LOCKHEED
NUCLEAR PRODUCTS

LOCKHEED NUCLEAR PRODUCTS
HEADQUARTERS, ATLANTA, GEORGIA

LOCKHEED NUCLEAR PRODUCTS is an organization devoted to nuclear technology and its application to the construction of reliable and effective nuclear products. Experience in Atomic Energy dates back to 1949 with the company's participation in the Aircraft Nuclear Propulsion Program. Lockheed developed the conceptual design for the Georgia Nuclear Laboratories, supplied technical guidance during construction, and provided over-all project management. The experience gained while accomplishing this project, plus the individual capabilities of the staff personnel, has given Lockheed a competent and effective nuclear engineering organization. This organization is complemented by extensive nuclear facilities, including an experimental reactor which is unique in the field, and a complete hot cell laboratory complex. Backing up the skilled personnel and nuclear facilities is the well established reputation and history of the Lockheed Aircraft Corporation, which has as part of its capital equipment almost every important type of manufacturing, testing and experimental machine known. These three factors, — experienced personnel, nuclear facilities and extensive manufacturing capabilities, are the things which Lockheed offers. This brochure is presented as a brief introduction to the competence of Lockheed Nuclear Products.

Lockheed Nuclear Products management, left to right:
R. W. Middlewood Manager, R. M. Jones,
Dr. J. C. Flack, W. R. Rhoads, B. A. Martin.

NUCLEAR ENGINEERING

REACTOR DESIGN

INSTRUMENTATION

ENGINEERING STUDIES

PROJECT MANAGEMENT

The technical staff of Lockheed Nuclear Products is made up of scientists, engineers and technicians who not only have past experience in reactor projects, but who also understand modern nuclear concepts. Represented among them is every specialty in the nuclear field. They bring to their task an extensive background in the practical application of nuclear technology.

ROBERT MURPH JONES, JR. has been associated with Atomic Energy since 1945, and has organized and managed reactor projects for both commercial and government nuclear organizations. He is co-holder of a basic Engineering Test Reactor patent, and has served as director of Nuclear Test Center Study Group, sponsored by four major U. S. corporations. His background also includes marketing supervision, contract administration, and foreign affiliation negotiations.

T. H. THOMAS has over 15 years experience in the nuclear field including 12 years at Oak Ridge in supervisory positions in reactor design, experimentation, and operations. He is co-author and editor of "Reactors and Earthquakes," for the AEC's division of Reactor Development. He has also been associated with nuclear rocket propulsion and auxiliary power studies.

J. F. HAUCK, holder of 24 patents in metallurgy, instrumentation systems, radiation measurements, has developed unique commercial applications for reactor and radiation detection systems. He is manager of Isotope Development studies and training reactor projects.

D. F. JUDD is experienced in thermodynamic analysis of reactor systems, and process equipment design. He participated in conceptual designs for the nuclear ship "Savannah", and the Consolidated Edison nuclear power plant.

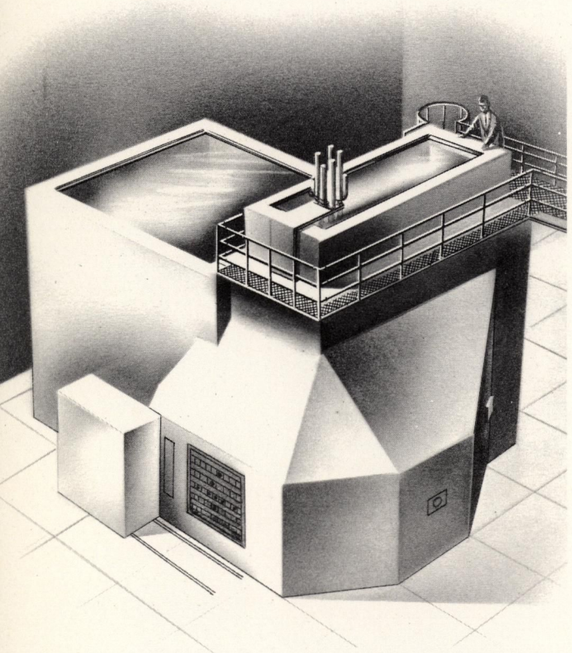
C. C. FOWLER is a specialist in the construction, maintenance and testing of nuclear instruments. His professional experience of over ten years includes development of weapons and fire control systems, and aircraft electronics.

