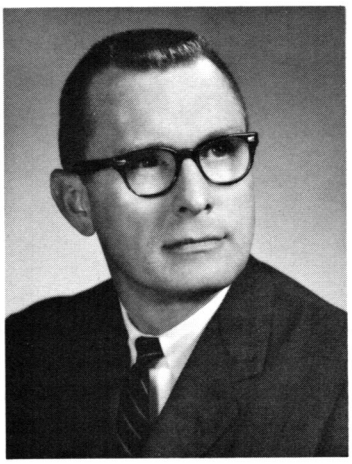

Industrial Nucleonics CORPORATION
AccuRay®



THE COMPANY

Since 1950 Industrial Nucleonics has concentrated on development of industrial process management systems, and has pioneered in the application of sound economic principles to the control of essential customer profit-related variables. Customer acceptance of these basic concepts has caused our company to grow to its present complement of over 750 dedicated, capable people — people who constitute our most valuable asset.

THE CHALLENGE

Our opportunity begins with the recognition of the latent potential savings available through the control of raw materials in basic industries — steel, paper, plastics and rubber. The amount of finished product which can be made from a pound of raw material becomes a key economic factor in determining the overall profitability of each customer's business. Our contribution is based upon our capability to produce significant results by joint cooperative effort.

EVOLUTION OF A PROGRAM

Our company has been a pioneer in the fields of automation and data processing. More than a decade ago we were already viewing each customer's business as a closed-loop function consisting of:

— the *process control system* at the factory level.

— a *central data reduction area* designed to transmit process and production information to a management decision area.

— the *management decision area* where information from the factory is integrated with overall company plans, goals, marketing data and raw material costs.

— the *closed-loop feedback* to transmit management decisions to the factory in a continuing effort to reach optimization.

By applying our systems and consulting services to customer operations, we have opened whole new areas of real-time management control.

RESULTS OPERATIONS PROGRAM

As the technologies, methods and services which define the nature of our business have been perfected, they have been incorporated into an overall effort known as the Results Operations Program — an advanced approach to improving customer operating profits. A closer look at this program as reviewed in this report will provide new insight into our Company.

PERSONNEL

Much of what makes our Company successful rests in the fundamental concepts which guide our personnel. The spirit and motivation of our people in pursuing intelligently planned courses of action justify our optimism for the future.

