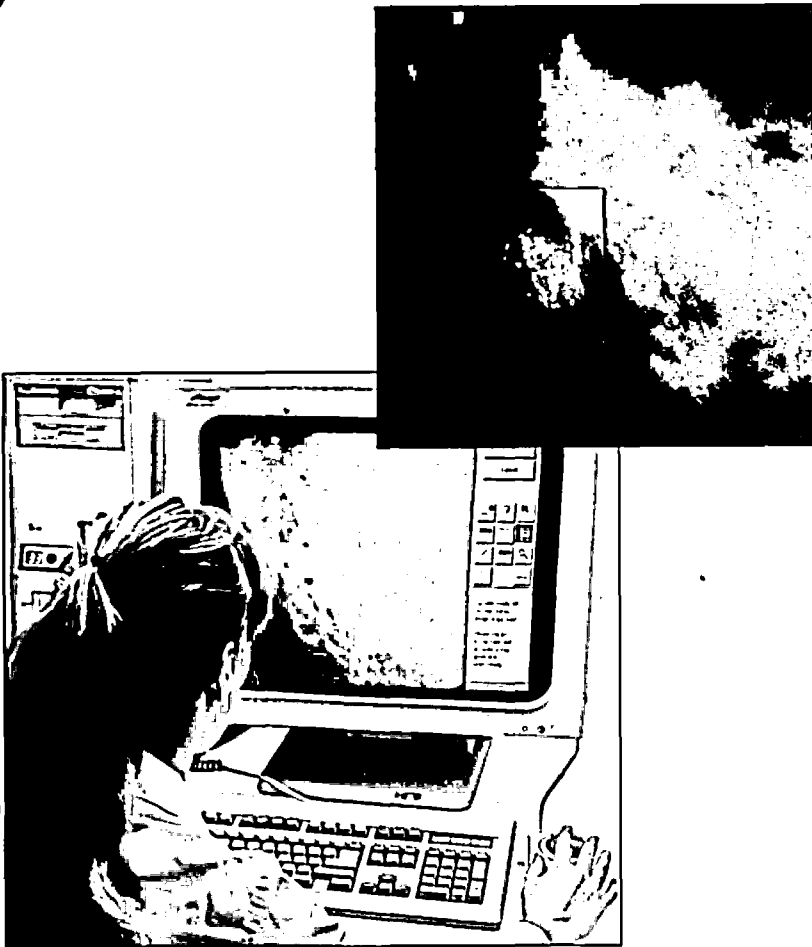
"Middleware" Technology Moves from NASA to Local Health Agencies

Two years ago, RTI computer scientists set to work helping NASA access valuable information that was stored on 30-year-old mainframes. This information was under-utilized because it was too difficult to retrieve. Today, the information is still stored on mainframes, but NASA staff can access it easily from desktop computers.

Since then, RTI computer scientists have learned to use emerging middleware technology to establish connectivity and interoperability across diverse software and hardware platforms.

In a new project funded by the Robert Wood Johnson Foundation, RTI staff work with North Carolina's Department of Environment, Health, and Natural Resources to enable the state's 100 county health departments to access immunization, nutrition, and other health databases from a single desktop application.

The integrated access to the state's health care information sources and the ability to query the integrated system will enable health care managers to make more informed business decisions and to run their organizations more effectively.



(Top) RTI created a technology transfer opportunity to commercialize digital imaging for much-needed improvement in early detection of breast cancer.

(Left) RTI is putting middleware technology to work for North Carolina's providers of public health services.

Technology Transfer in Photovoltaics

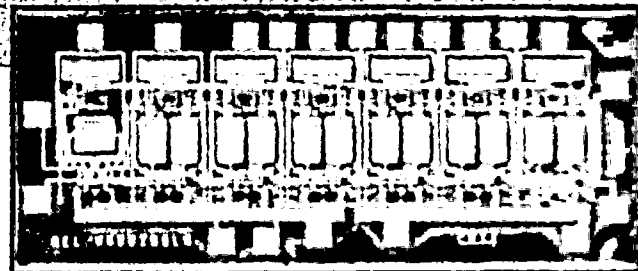
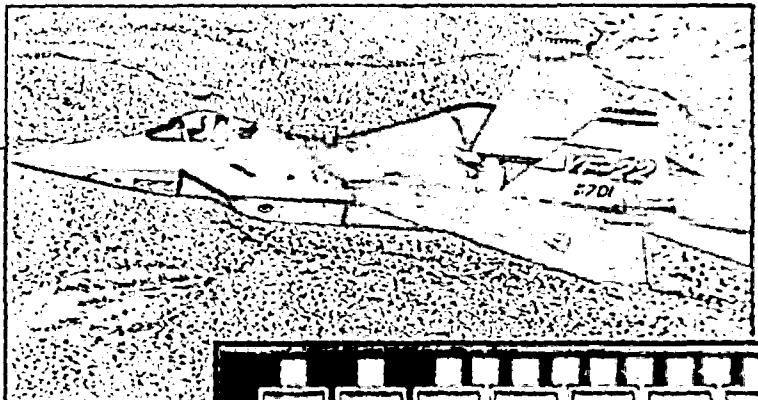
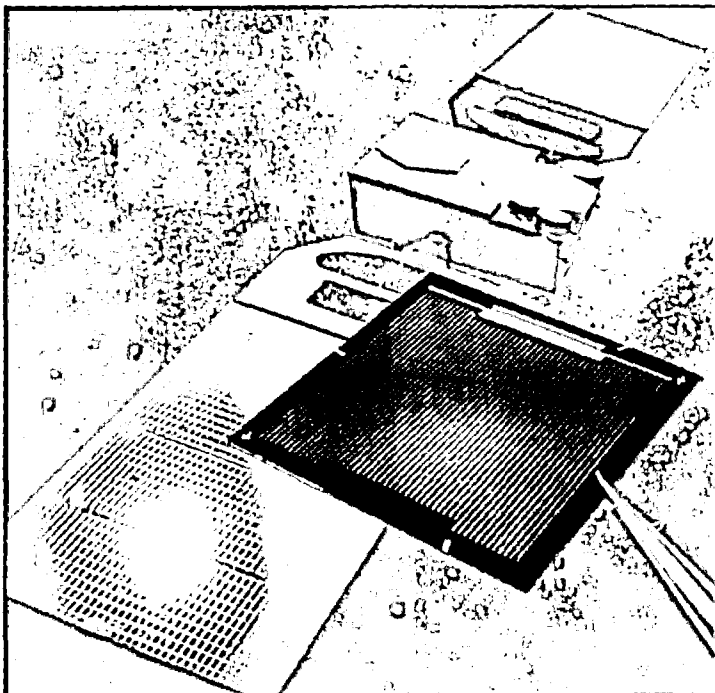
Applied Solar Energy Corporation (ASEC) is beginning to deliver new high-efficiency cascade solar cells for use on satellites. The cells result from five years of work involving RTI, ASEC, and the Department of Energy's National Renewable Energy Laboratory (NREL).

RTI has been a leader in cascade solar cell technology since 1978, when the Institute first demonstrated a monolithic cascade cell.

In 1994, RTI transferred its new p/n cascade cell structure and growth process to ASEC. In 1995, ASEC applied the RTI/NREL technology in a manufacturing process so that delivery of the new cells could begin in 1996.

Commercial availability of this new product is expected to enable advanced space power systems, first for military applications and later for commercial satellites in new wireless communications systems.

RTI semiconductor technology has become integral to a variety of avionics and communications technologies. Transistor technology (right) has been designed for applications in new aircraft and in wireless communications satellites. Advanced solar cells (left) are meeting the power needs of communications satellites.



Custom High-Performance Integrated Circuits

RTI has launched a new wafer growth and fabrication service for heterojunction bipolar transistor (HBT) integrated circuits (ICs). This service provides small quantities of reliable, high-performance chips.

Initial products in 1995 from this service include a new indium phosphide (InP) photoreceiver IC chip and a new gallium arsenide (GaAs) logarithmic amplifier chip. These chips are useful for applications such as radar, radar warning receivers, missile guidance, and altimeters. For example, the logarithmic amplifier chip has been designed for a variety of military avionics and space applications, such as the Air Force's F-22 aircraft and the Globalstar wireless communications satellite system.

RTI's HBT fabrication capability comes from more than a decade of R&D for military and industry clients, emphasizing the compound semiconductor materials GaAs and InP.

Semiconductors

New Technology for Solid-State Cooling and Power Generation

RTI created a unique approach for fabricating high-performance thermoelectric devices for military and commercial solid-state refrigeration and power-generation applications. This approach applies a class of semiconductor thin-film structures, known as superlattices, that potentially could exceed the performance of current state-of-the-art thermoelectric technology by a factor of two to five.