DR. E. C. SMITH participated in the development of the basic designs of the Georgia Nuclear Laboratories, and has conducted studies in the effects of radiation on aircraft systems. During his 5 years at ORNL, he directed experimental work in basic research for neutron measurements.

C. C. HOFFMAN coordinated the design, fabrication, and installation of the Ohio State University training reactor. With the Navy Bureau of Aeronautics he served as Research Section Chief on nuclear weapons programs.

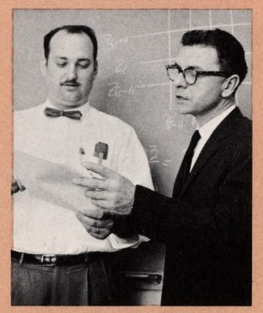
J. B. BROWN participated in the design of the ORR and HRE at Oak Ridge, and pressurized water reactors for the U. S. Navy's submarine fleet reactor program. He is also experienced in general reactor facilities design, test loops and reactor components.

G. W. CRAIG, was responsible for coordinating the design and construction of the Georgia Nuclear Laboratories. He has developed reactor auxiliary hardware and remote handling equipment.



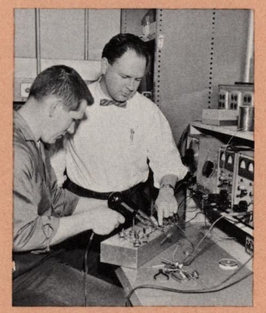
The Ohio State University 10 kilowatt research and training reactor, designed and built by LNP.