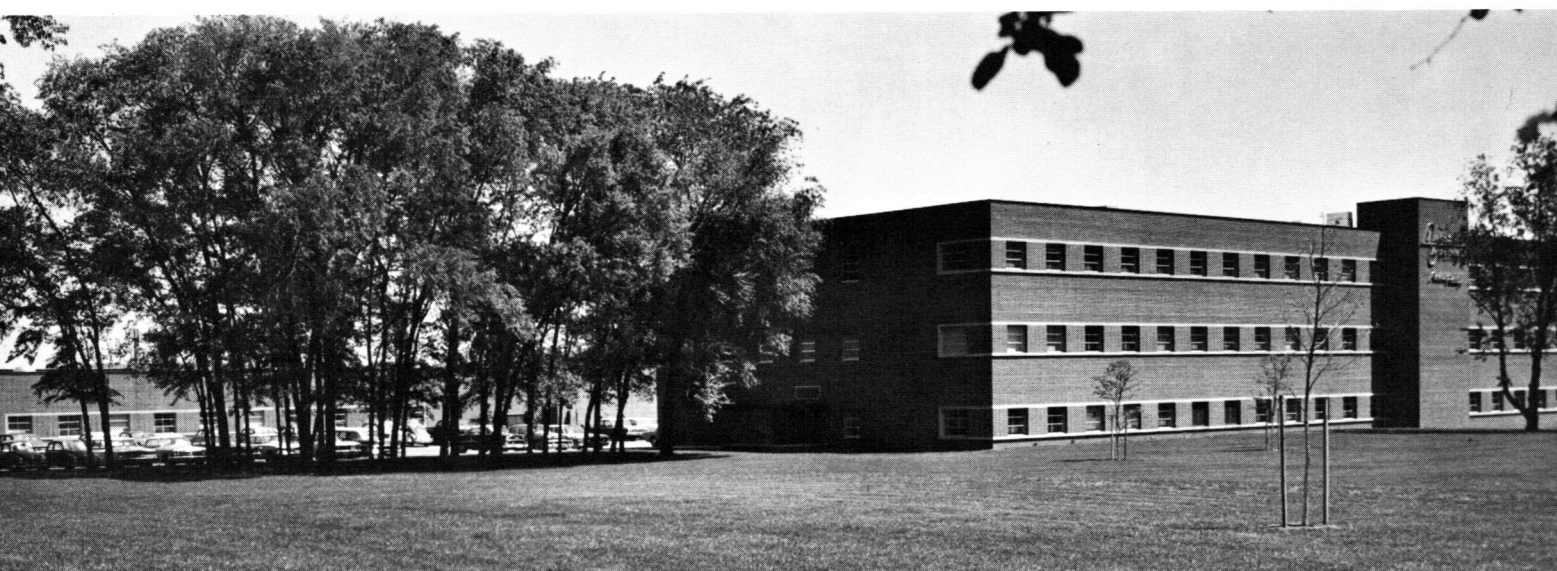
INDUSTRY GROWTH

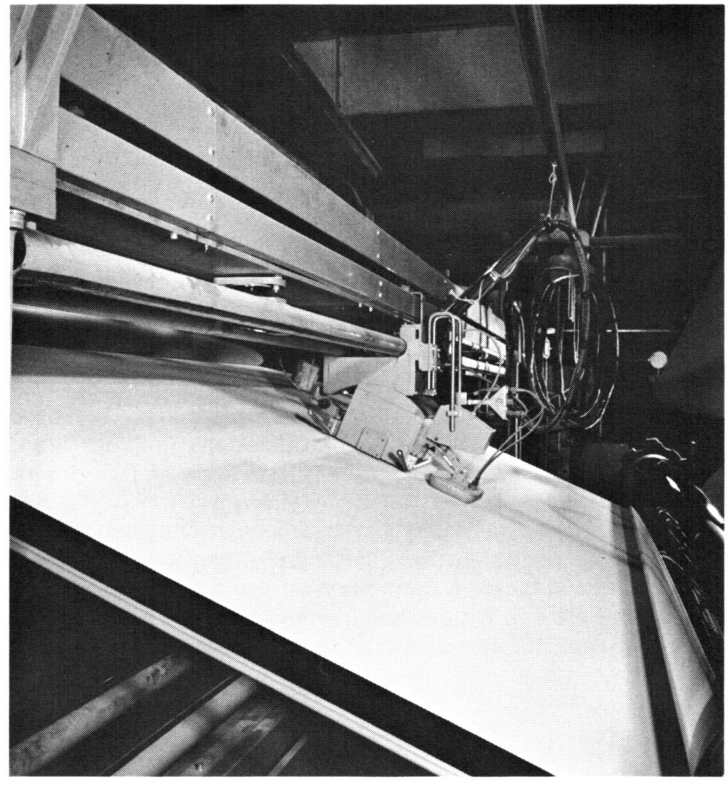
Recent estimates indicate that the industrial segment of the electronics industry — which includes industrial and process controls, analytical instrumentation and data processing — is expected to exhibit outstanding future growth. The Electronic Industry Association predicts an average annual growth rate of 15-20 per cent per year in these markets over the next decade.

We hope this report will create a new awareness of the scope of our activities, capabilities, prospects and plans for future growth.

W. E. Chope

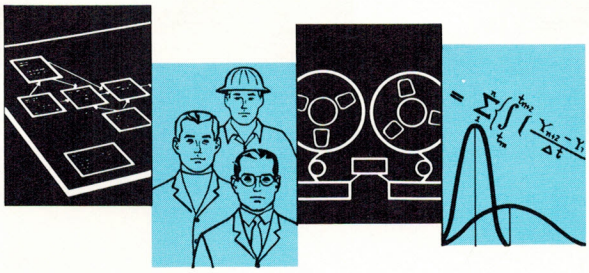
W. E. Chope
Chairman of The Board





Our AccuRay Control System measures (above) and records at the Operator Control Station (left) the primary variables in the bulk-to-area conversion of paper — basis weight and moisture content.

The ratio and absolute amount of fiber and water in the sheet of paper determine the profitability of fourdrinier paper machines, as shown below, which typically process a range of 10-20 million dollars of raw material throughput per year.



the challenge

LATENT POTENTIAL MARKET

A major area of our business centers in the *control* of sheet materials. The world's largest companies — such as U.S. Steel, DuPont, Goodyear and International Paper — produce huge quantities of sheet products such as steel, paper, plastics and rubber. Many of these products are finished goods when they leave the basic manufacturing process. Other products require additional processing before reaching the end user. For example a sheet of cold rolled steel, used to manufacture automobile bodies, must be converted into final form by a stamping operation.

SHEET MATERIALS ARE USED ON AN AREA BASIS

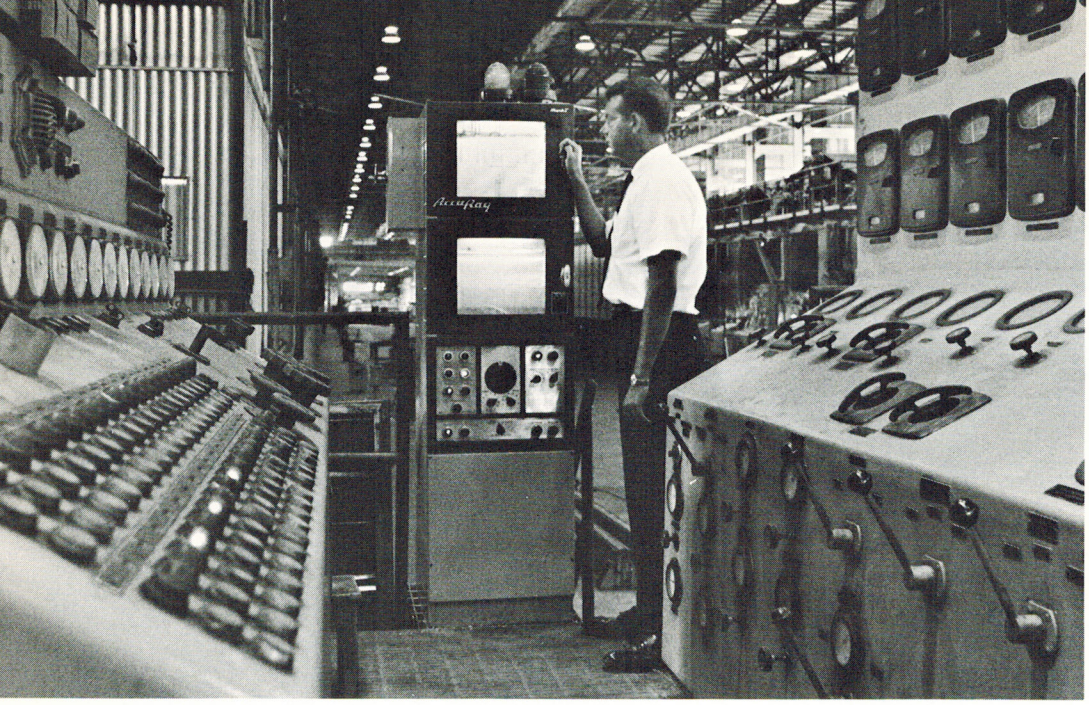
While *all* sheet materials are used on an area basis, they are initially made from bulk material. Paper is made from trees, plastics from man-made chemicals and steel from iron ore. In each process there is a point where the basic transformation of bulk to area must take place.