In 1995, RTI invented a novel technique to deposit the required superlattice structures and also experimentally demonstrated several important aspects of this new approach for both cooling and power generation applications.

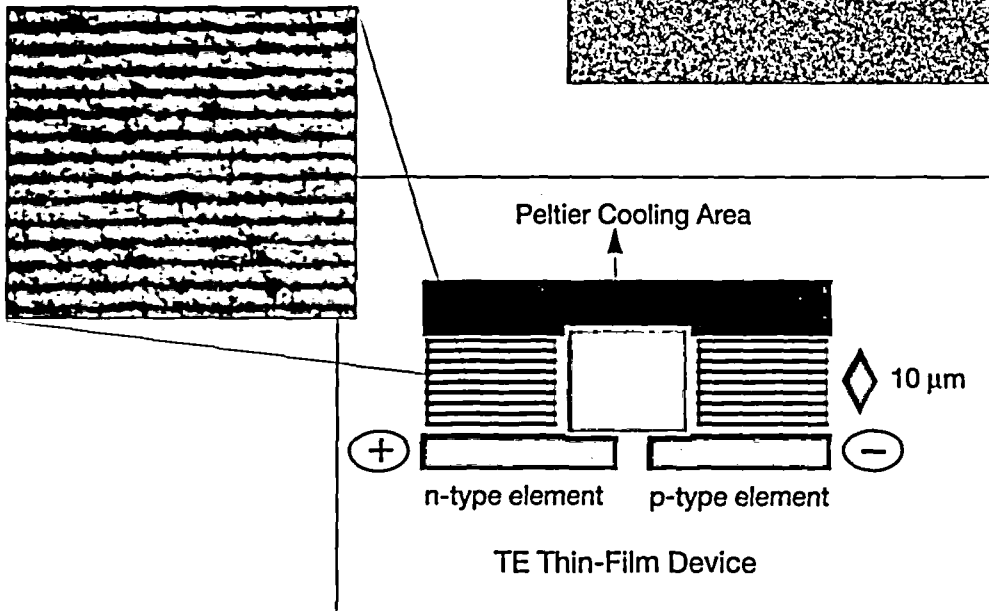
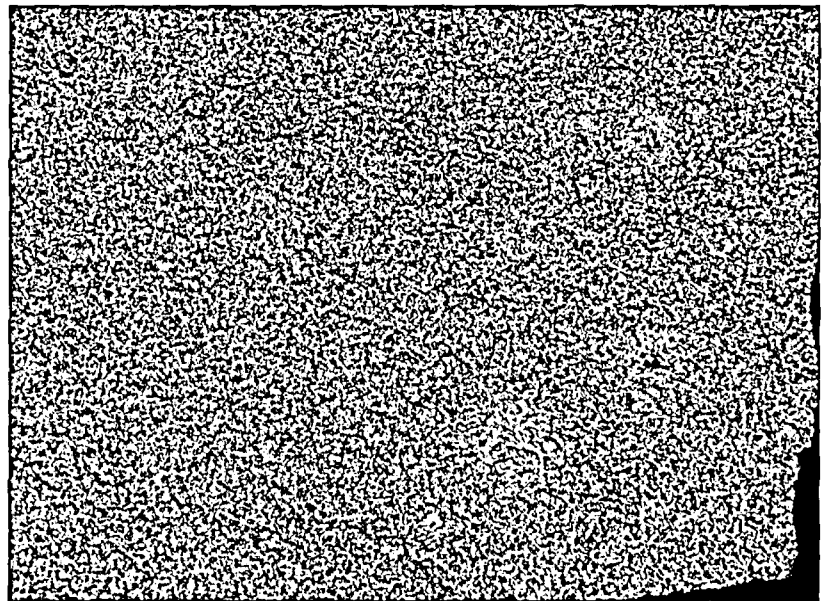
This new solid-state technology has the potential to be environmentally friendly yet competitive with conventional Freon-based refrigeration systems. The approach also could apply to nonmechanical, noise-free power generation systems.

Low-Cost Diamond Fabrication Technology

In 1995 RTI successfully transferred a proprietary technology for fabricating very low-cost diamond to the 3M Company. This technology emerged from military-funded research on processes for synthetic diamond.

With 3M, ASTeX Corporation, the Naval Research Laboratory, and Honeywell Corporation, RTI is developing this diamond manufacturing technology for a variety of commercial and military applications.

Using a prototype large-area reactor, RTI is bringing its synthetic diamond process to commercial scale. The largest sheet produced by the end of 1995 was 8 inches square. The polycrystalline diamond surface shown here is from a sheet that measures 1.25 by 10 inches.

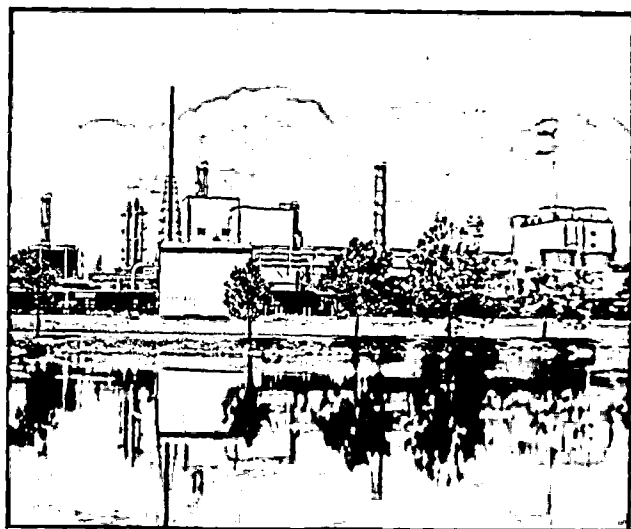
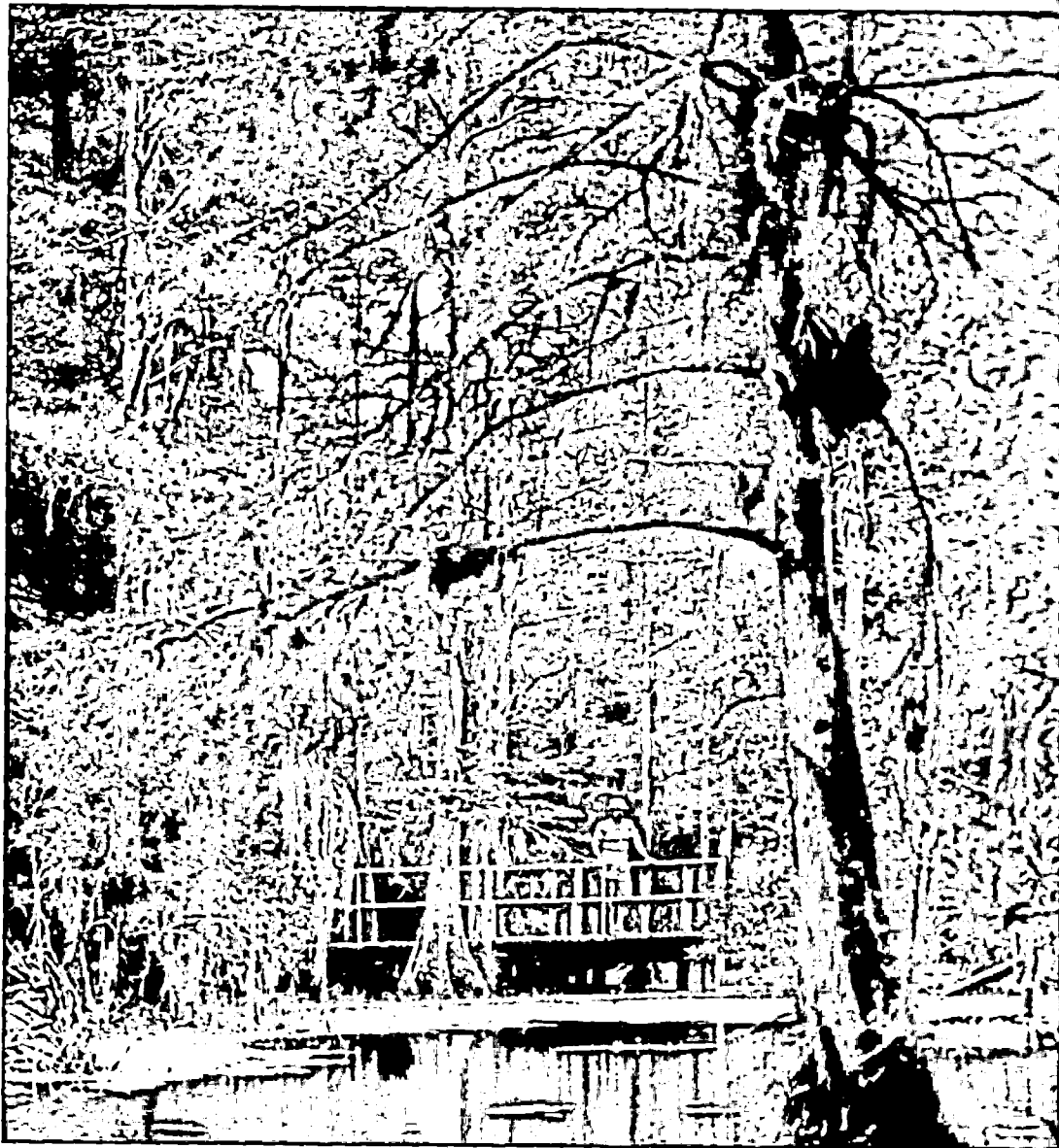


A new deposition method for superlattice structures is a key component of RTI's project to develop high-performance thermoelectric materials. The detail on the left is a scanning electron micrograph of a Si/Ge superlattice of $\sim 100\text{\AA}$ period.