Jones

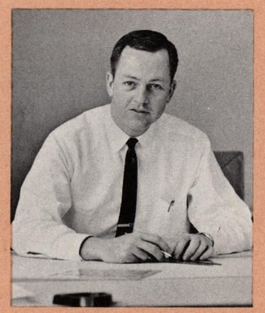


Judd *Thomas*

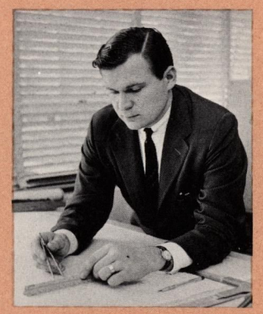
Smith *Hoffman*



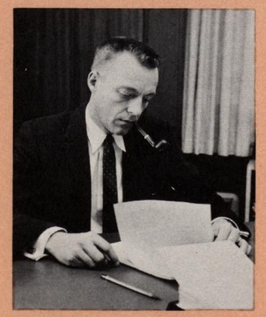
Fowler



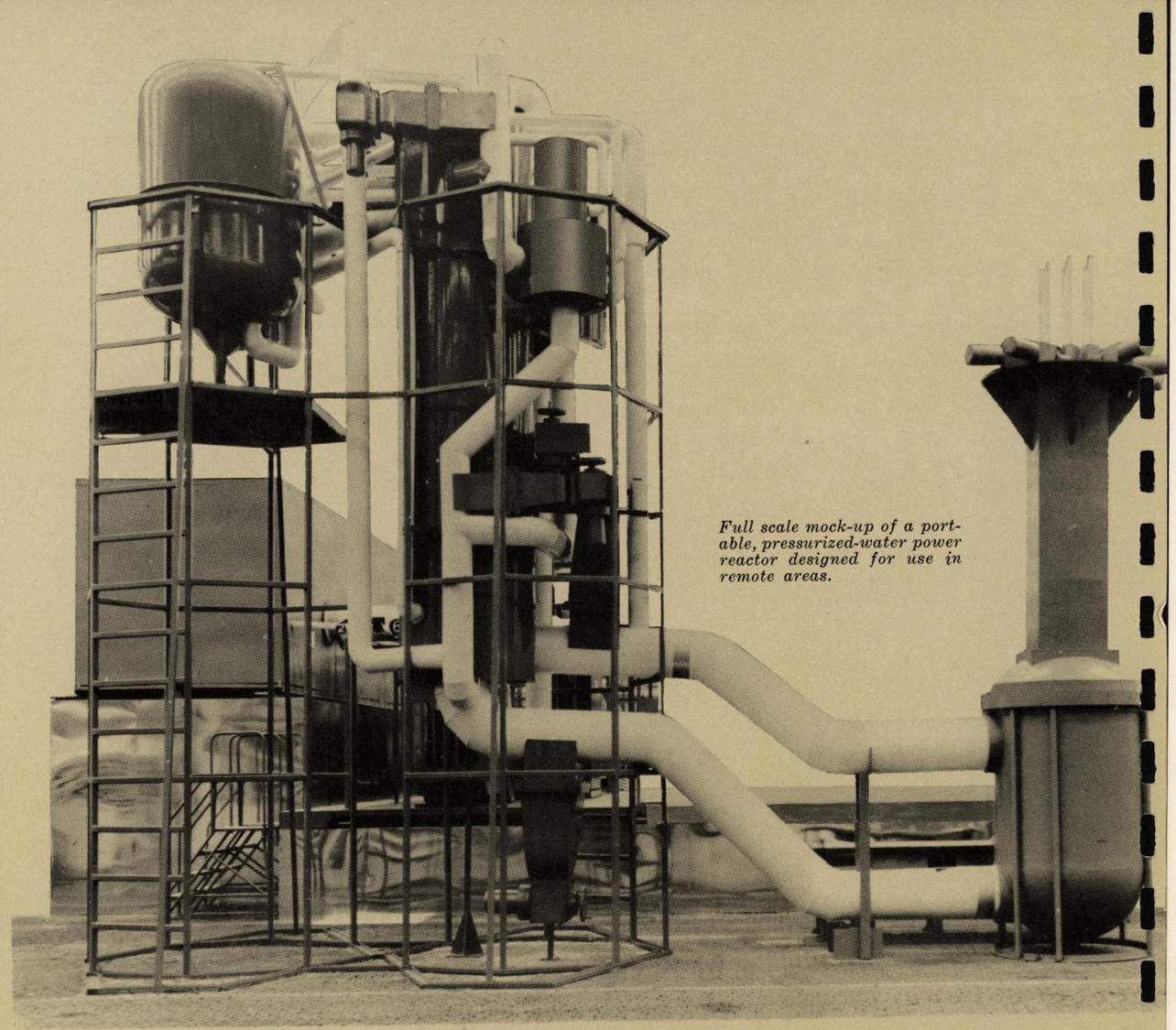
Brown



Hauck



Craig



Full scale mock-up of a portable, pressurized-water power reactor designed for use in remote areas.

RESEARCH AND DEVELOPMENT

FUEL CYCLE STUDIES • RADIOISOTOPES

HEALTH PHYSICS • AREA MONITORING

Through research and development Lockheed Nuclear Products is striving to achieve important technical advances in its continuing search for new and better applications of nuclear energy. At Lockheed, comprehensive facilities and experienced personnel are combined to make R & D an effective tool.

DR. J. C. FLACK was responsible for the design and construction of the Georgia Nuclear Laboratories and now directs its operation. In the Aircraft Nuclear Propulsion program, he directed radiation shield design, airframe activation studies, radiation damage analyses, and the nuclear aspects of ground handling techniques.

J. T. BRACKEN'S experience includes design of instrumentation for Lockheed nuclear laboratory facilities, and early work in the aircraft nuclear propulsion program.

W. R. CHAMPION worked on the BSF at Oak Ridge National Laboratory. He has a background of over 12 years in the nuclear field including research and development of radiometric measurements for geophysical programs, and in gamma ray spectral analysis.

J. H. TOLAN has been associated with Atomic Energy since 1950. As senior research physicist for Georgia Tech he directed important projects involving radiological defense and nuclear measurements. He has developed important new industrial applications for radioisotopes.

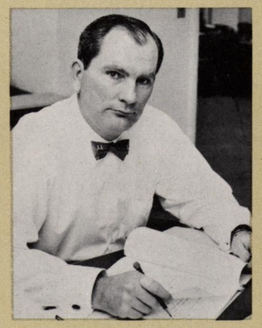
W. T. PRICE directs the Nuclear Safety Program for the Lockheed Georgia Division. Since 1951 he has been engaged in nuclear research and analytical studies on reactor programs, and the formulation of experimental nuclear test programs.

DR. H. CLAY PRICE, JR., has over 12 years of experience including senior positions with Johns Hopkins University ORO, Reactors Branch of Naval Research Laboratories, and the National Bureau of Standards.

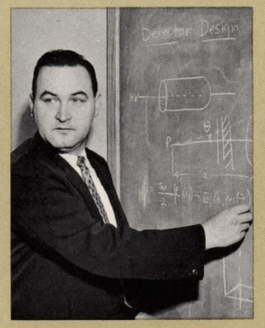
R. L. BUTENHOFF was former Chief of the AEC Radiation Instruments Branch, and served as Science Coordinator with the Department of State in the Brussels World's Fair. He also performed basic nuclear research at Oak Ridge and the University of Chicago.