BULK-TO-AREA CONVERSION RATIO — KEY ECONOMIC PARAMETER

The most important economic factor is the bulk-to-area conversion ratio.

- This ratio determines the square feet of steel, paper, plastics and rubber which can be made from each pound of raw material.
- Bulk-to-area conversion is of prime importance because the basic raw material cost is over 50 per cent of the final product sales price.

The objective is to minimize the quantity of raw material required for a given amount of production while providing a more uniform, higher quality finished product.



The Operator Control Station on this paper machine monitors the daily conversion of 1,000 tons of raw material into 47 million square feet of linerboard—equivalent to an annual raw material throughput of 17 million dollars.

MACHINE COST

Most raw material conversion processes must operate 24 hours a day in order to be profitable. Hence, as demand increases, the manufacturer is not able to add shifts in order to increase production. Major capital investments become necessary. For example, a modern paper machine costs approximately 4 million dollars, and the overall cost of the mill including auxiliary equipment may reach 36 million dollars. The paper industry alone spent 1.5 billion dollars last year for capital equipment. A major portion of this investment was made for new paper mills and other modernization programs.

IMPACT ON CUSTOMER EARNINGS

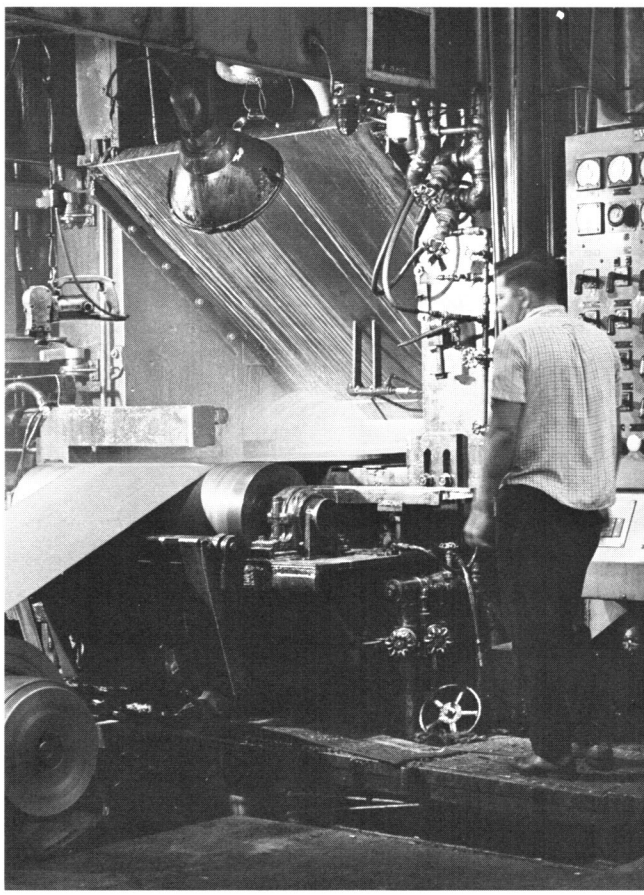
During the last decade basic raw material industries have faced declining profit margins from operations. Industry medians for return on sales during 1967 as reported in *Fortune* magazine for the 500 largest corporations were:

Paper and wood products	4.9%
Rubber	3.5%
Metal products	5.3%

However, the opportunity exists to increase customer profits substantially by minimizing the bulk-to-area conversion ratio.

— A 2-4 per cent savings in raw material costs is equivalent to a 10-20 per cent savings in the product profit margin.

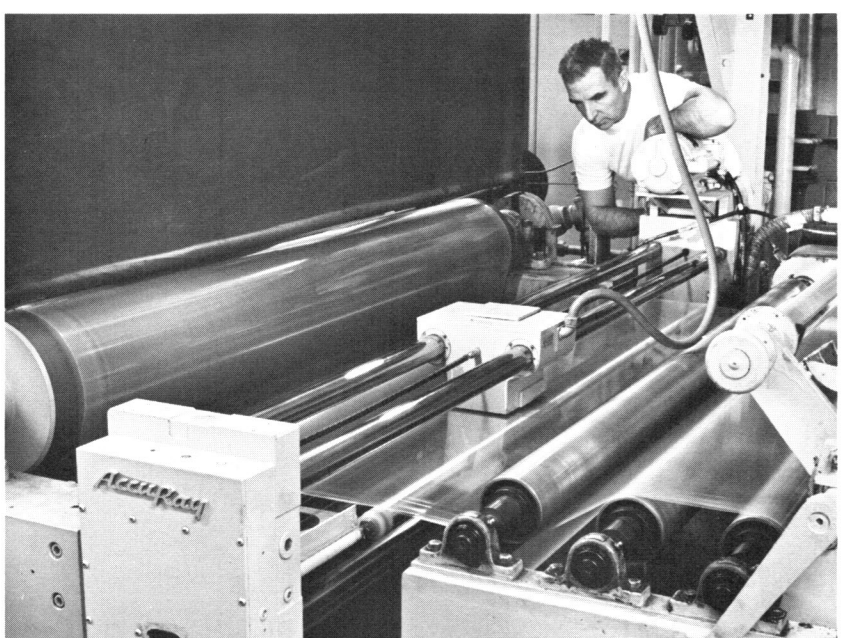
— An increase in throughput of 2-20 per cent from an existing process improves customer profitability through higher sales and lower machine costs.