Environmental Protection

Environmental protection, as researched at RTI, seeks the greatest benefit for human health and the ecology with the least interference in the private economy.

With tools for multimedia risk analysis, RTI helps EPA and state governments develop cost-effective ways to protect human health and the ecology (page 13).



RTI Demonstrates a New Energy Technology

A consortium led by RTI is building a full-scale demonstration of a new alternative energy technology. The process diverts wood waste that otherwise would be landfilled or burned to produce electricity in an efficient and environmentally responsible manner.

The power plant will generate one megawatt of electricity for the Camp Lejeune Marine Corps base in North Carolina, using wood waste from the base. RTI has teamed with the Department of Defense, the Environmental Protection Agency, and the State's energy division. Another key member of the team is Thermal Technologies, Inc., a company that plans to commercialize the technology.

The wood is first converted to combustible gas, which powers a reciprocating engine to turn a generator. The RTI team chose reciprocating engines because they are more practical at this scale than turbine engines. This characteristic will be important for small towns, industrial sites, or developing countries, which might use the technology to generate their own electricity.

(Far Left) Formerly destined for a landfill, this wood will fuel a large-scale technology demonstration plant to generate electricity for the Camp Lejeune Marine Corps base.

(Left) This Eastman Chemical Company plant in Tennessee already produces some industrial chemicals from coal. RTI is working with Eastman and Bechtel Corporation to develop catalytic processes to introduce more versatility and cost-effectiveness to this technology.

(Right) In 1995, RTI completed a pilot demonstration of a process that efficiently produces electricity from coal without sulfur pollution.

Clean Coal for Long-Term Energy Needs

Coal is the most important and abundant long-term energy source in the United States, but it also contributes pollutants such as particulate matter and acid-forming sulfur and nitrogen compounds. Removing these from flue gases is costly and produces hazardous waste. A new type of power plant, the integrated gasification combined cycle (IGCC), allows for increased electric power generation from coal while simultaneously reducing coal's environmental impact.

In 1995, RTI completed a pilot-scale demonstration of its patented Direct Sulfur Recovery Process (DSRP), which is an integral part of modern IGCC technology for clean and cost-effective use of coal to produce electricity.

The RTI technology uses a patented zinc titanate sorbent and the DSRP to remove more than 99% of the sulfur from the coal gas and recover it in the pure, elemental form. The sorbent is reused in the process, and the sulfur could be marketed as a chemical commodity. RTI is working with chemical manufacturers and the U.S. Department of Energy to transfer the technology and to ensure commercial production of sorbents as new power plants are built.

In 1995, RTI expanded its clean-coal R&D to include processes to remove two other contaminants: ammonia and hydrogen chloride.

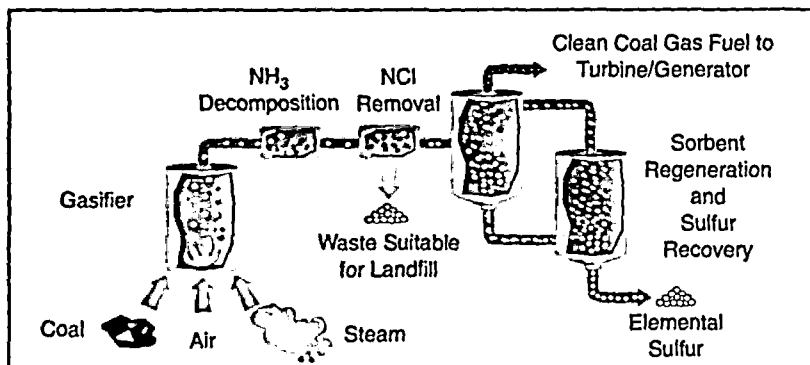
Producing Industrial Chemicals from Coal

In 1995, RTI formed a team with Eastman Chemical Company and Bechtel Corporation to find new ways to convert coal into industrial chemicals.

Coal, an abundant resource in the United States, can be a source of many chemicals that currently are derived from petroleum. An ability to produce chemicals from coal cost-effectively would reduce the nation's dependence on imported oil.

With funding from the U.S. Department of Energy, RTI is developing catalysts and laboratory-scale processes to build on an existing technology. Eastman operates the world's first modern, coal-based gasification process to produce industrial chemicals.

Bechtel, a leader in engineering design, is working on conceptual design and economics of key processes. Bechtel worked on the design and construction of Eastman's existing coal-based plant in Tennessee.



Environmental Protection

Stopping Pollution

Pollution Prevention Helps Industry

RTI is helping the fiberglass reinforced plastics and composites industry reduce emissions of styrene, an air pollutant.

Styrene is emitted both during and after a common manufacturing process — the spraying of gel coat and resin onto the surface of an open contact mold. This open molding process is used in the manufacture of a wide range of products, including bathtubs, shower stalls, spas, vehicle parts, boats, and home appliances.

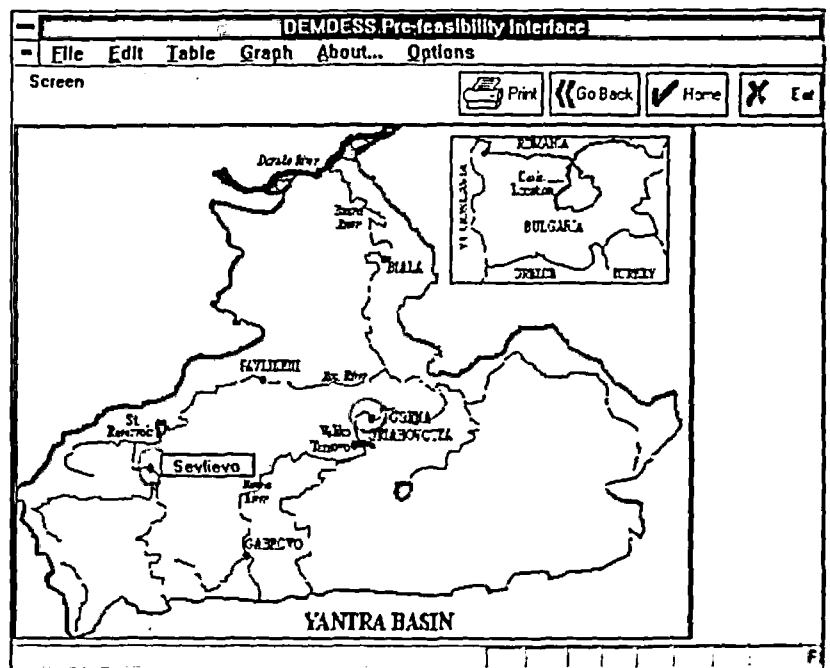
Working with EPA's Air Pollution Prevention and Control Division, RTI evaluated various pollution prevention techniques that can reduce styrene emissions. RTI engineers conducted emissions testing in an isolated spray booth at the Reichhold Chemicals, Inc., physical testing laboratory in the Research Triangle Park. The booth was equipped with monitoring devices to measure styrene emissions, making it possible to evaluate, for example, the use of nonspraying equipment, improvements in operator spraying technique, and different gel coat and resin formulations.

Test results have indicated that pollution prevention techniques could reduce styrene emissions, and in 1996 RTI will seek more techniques, including airflow management and the effect of fillers in the resin.



The Reichhold Chemicals, Inc., facility in Research Triangle Park, NC, is the site of an RTI project to develop alternative processes that reduce styrene emissions in the fiberglass reinforced plastics and composites industry.

The DEMDESS modeling system is helping clean up the Danube River by giving local and regional decision makers user-friendly access to comprehensive data about the river and the impacts of their alternatives.