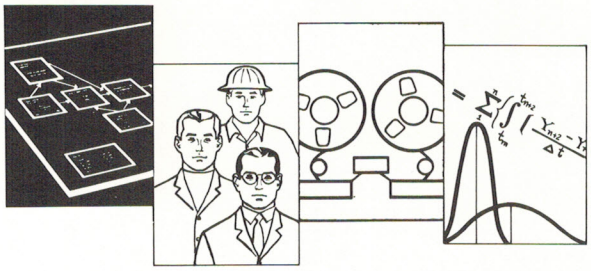


Over 8 million dollars of rubber — approximately 40 million pounds — are used to produce approximately 20 million square yards of tire fabric annually on this calender process.

A steel rolling mill will convert 20-40 tons per hour into final sheet form — equivalent to an annual raw material throughput of 25 million dollars.

A plastic extrusion line will convert 2-4 million pounds of polymer per year — annual value 0.5-1.0 million dollars — into plastic sheet.





results operations program

OBJECTIVE

The Results Operations Program is a planned concentration of resources available to our customers for controlling sheet materials in basic raw material industries.

The Results Operations Program provides a framework within which our people and technologies are integrated with proprietary *experience, methods* and *facilities.* A step-by-step plan guides each application from the beginning—through the required decisions and actions—to its completion.

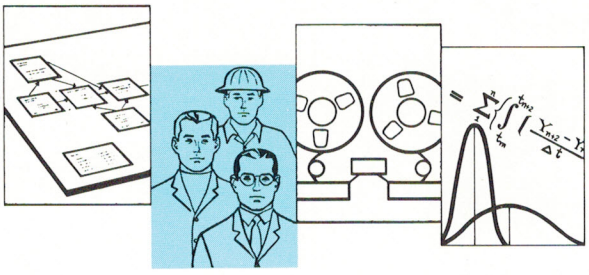
COMBINED EFFORT

Customer management must make sound decisions, however, to achieve the full economic potential. We provide the factual information and consulting services necessary for those decisions at all levels of the customer's organization. The program concentrates our own efforts with those of the customer to:

—establish program goals
—analyze customer operations
—evaluate limit factors on savings and efficiencies
—implement techno-economic management decisions
—provide management information systems.

The Results Operations Program also includes the continuing year-to-year requirements in order to *maintain* a high return on investment from each AccuRay Control System.

Joint teamwork is an essential part of the Results Operations Program on this tire fabric calender installation.



task force

KNOWLEDGE NEEDED

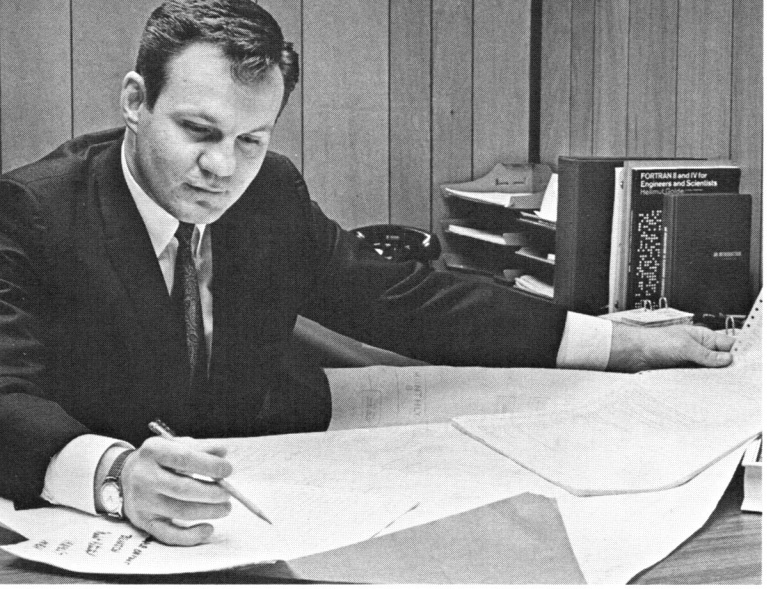
Achieving significant technical and economic benefits in the raw material industries is a complex business. A wide range of skills must be available to each customer. Intelligent management decisions demand detailed knowledge of control engineering, mathematical techniques, management methods, information systems and business analysis. It is unrealistic in this age of specialization to expect any individual to possess the total knowledge required.

PERSONNEL

The nature of our business has made it essential that we develop expertise in the fundamental disciplines of material control. Through years of pioneering effort we have developed these capabilities. By pooling the talents of our professional staff in support of each customer program, we can provide the necessary diversity of services to customers who currently face critical shortages of these same engineering resources.

CONSULTANTS

In addition to our own staff, we retain consultants in a wide range of fields including nuclear physics, automatic control systems and operations research analysis. Massachusetts Institute of Technology, Ohio State University and Battelle Memorial Institute, along with other leading institutions, currently provide consultants and specialized research.



Customer information systems for product control are designed with the cooperation of our Management Science Director.

Process Specialists use our data processing facility for advanced statistical control analysis.

ORGANIZATION

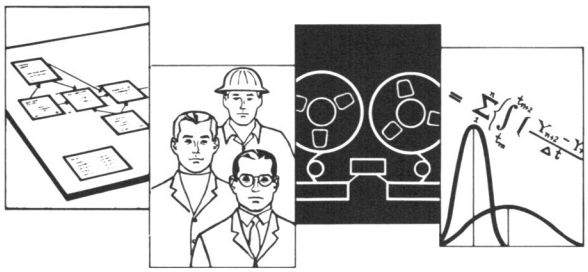
The task force organization focuses abilities and assets of our Company on a particular application. Our staff works with the customer in training his personnel, analyzing his process and documenting his process savings and efficiencies. Each member of the task force contributes his specialized technical skill.

A typical task force is composed of a Systems Engineer, Process Specialist, Control Systems Specialist, Advanced Systems Consultant, Financial Analyst and Management Science Director.

The Advanced Systems Consultant verifies the application of all systems requiring computation and on-line control.

The Financial Analyst aids in establishing methods for evaluating system results.

Systems Engineers and Process Specialists insure training of customer machine crews.

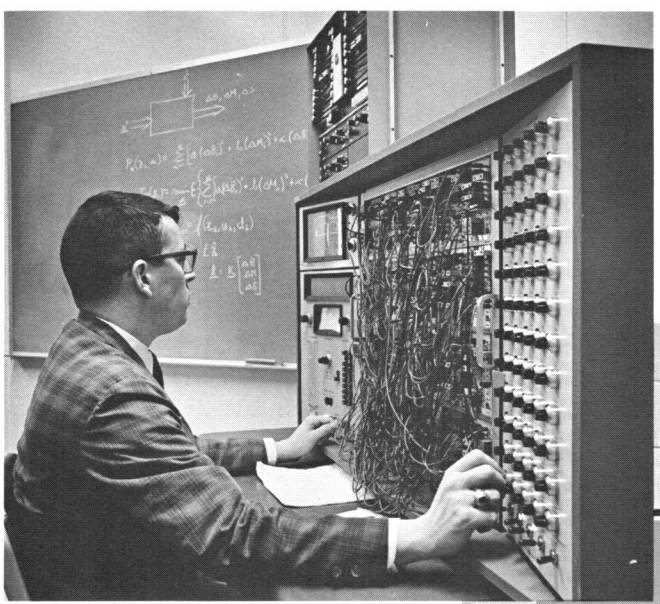


facilities

Specially designed facilities have been created to support the Results Operations Program.

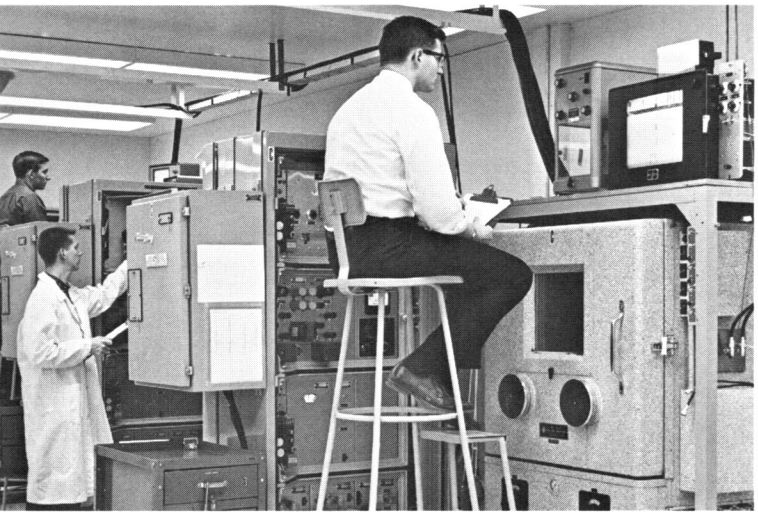
ADVANCED SYSTEMS LABORATORY

Laboratory facilities, which include both a general purpose digital computer and an analog computer, assist our advanced research in the application of process computers for on-line control. These facilities also provide process modeling capabilities such that our engineers can simulate complete industrial processes in the laboratory. This technique permits design and analysis of a complex system before the actual installation of the control equipment. In addition, our expanding general data processing center provides the means for advanced statistical analysis—an important mathematical tool.



A digital computer samples signals from a simulated process and tests a recommended control system.

A Control System Specialist uses an analog computer to model an industrial process.

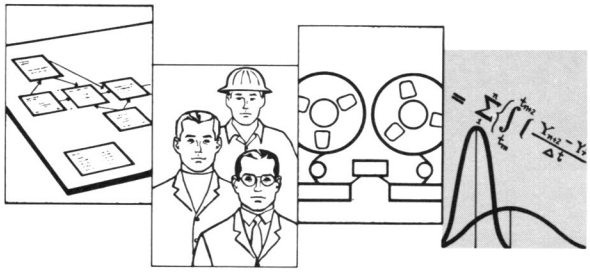


Each MOISTRON System is calibrated prior to shipment using actual samples of the customer's product.

Advanced research leads to new methods and techniques for accurately measuring properties of materials.

MOISTURE CALIBRATION LABORATORY

The moisture calibration laboratory is maintained under carefully controlled conditions of temperature and humidity. The laboratory is uniquely equipped with environmental chambers which are utilized to condition samples over a wide range of moistures. Special equipment has also been designed to permit the rapid drying and continuous weighing of paper samples. Using such facilities and methods, all moisture gauges are calibrated at the factory, thus minimizing the extent of field sampling required.