Restoring the Danube River

In recent years, RTI has found creative new applications in Central Europe for U.S. experience in protecting waterbodies. In 1995, and continuing in 1996, RTI's efforts have come full circle, with the new methods being applied in the U.S.

RTI has worked for years with EPA and state agencies in the U.S. to collect and analyze data on the quality of waterbodies and the costs of pollution control. RTI took this experience to Central Europe and applied it in a multinational effort involving Bulgaria, Hungary, and Slovakia to restore the environmental and commercial value of the Danube River.

The result was DEMDESS, a comprehensive database and modeling system that lets decision makers at the local, regional, and national levels predict how their water treatment decisions will affect the river. For example, by directly linking treatment costs with improved water quality, DEMDESS demonstrated for one city that cleaning up a tannery would be more cost-effective than any other option to obtain improved water quality.

Now, state and local governments in the U.S. have recognized that the approach used in DEMDESS could be of value to them, and RTI is developing U.S. applications.

Software Provides Training in Waste Management

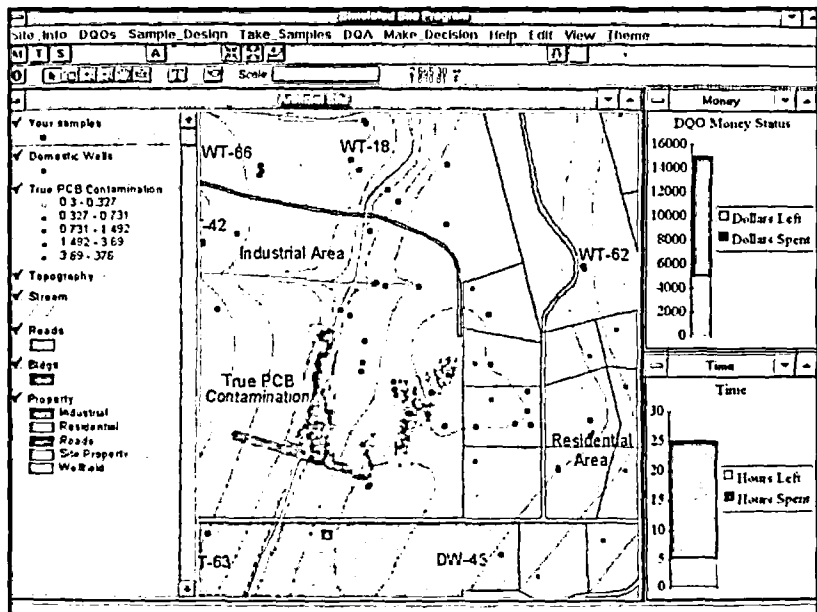
In 1995, RTI developed a computer-based training tool to help managers of hazardous waste sites learn to conduct field investigations more efficiently and effectively. The tool applies RTI's years of experience in EPA-funded research on such sites.

The Simulated Site Interactive Training Environment (SimSITE) functions like a cross between a data management tool and an adventure game. It contains extensive data on a hypothetical hazardous waste site, along with reference data and statistical tools for implementing the Data Quality Objectives process (an approach that RTI helped EPA develop for planning environmental data-collection activities).

Through a graphical user interface, the user simulates the planning and implementation of sampling at the site. The goal is to determine which areas are contaminated while working within cost and time budgets. Once the user has decided which areas of the site are contaminated, SimSITE reveals the "true" locations and evaluates the user's sampling design.

Although SimSITE has a lighter side, expressed in game-like features, future development will allow the core components to be adapted for use as a tool for environmental statistics and quality assurance research using computer simulation methods.

The SimSITE software trains managers of hazardous waste sites and is being developed as a tool for environmental statistics and quality assurance.





By developing and applying new test methods, RTI helps industry meet consumers' demands for reduced indoor air pollution from products such as office equipment and aerosol sprays. Above, RTI engineer Don Whitaker operates a test chamber.

Improving the Indoor Atmosphere

Modern office equipment can relieve business-efficiency headaches, but its emissions of indoor air pollutants can give some people literal headaches and other ailments. Concerned manufacturers are addressing this problem, but they have encountered a lack of basic information to help them identify sources and specific pollutants.

RTI is part of a cooperative research program to investigate pollution prevention approaches for reducing air emissions from office equipment. RTI chemists and engineers, along with researchers from EPA and Underwriters' Laboratories, Inc., are bringing to bear years of experience in air sampling and analysis to develop standard methods to characterize and identify sources.

RTI has developed chamber tests for evaluating products during operation in a controlled environment that approximates conditions found in office buildings. In a recent study on photocopiers, RTI provided industry with information for comparing emission rates and types of pollutants.



Emission Measurements Protect Your Health

RTI's work to develop test methods for measuring air pollutant emissions from consumer and commercial products is important to government and industry because these test methods help ensure that regulations are both cost-effective and meaningful. This work also is important to consumers who are concerned about air quality inside their homes and workplaces, and outside in the backyards and streets of their home towns.

One important issue addressed in 1995 is emissions of volatile organic compounds (VOCs) from consumer products, such as aerosol sprays, that contribute to photochemical smog. Working for both EPA and the California Air Resources Board, RTI has developed reliable, cost-effective methods to test such products for compliance with emission regulations.

Currently RTI is developing methods to measure VOCs from wood furniture coatings and printing inks.

Multimedia Risk Assessment

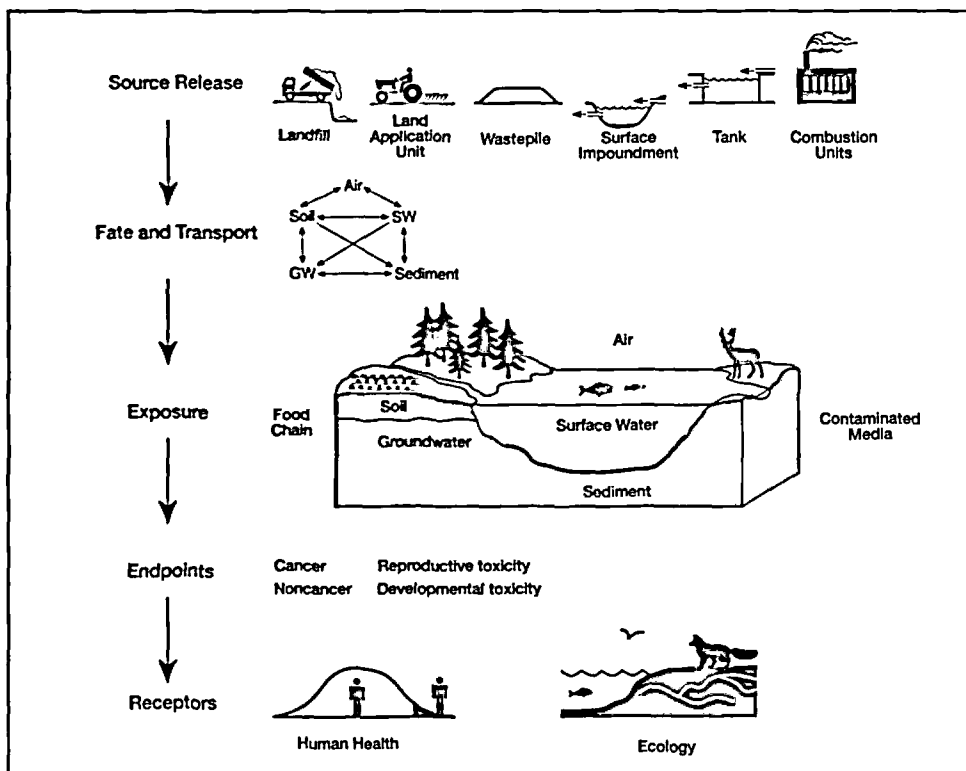
In 1995, RTI conducted numerous site-specific multimedia, multipathway risk assessments to assist EPA regional offices with a strategy to reduce reliance on combustion of hazardous waste and to encourage waste reduction. One of the primary goals of this strategy is to ensure that combustion facilities do not pose unacceptable risk to human health and the environment.

Under each assessment, risk estimates address different human exposure scenarios representing typical populations and high-risk subpopulations (e.g., infants and children). These assessments include exposure to contaminants through multiple routes, including consumption of food and water, incidental ingestion of soil, and inhalation of vapors and particulates.

Also in 1995, RTI assisted the NC Division of Solid Waste Management in the development of a protocol that will help permit applicants conduct indirect risk assessments for use of hazardous waste as fuel. Establishing this protocol will enable the state to promote consistent risk assessments that allow evaluation of human health risks while minimizing cost to the regulated community in terms of both time and resources.

In 1996, RTI is developing a software package, MultiPathway Analysis Tool for Health and Ecological Risk (MPANTHER), that will serve as a tool to assist state and federal agencies in conducting multimedia, multipathway risk assessments. Through the use of MPANTHER, the assessor will be able to evaluate risks attributable to releases from combustion units as well as other waste management units, such as landfills, surface impoundments, land application units, and storage and treatment tanks.

Multimedia, multipathway risk assessments provide thorough and consistent evaluations of human health risks from pollutants.



Public Policy

Through analysis, demonstration projects, evaluations, and technical assistance, RTI translates research into effective policies that make positive differences in people's lives. RTI's staff are at work in education, public utilities, public health, and environmental protection, both in the United States and in developing countries.



Jerry VanSant (upper left), RTI's director of International Development, and RTI's Al Sharp (upper right) consult with local government officials in former Soviet States (page 16).



Early Childhood Education and Intervention

RTI serves as the project coordinating center for Project BEGIN, a multiyear study funded by the Centers for Disease Control and Prevention. This longitudinal study will test the effectiveness of a specific early childhood intervention model, providing data to assist in establishing state and national policies and services for young children and their families.

The primary criterion for participating in the study is low maternal education (defined as less than 12 years of formal education at the time of delivery). Participants receive a comprehensive, family-centered program to promote optimal development of the child and to enhance the quality of the interaction between parent(s) and child. The intervention will last three years and will include home visits, attendance at a child development center, and participation in parent groups. Program staff will help families access needed services within the community during the three-year period.

Project BEGIN is designed to provide extensive data about the potential benefits of early intervention for at-risk children and their families. Follow-up studies will be conducted to determine the long-range educational and social outcomes (e.g., school performance, employment, dependency on social services, incarceration).

At the conclusion of this study, policy makers at national, state, and local levels should have a deeper understanding of the impact that early intervention can have on subsequent academic performance and social adjustment.

(Far Left) RTI's project BEGIN is providing extensive data about the potential benefits of early intervention for at-risk children and their families.

(Left) Vocational rehabilitation helps thousands of people improve their employment and earnings. RTI research contributes to decisions on improving this important effort.

Redesigning a State's Education System

In 1995, RTI started a new initiative to help improve education in North Carolina through greatly enhanced use of information for management of schools and instruction in the state's elementary schools.

One aspect of this initiative focuses on providing local superintendents and school principals with better, more timely, and more usable information about their schools and the performance of their students, along with expert analysis and recommendations on how to use the information. In 1995, RTI designed a system to provide a comprehensive diagnostic profile that identifies strengths and opportunities for improvement in individual schools. The profile, combined with RTI consultation and support, is being implemented in 1996 to assist principals in working with teachers, parents, and local policy makers to plan an allocated resource for improving student performance.

Vocational Rehabilitation Sustains Productive Lifestyles

In 1995, RTI completed the first year of data collection for a six-year longitudinal study of the Vocational Rehabilitation Service Program.

Funded by the Rehabilitation Services Administration (RSA) of the U.S. Department of Education, the RTI study will evaluate the performance of the program in increasing employment and earnings among individuals with disabilities. The foremost goal of the project is to assist Congress and RSA in determining the extent to which vocational rehabilitation services help persons with disabilities to achieve sustained improvement in employment, earnings, independence, and quality of life.

Data collection from about 10,000 randomly selected consumers in 40 locations across the country will continue over a three-year period, enabling RTI to investigate the entire vocational rehabilitation process from application for services to three years after case closure.

The final report, scheduled for 1999, will enable Congress, RSA, and state agencies to make decisions regarding vocational rehabilitation program improvement.



RTI has launched a new program to help schools in North Carolina enhance their use of information for improving education.

City Governments and Residents Working Together

During the past two years, RTI technical advisors in eight cities of the former Soviet Union have led the field work for the Municipal Finance and Management Project, funded by the U.S. Agency for International Development.

RTI's accomplishments represent landmarks in the progress of cities and their citizens away from top-down political control and toward representative democratic self-rule by making city administrators more accountable, giving people a voice in local decisions and saving scarce resources by improving efficiency.

This effort introduces municipalities in Russia, Ukraine, Kazakhstan, and Kyrgyzstan to the best available techniques and systems for budgeting, finance, and management, in the context of democratic local governance and the free market system.

Practical examples include getting mayors to hold public televised hearings on the budget, to hold focus groups with residents, and to publish detailed budget information in newspapers; teaching courses in municipal finance to federal, regional, and local officials; adapting financial management software, installing it, and teaching municipal staffs how to apply it and to share information; creating economic planning departments to encourage trade and tourism, and investigating ways to improve services such as transportation.



In Ternopil, Ukraine, RTI helped improve management of a badly degraded bus fleet, on which 90 percent of residents rely for basic transport. RTI's Paul Hoover (right) joins a city official in dedicating a new addition to the fleet.

Community Involvement in Managing Environmental Pollution

RTI has been active internationally with water, sanitation, and environmental health issues for more than 15 years through projects with the U.S. Agency for International Development. The goal is to reduce environmentally related diseases and hazards, including tropical diseases, so that nations can develop to their full economic and social potential.

An important new initiative is called Community Involvement in Management of Environmental Pollution (CIMEP).

CIMEP's purpose is to promote greater understanding and partnerships among municipalities, national decision makers, private-sector organizations, and the client communities they represent. These efforts help to resolve environmental health problems with community-based local solutions.

In a process that takes one to two years, RTI helps communities with five main activities:

- risk assessment to define training needs, health conditions to be addressed, and cultural and other factors to be considered;
- skill-building workshops at which participants from national ministries, municipal governments, and non-governmental organizations create a specific work plan;
- follow-up practicums for workshop participants;
- community-level interventions, called microprojects;
- policy makers' roundtables for municipal staff to discuss issues that constrain their work in communities.

RTI helped design the CIMEP model and is involved with implementing it in Tunisia, as well as planning for implementation in Egypt, Jordan, Gaza, and Morocco.

International Development



**Family Planning Contributes to
Socioeconomic Development
Infant and Maternal Deaths Averted
1972-1991**

Infants 1,935,000

Maternal 198,000

In Bangladesh, RTI conducted a benefit-cost analysis comparing the cost of an enhanced family planning program with the savings that would accrue in other social services.

Strengthening Population and Health Policies

In 1995, RTI became part of a team that embarked on a new population-related effort by the U.S. Agency for International Development, called the POLICY project.

"Participation" has been a key concept during RTI's 17 years of implementing this type of international population project. This concept has made RTI a leader in providing technical assistance for population, family planning, and reproductive health policy development.

The main purposes of these efforts are to help developing countries create a participatory policy process and to develop and implement policies that respond effectively to the needs of family planning clients.

Bangladesh has received special attention because its population density and growth rate are among the highest in the world, while the country is among the poorest. Analyses by RTI staff have demonstrated that family planning in Bangladesh significantly improves health and reduces mortality rates for women and young children. A benefit-cost analysis of Bangladesh's family planning program, conducted by RTI and Bangladeshi partners, showed that the family planning program also is an excellent financial investment for the nation's government.

In 1996, a joint RTI-Bangladeshi team will complete a 10-year strategic plan for the national family planning program. Future RTI assistance will include developing presentations on "Family Planning, Quality of Life, and Community Participation." The goal of these presentations is to show community leaders and decision makers at all levels that slowing population growth through family planning is vital for Bangladesh's well-being at the household, community, and national levels.



In Tunisia, members of local Water Users' Associations work to solve environmental health problems such as partial waste and sewer systems.

Health and Medicine

RTI focuses on helping government, industry, and the public identify and use the most cost-effective approaches to preventing and treating problems arising from drug abuse, chronic disease, infectious disease, aging, violence, and other issues in human health.

Access, quality of care, and sound data for decision making are key elements of RTI's achievements on cost-effective health care (pages 20-21).



Restoring Hearing with Cochlear Implants

RTI is working to improve the performance of signal-processing devices that restore some hearing to people who cannot be helped with hearing aids. Projects in 1995 and 1996 include studies of profoundly deaf patients who have electrodes implanted in their inner ears (cochleas) or brain stems and pilot studies of acoustic synthesis aids designed to bring similar benefits without surgery to patients who have some residual hearing.

RTI's research focuses on patients who have direct access to their implanted electrodes through their skin. Wearable speech-processing hardware that supports advanced RTI designs, built at the University of Innsbruck and the Cantonal Hospital of Geneva, is now available for studies of everyday use by several such patients. Direct access to the electrodes also allows measurement of intracochlear potentials evoked by electrical stimulation. This promising technique allows researchers to observe how the auditory nerve responds to stimuli and should eventually lead to greater refinements in speech-processing technology.