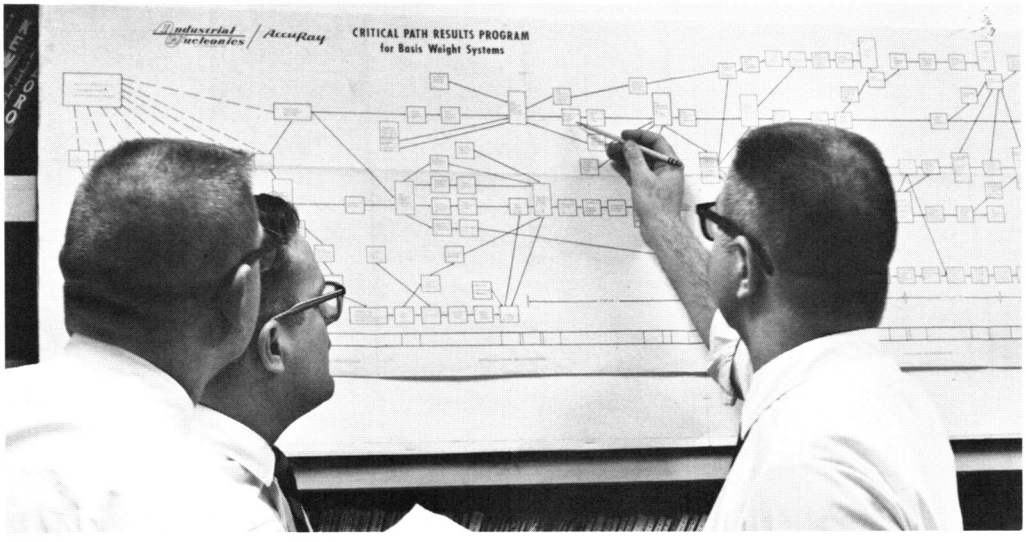


methods

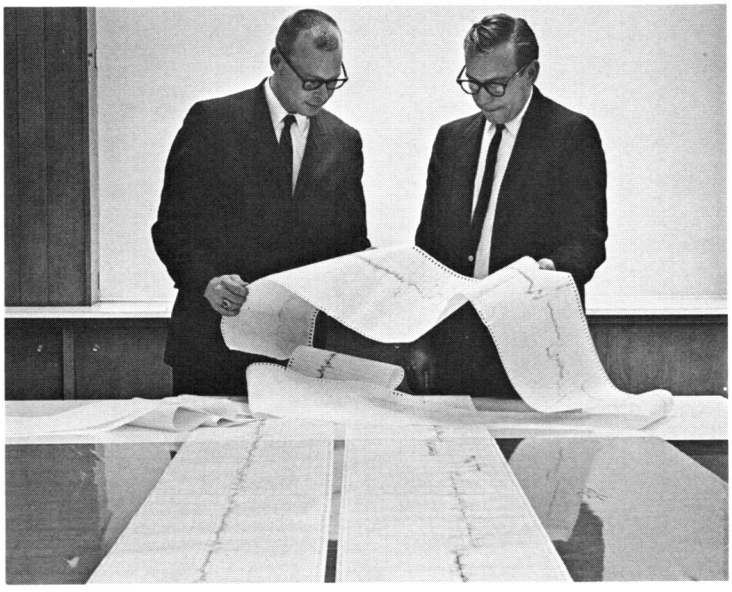
The Results Operations Program is built upon a foundation of experience, methods and documented techniques.

CRITICAL PATH PROGRAM

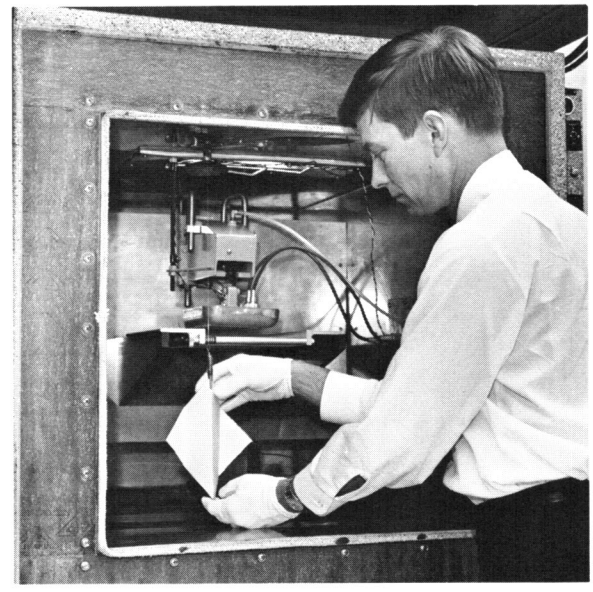
All activities and decisions involving both the customer and our task force are studied and programmed before each installation. Special attention can then be directed toward any series of activities—or critical path—that limits completion time of the total program. As our systems have grown in sophistication, this technique has proven effective during planning, preparation, evaluation, results verification and continuing program phases.



The final result of this graphic layout of interacting activities and events is a coordinated effort.



Ink traces from recorder charts provide the data for analysis of the customer's process.



A development engineer uses a special test chamber for advanced research in moisture-measuring techniques.

VARIANCE PARTITION

A complete package of statistical methods is available for our systems engineers. Variance partition involves the separation of process variance—such as that of the basis weight or moisture of a moving web of paper—into a machine-direction component and a cross-machine direction component. The optimum corrective actions can then be implemented for these two distinct sources of variation.