Some patients with severed auditory nerves receive implanted electrodes in their auditory brain stems. RTI designed the processing strategies for such patients and soon will assess the potential of such strategies when used with new multielectrode implants developed by the House Ear Institute in Los Angeles.

(Left) Cochlear implant patients come to RTI's laboratories to work with Charles Finley, Ph.D., in R&D of signal processing devices that enhance the performance of auditory prostheses.

(Right) RTI drug discovery emphasizes teamwork with industry and government to develop compounds such as 9AC, an anticancer drug based on camptothecin, a compound discovered in RTI's natural products program. 9AC is now in clinical trial, licensed by RTI to Upjohn-Pharmacia.

Discovering New Treatments for Pain and Addiction

During the past year, RTI has compiled a library of the compounds its scientists have developed in 35 years of chemistry research. Additional chemical libraries are being generated by the use of combinatorial chemistry. Along with the Institute's ability to develop rapid bioassays for screening candidate compounds, the approach offers a powerful tool for discovering new pharmaceuticals.

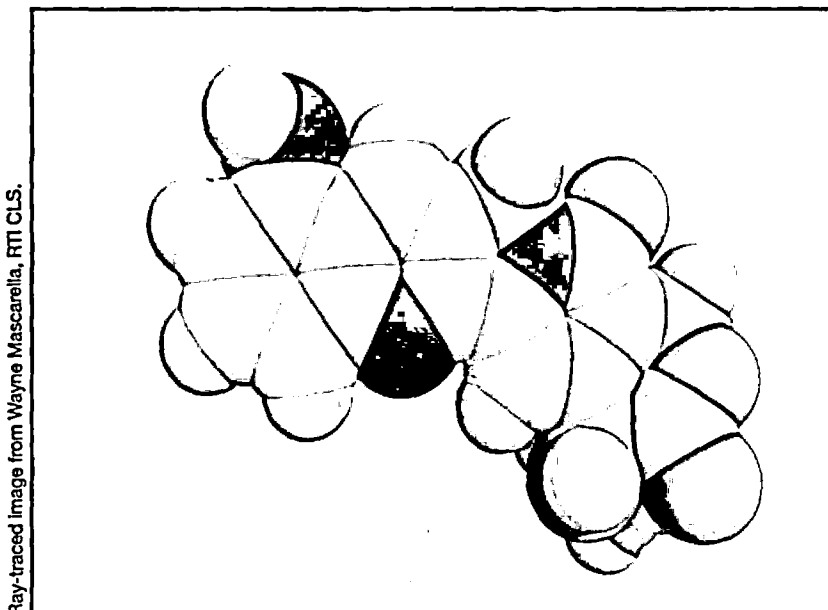
In 1995, RTI started a new effort, supported by the National Institute on Drug Abuse and in collaboration with industry scientists, to use combinatorial chemistry in development of compounds to treat pain and addiction to opiates such as heroin. These new compounds also will serve as important tools for research on the biochemical processes of addiction and effects of withdrawal.

New Cancer Drugs from Natural Products

In 1995, RTI formed a new alliance with North Carolina Central University to establish a natural products research program at the university, coordinated with a growing biotechnology industry in the state.

Also in 1995, RTI developed a new research team, including RTI, the University of Illinois at Chicago, and Bristol Myers Squibb Co. Each group brings unique knowledge, such as Bristol's outstanding capability to screen new compounds for effectiveness.

RTI has a rich history of discovering natural products for treating cancer, including the well-known drugs taxol and camptothecin. In addition, RTI has contributed to the science and methods of natural products discovery, as recognized by numerous awards to Dr. Monroe E. Wall and Dr. Mansukh C. Wani.



Cost-Effective Care

Helping State and Local Governments Assess Immunization

Public health officials have long known that vaccinations against preventable childhood diseases are among the most effective public health measures available. Across the nation, state and local programs urge parents to immunize their children, and, in some places, students must be vaccinated before they can enter school.

But data documenting how well these efforts work vary greatly from state to state. With funding from the National Center for Health Statistics and the Centers for Disease Control and Prevention's National Immunization Program, RTI statisticians are developing a reliable method that state and local governments can use to measure childhood immunization rates.

In 1995, RTI researchers evaluated the relative costs and data quality for two primary modes of data collection: telephone and mail. In 1996, they will complete a survey manual and computer software that health departments, with limited staff, can use to conduct immunization surveys.

Quality and Cost-Effectiveness in Long-Term Care

RTI research has improved the quality of long-term care while helping to contain and manage costs.

While RTI was completing a national study on the impact of state regulation on quality in board and care homes in 1995, RTI and the State of North Carolina already were putting the results to work by determining the level of resident disability and developing a resident assessment system to improve the quality of care.

Under contract to the Health Care Financing Administration, RTI also led a team that developed the national Nursing Home Resident Assessment Instrument (RAI), often called the Minimum Data Set. The RAI helps long-term care providers assess needs of individual residents and develop their plans of care. It is used in all nursing homes in the U.S. that serve Medicare and Medicaid patients and is being tested throughout Europe and in Japan. A five-year study of the RAI's impact in the U.S. found it improved the quality of care and led to a significant reduction in the number of nursing home residents who were hospitalized.



Using a research design developed by RTI, local health departments with limited staffs and budgets will have a practical way to assess immunization rates in their communities.



Good Decisions Mean Good Health

Throughout the health care system, competition is growing and opportunities for consumers to make choices are expanding. So far, however, consumers lack consistent indicators to measure the performance of health-care insurance and managed care plans. Such indicators would empower consumers to make informed choices. This, in turn, would bring free-market forces to bear on companies and encourage them to improve service and cost-effectiveness.

In 1995, RTI completed a project to identify the kinds of information consumers want and need and began developing effective ways to communicate it. RTI also is developing new tools to generate needed information, such as surveys of consumers' satisfaction with their health plans. This work has been conducted for two federal health agencies.*

For the State of Maryland, RTI is putting the results of federally funded research to work by designing a survey to assess the performance of health maintenance organizations that serve the state's residents.

In addition, RTI is designing "information interventions," using multiple media to communicate with consumers. In several states, RTI will implement these interventions and evaluate their effectiveness.

*The Agency for Health Care Policy Research and the Health Care Financing Administration, both of the U.S. Department of Health and Human Services.

(Top) An approach developed by RTI is helping long-term care providers in the U.S. and around the world assess and cost-effectively meet the needs of individual patients.

(Left) RTI is leading a research consortium to develop information interventions to feed back survey results and other health plan information to health care consumers and evaluate the impact of the interventions on health plan choice.



Health and Social Outreach Programs

Communities near the Research Triangle Park often benefit from their proximity to RTI when Institute researchers team with local social service organizations to conduct research on the most effective ways to solve social problems.

In 1995, RTI researchers started a new program, working with state and local agencies in Wake County, North Carolina, to measure HIV risk and the effect of risk-reduction efforts, primarily targeting women substance abusers in rural areas and urban hot spots. In a demonstration project, outreach workers canvass the community while a mobile unit, which functions as a data-collection and intervention office, facilitates access to "hard-to-reach" populations. RTI researchers and their colleagues in Wake County are gaining a deeper understanding about at-risk individuals and information about which kinds of intervention programs most effectively reduce HIV risk.

An ongoing project in Durham, North Carolina, funded by the Centers for Disease Control and Prevention's (CDC's) Division of Violence Prevention, aims to help curb the high level of violence among African-American male adolescents. Working closely with Durham government and community groups, RTI researchers are developing, implementing, and assessing a multifaceted, community-based, violence-prevention program.

Helping States Cope with Substance Abuse

With funding from the U.S. Center for Substance Abuse Treatment, RTI started working with six states in 1995, applying the Institute's extensive experience in drug abuse epidemiology to help the states establish their needs assessment data for preventing and treating alcohol and drug abuse.

As budgets become tighter, states increasingly need reliable data on the extent and nature of problems they face and the effectiveness of their programs and services that address those problems. Knowledge and experience in surveys and in research on substance abuse treatment make RTI staff natural partners for state officials.

RTI has developed a set of studies, specifically configured for each state. The studies cover populations ranging from school-age children to adults, as well as people on probation and both juvenile and adult arrestees. The studies also include assessments of alcohol and drug abuse treatment systems and models for integrating the results into a comprehensive view of the needs for treatment services in each state.



Teaming with local service agencies in 1995, RTI is evaluating the impact of new approaches to prevent substance abuse and HIV, so that other communities can implement cost-effective interventions. This van is part of an outreach demonstration project in Wake County, NC.

Quality Adds Value to Drug Abuse Treatment

Managed care, rapidly becoming universal in health care, is a strategy to ensure that payers, such as insurance companies, receive the greatest value for their dollar. While this thinking usually focuses on cost, RTI is working on another measure of value: quality. With funding from the National Institute on Drug Abuse, RTI is working on an approach aimed at making existing drug abuse treatment programs better, so they will have more impact.