FREQUENCY ANALYSIS

Frequency spectral analysis is another technique for describing a process variable. Separating the measured variable into frequency components of varying amplitude and phase often reveals recurring patterns of process variation. From these patterns the frequency spectral analysis provides the customer with clues as to the cause of process disturbances.

MOISTURE CALIBRATION METHODS

Our engineers have successfully developed many new methods for precise moisture measurements. These include techniques for minimizing moisture pickup during paper machine reel sampling. Studies are conducted to determine the time required for paper to reach equilibrium moisture under varying conditions of temperature and relative humidity. One recently completed project is a procedure for a new paper industry (TAPPI) standard for paper machine reel sampling.

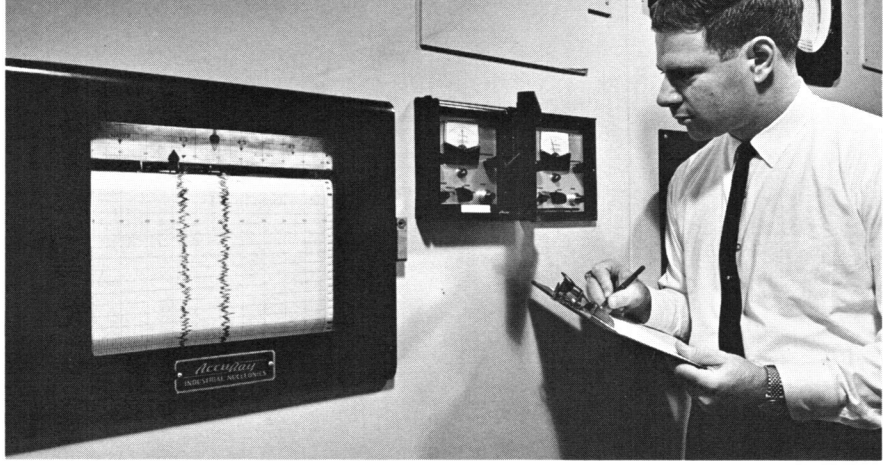
Account Managers receive intensive training in both process and product knowledge before joining our industry marketing teams.

TRAINING

Our staff of experienced, professional instructors provides training in the latest on-line analytical instrumentation and advanced control techniques. Educational programs for customers as well as training classes for our own personnel are continuously offered. Our most recent equipment is available to give thorough training in maintenance and operation.

The months of training for our Systems Engineers include practical experience with our equipment as well as technical seminars in the classroom.

AccuRay Systems for continuous on-line analytical measurements find wide usage in the control of unit operations.



process industries

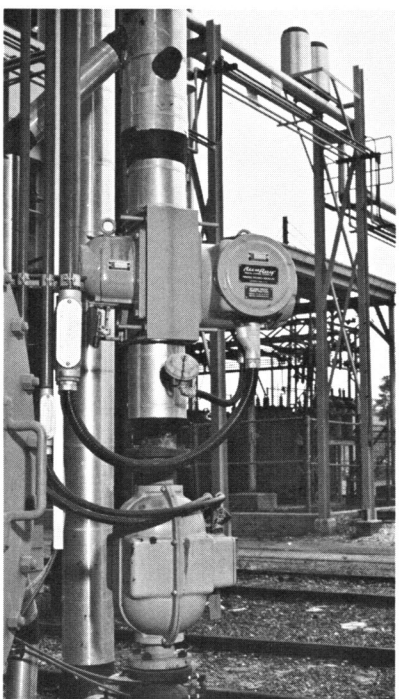
BROAD INDUSTRIAL ACCEPTANCE

Although the control of sheet materials has been emphasized in our report, there are literally hundreds of other applications for raw material control in the Process Industries. AccuRay Systems are employed by food processors, chemical companies and producers of petroleum or petrochemicals as well as mining, waste treatment facilities and cement manufacturing.

CONTROL OF UNIT OPERATIONS

Density measurement and composition analysis systems are controlling a wide variety of processes such as the density of coal slurries, the polymerization of synthetic rubber and the concentration of grape juice. In the minerals and beneficiation industry, continuous measurement of mass flow has now made possible complete plant process computer control for the first time.

Level systems perform measurements from outside of glass furnaces and across giant silos. Newly improved systems for coal-feed control serve an expanding market of power generation stations.



Mass flow/energy balance systems provide substantial economic returns in the paper industry.

An independent marketing organization provides a greater concentration of effort for the Process Industries.

H. R. Chope, Executive Vice President (right), and E. D. Jernigan, General Manager, Federal Systems Division, are shown with the I-R 100 award presented by NASA administrator James Webb in recognition for developing one of the top new technical products.

federal systems

MILITARY AND SPACE APPLICATIONS

The Federal Systems Division was originally created to apply the unique measuring and control technologies of the Company to military and space problems. Government-sponsored developments have led to a precision missile tracker, space radiation measuring devices, gauges for measuring cryogenic fuels in missiles and helicopter guidance systems.