This effort focuses on methadone treatment programs for opiate addicts. RTI provides quarterly program reports to the methadone programs and governments in seven states. These reports support comparisons of outcomes within the state and across the nation.

The idea is to give programs information for targeting their quality improvement efforts and to give decision makers, legislators, and payers hard evidence of what they really are getting from each program's services.

Using these reports positions the programs and the states to comply with requests for treatment outcome information and to enrich total quality efforts to improve treatment.

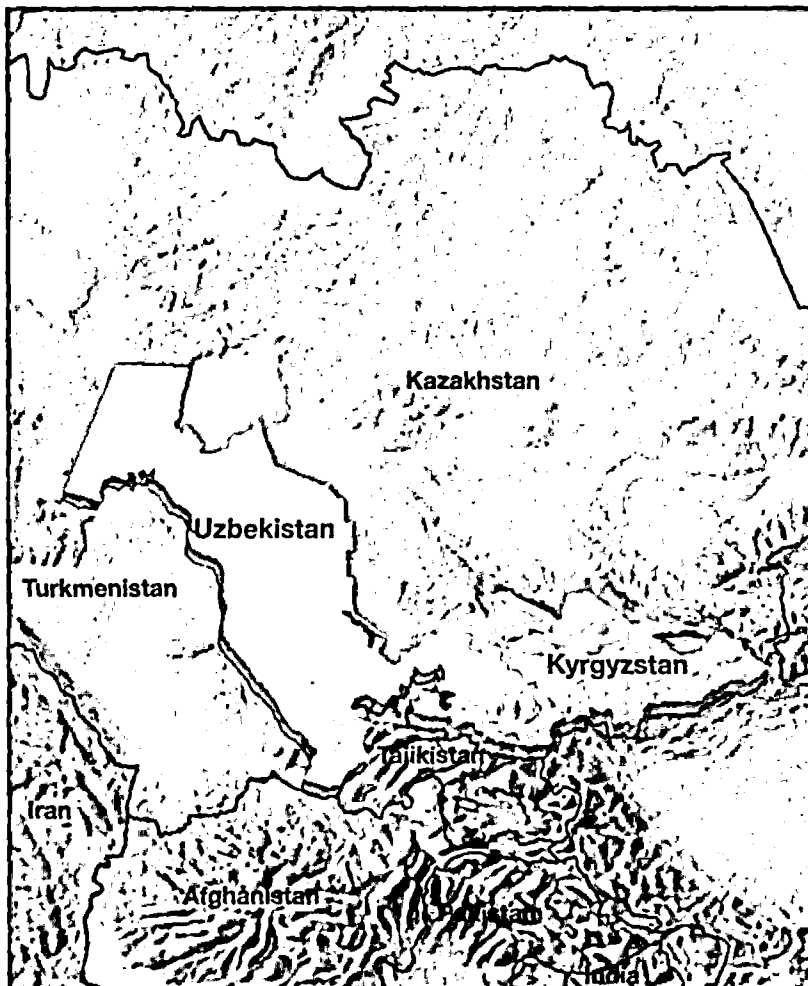


RTI research has shown treatment to be one of the most cost-effective tools for combating drug abuse. By teaming with state governments, RTI helps the states assess their needs for treatment programs, as well as utilize a managed care approach to enhance the value of these programs.

Survey Research Helps New Nations Govern

As developing countries make the transition from ~~command~~ models to decentralized market-based models, new governments often need to learn more about their people. With a new program started in 1995, RTI researchers are making that transition easier in Uzbekistan and Kyrgyzstan, new republics in Central Asia.

By using survey research methods developed in the United States, and working closely with local policy makers and researchers, RTI is helping these republics develop baseline measures and trends of living standards and poverty. The goal is to design and implement household surveys that provide information about family expenditures, employment, agriculture, energy use, health and nutrition, and social demographics. This information will support decisions on health care, education, municipal services, and job skills, helping the governments establish policies that address the needs of their populations.



The Central Asian republics Uzbekistan and Kyrgyzstan are the first to benefit from a new RTI program that helps emerging nations use survey research to support decisions on topics such as health care, education, municipal services, and job skills.

Pioneering Methods for Collecting Sensitive Data

Participants in surveys that ask about sexual partners, abortion, and HIV-risk behavior might feel uncomfortable discussing these topics at home, if it were not for an innovative, private method for conducting the interview. Listening to recorded questions over headphones and typing responses into a laptop computer, a respondent can complete a questionnaire, and nobody in the house can overhear.

RTI has pioneered this survey technology, called audio computer-assisted self-interviewing (ACASI). In 1995, RTI became the first organization to put it into large-scale field use.

Data from the National Survey of Family Growth help policy makers with issues such as preventing teenage pregnancies, assessing contraceptive effectiveness, coping with infertility, and providing child care. RTI has successfully used ACASI to gather information from more than 10,000 respondents in the survey.

Another 1995 project using ACASI technology was a national survey of adolescent males, in which RTI used both paper-and-pencil and ACASI interview methods. RTI found that respondents were more than four times as likely to report some sensitive behaviors in the ACASI interview than by paper-and-pencil.

For a national study of young mothers and pregnant women in 1996, RTI is using ACASI in a clinic setting as the sole questionnaire administration method.

RTI's ACASI technology has been accepted by key investigators because it produces significantly greater reporting of sensitive behaviors, respondents strongly prefer using it, and it works effectively in demanding field survey situations.

The ACASI method makes survey respondents more comfortable answering sensitive questions. In addition, RTI research has shown that the method also improves response through improvements such as better cognition of questions.



Operating Highlights

1995 Results

In 1995, RTI continued its record of growing in a very challenging marketplace.

Revenue in the 1995 fiscal year was \$141.8 million, a 12.3% increase over the previous year. RTI also booked \$149.7 million of new funding for research. This total was 5.2% higher than the previous year and represents the third consecutive annual increase in new business.

RTI owes this success primarily to initiatives that combine to give its clients greater value. The primary initiatives are investments in research capabilities, control of costs, and development

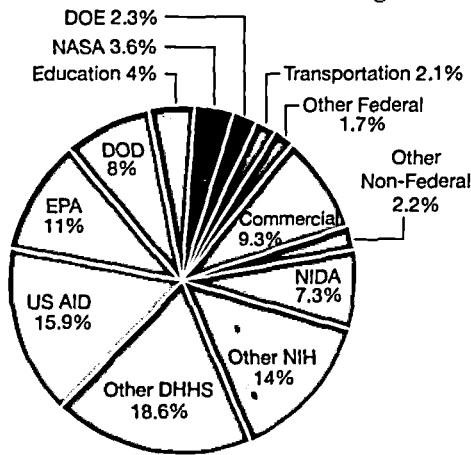
of teaming arrangements to put R&D results to work.

Investments

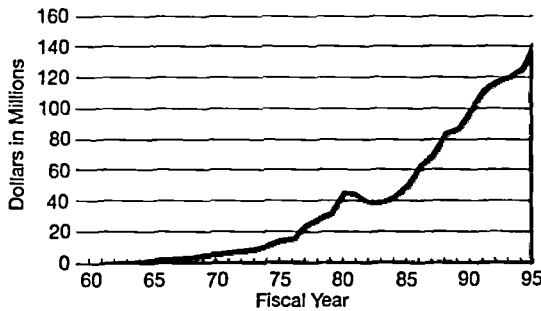
RTI makes systematic investments in its technical capabilities while carefully controlling costs.

Examples of investments in research capabilities include combinatorial chemistry (page 19), audio computer-assisted self-interviewing (page 25) and virtual reality (page 3).

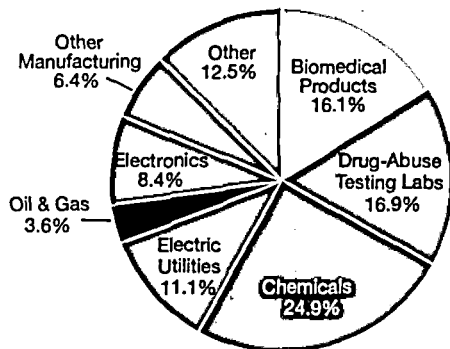
At the same time, RTI's staff have achieved a 9.2% decrease in the research overhead rates charged to clients and a 7.9% decrease in administrative rates, compared with 1993. Continued reduction in overhead rates is planned for 1996.