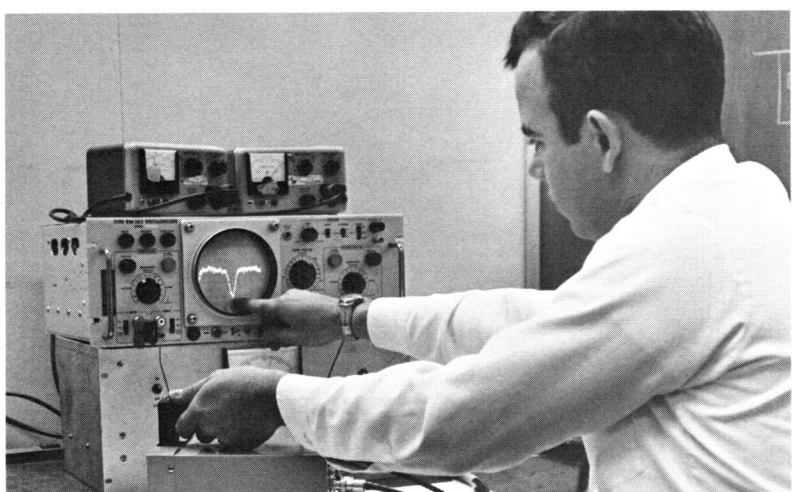
The work of this division has provided the Company with new knowledge and experience in advanced technologies. Included among these are solid-state physics, sensitive measuring techniques for zero-gravity and cryogenic environments and methods for measuring the properties of materials used in aerospace devices.

RECOGNITION

The Company's development of new and related technologies has been cited by the National Aeronautics and Space Administration as an ideal example of technology transfer between the federal and private sectors of our economy. The Company received one of the top research awards last year for its highly sensitive Cryogenic Hydrogen Meter used in the Saturn rocket program.

FUTURE

Application of the advanced instruments and systems under development in this division can provide new market potential in areas of air and stream pollution control, oceanography and high-speed chemical processing.



Instrumentation for detecting corrosion of metals under painted surfaces has future potential.

BOARD OF DIRECTORS

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Wm. Blair & Company

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vice-president of business and finance—Ohio State University

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executive vice-president of Industrial Nucleonics, national president of Tau Beta Pi

WILBERT E. CHOPE
chairman of the board of Industrial Nucleonics

JOHN ECKLER
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DAVID L. NELSON
president of Industrial Nucleonics

ROBERT E. SWENSON
vice-president—finance/ treasurer of Industrial Nucleonics

GEORGE B. YOUNG
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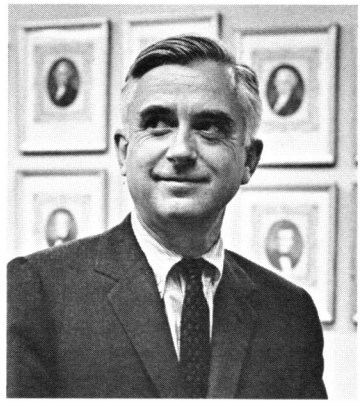
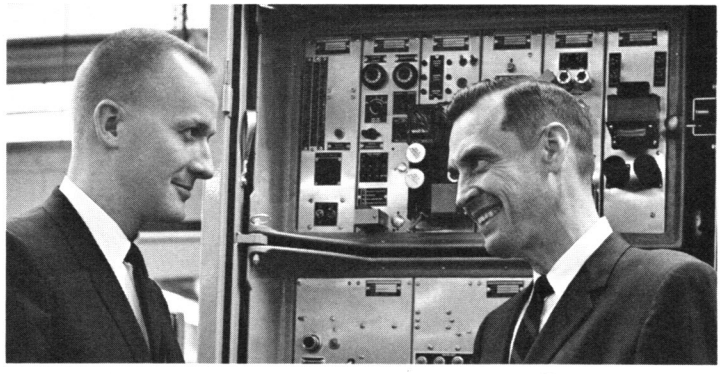
WALTER H. CANTER
vice-president—manufacturing

CHRISTOPHER J. CAMPBELL
assistant treasurer—manager of administration

Wilbert E. Chope

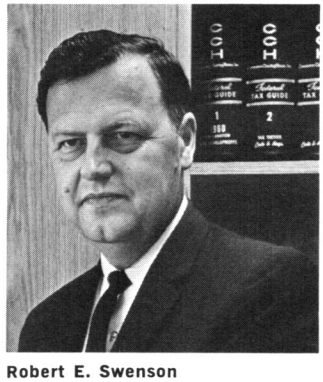


Edward McCormick Blair

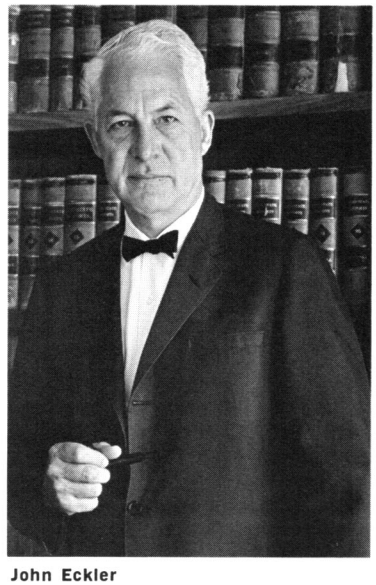


David L. Nelson

Henry R. Chope

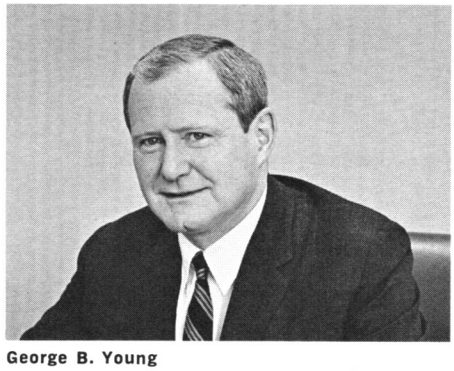


Robert E. Swenson



John Eckler

Gordon B. Carson



George B. Young

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