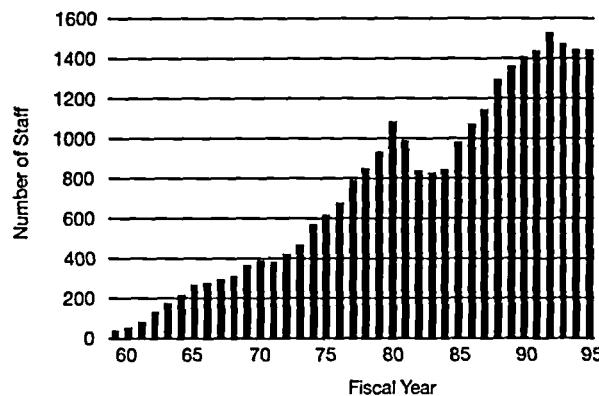
1995 Revenue



RTI Revenue



1995 Industry Revenue



RTI Staff

Teamwork

RTI has found new ways to ~~develop~~ one of its traditional modes of ~~doing business~~: forming teaming arrangements with the private and public sectors.

In 1994 and 1995, RTI ~~increased~~ an emphasis on working with industry ~~and~~ with state, local, and foreign ~~governments~~. As a result, an increasing share of RTI's revenue comes via teaming arrangements with industry, state and local ~~governments~~, and human service providers. Examples include diamond technology (page 7), biomass for alternative ~~energy~~ (page 9), new projects in six states to improve drug abuse treatment (page 22), and rapid growth in assistance to ~~developing~~ countries (pages 17 and 24).

This kind of teamwork is highly ~~effective~~ at putting research results to ~~work~~. Examples of teaming with industry include diamond technology (page 7), middleware for data access (page 5), ~~digital~~ mammography (page 4), synthetic ~~chemicals~~ from coal (page 9), and natural ~~products~~ for cancer treatment (page 19).

Examples of teaming with state and local public service providers include local social and health outreach (page 22), improvement of drug abuse treatment (page 23), health-care information for consumer choice (page 21), and early childhood interventions (page 20).

Many of these initiatives take advantage of the wide diversity of technical capabilities at RTI. For example, conjoint virtual reality for product development (page 3) resulted from teamwork among

RTI's staffs in electronics and economics, assistance to industry in indoor air quality (page 12) is a joint venture of RTI's chemists and engineers, and the success of combinatorial chemistry requires capabilities in synthetic chemistry and life sciences.

Governance and Corporate Officers

Board of Governors

Of the 29 governors, five hold seats by virtue of their positions: the presidents of The University of North Carolina, Duke University, and the Research Triangle Institute, and the chancellors of North Carolina State University and the University of North Carolina at Chapel Hill; two are specified in the Bylaws: William C. Friday and Marcus E. Hobbs; nine are appointed annually to represent Duke University, The University of North Carolina general administration, North Carolina State University, and UNC-Chapel Hill; up to 15 governors are selected from the business and scientific communities.

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The Members are the equivalent
of RTI shareholders. As such, they
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The Members of the Corporation
include: the chairmen and presidents
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RTI officers, including the
research vice presidents listed on
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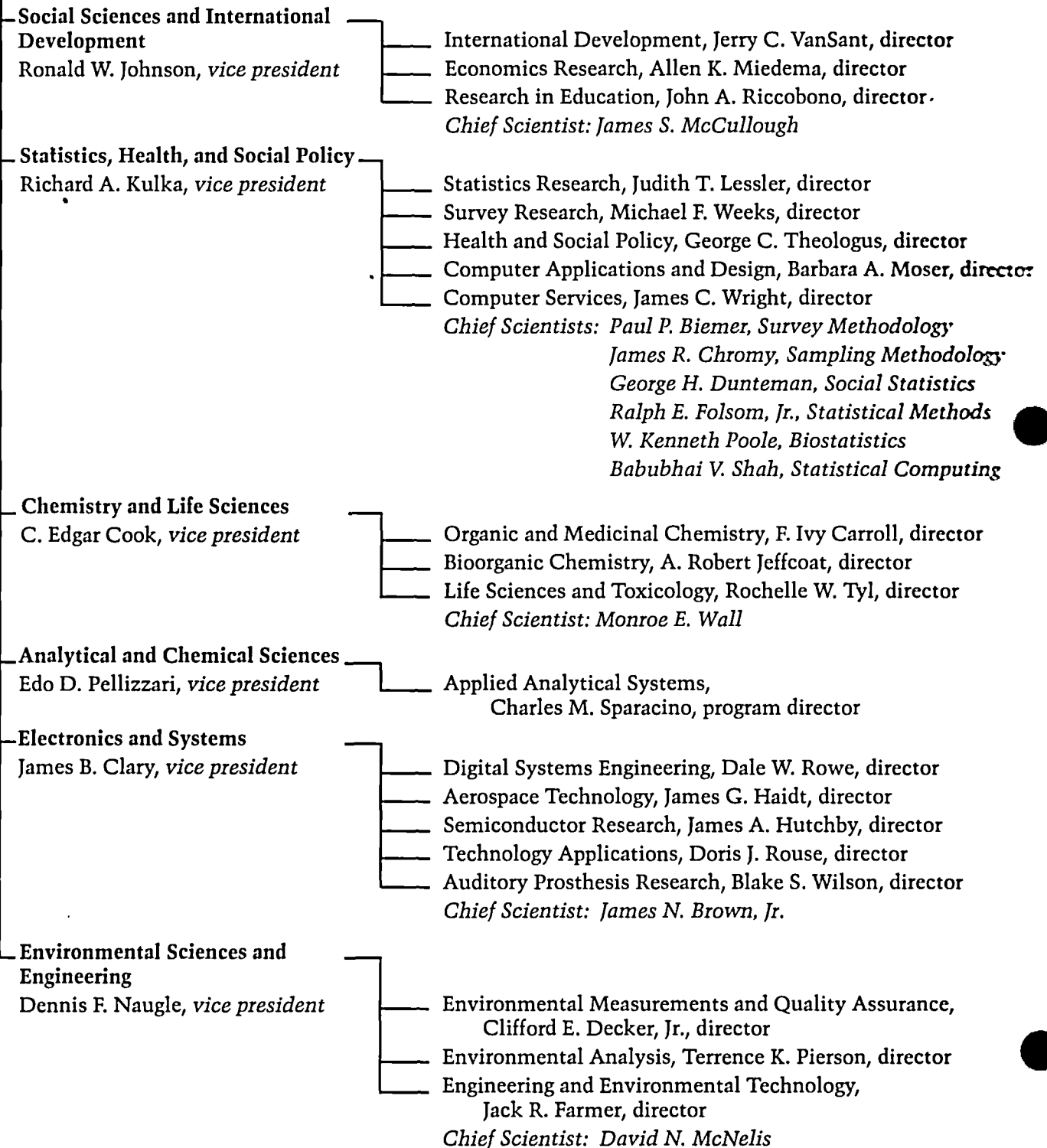
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Executive Committee

F. Thomas Wooten, President ————— Administrative Organization

Alvin M. Cruze, Executive Vice President



Research Programs

Research Triangle Institute

Research Triangle Institute is an independent research organization that serves government and industry clients in the United States and abroad. With a staff of 1,450, RTI conducts research and provides technical services in advanced technologies, public policy, environmental protection, and public health and medicine.

RTI was founded in 1958 as the initial R&D center in the Research Triangle Park. Three universities worked together to establish RTI, and close ties are maintained with these universities through collaborative research, adjunct appointments, and other professional interactions.

Social Sciences and International Development

Applies economic, sociological, psychometric, and policy analysis methods to develop policies for governments and companies. Studies education, social welfare, environmental protection, public utilities, and economic development.

Statistics, Health, and Social Policy

Conducts collaborative research on public health, medical, environmental, social, and other areas of public policy and research. Designs and carries out scientific sample surveys, epidemiologic studies, community-based research, and clinical research. Provides evaluations of products and programs for public- and private-sector sponsors. Evaluates the effectiveness of national, regional, and local initiatives. Provides specialized data capture, management, and analysis for statistical, social, and policy research.

Chemistry and Life Sciences

Designs, synthesizes, and assesses pharmaceuticals and agricultural, industrial and environmental chemicals. Performs research in synthetic and bioorganic chemistry, metabolism, immunology, toxicology, and polymers.

Analytical and Chemical Sciences

Develops fundamental analytical methods and applies them in research on pharmaceuticals, pollutants, toxicology, and industrial processes.

Electronics and Systems

Develops electronic technologies for aerospace, manufacturing, and medicine. Technical areas include materials and devices, reliable high-performance systems, graphics, communications, automation, software engineering, and computational intelligence.

Environmental Sciences and Engineering

Develops basic information, regulatory strategies, and new technologies for environmental protection. Provides environmental measurements, quality assurance, risk assessment, technology assessment, chemical engineering, indoor and outdoor air quality analysis, pollution prevention, and contamination control.

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