F. D. EICHENBAUM'S background includes the application of digital computation techniques to reactor core parameter studies. While working on the STR program, he formulated original analytic solutions to special problems in nuclear design and core analysis techniques.

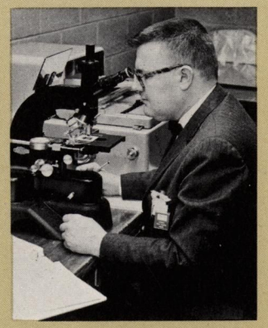
Bracken



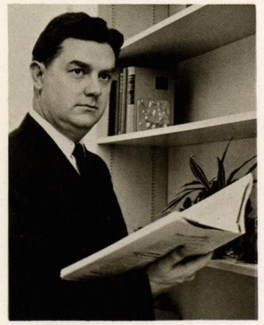
Tolan



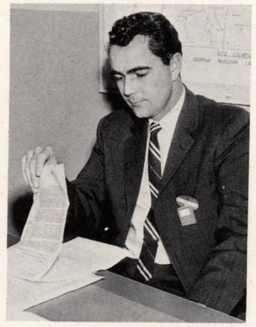
Butenhoff



H. C. Price

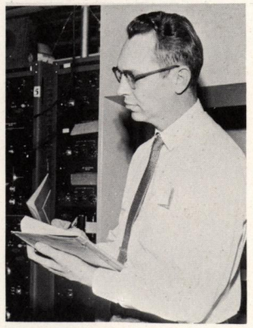


Flack

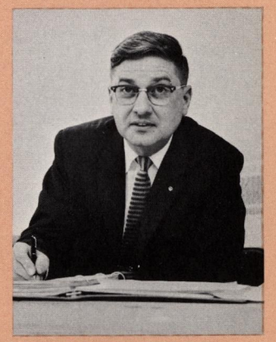


W. T. Price

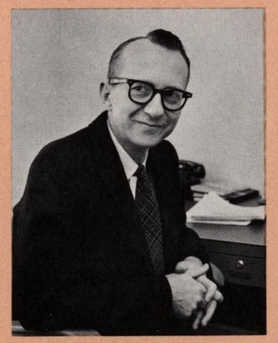
Eichenbaum



Champion



Schofield



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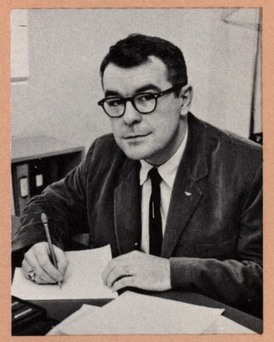
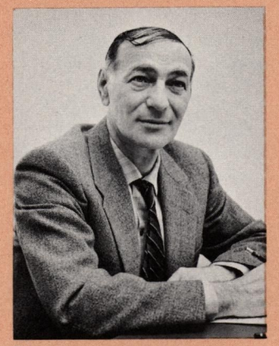
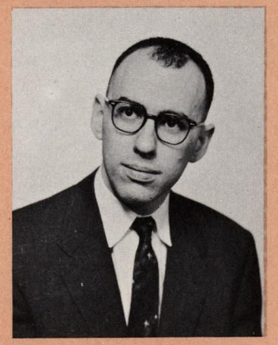


Rusche



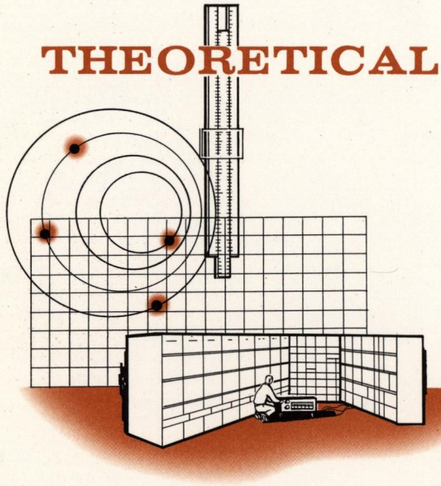
Rosen



Stern

Rollor

THEORETICAL ANALYSIS



CORE PHYSICS

HAZARDS

SHIELDING

HEAT TRANSFER AND FLUID FLOW

The personnel engaged in theoretical analysis work at Lockheed Nuclear Products represent an impressive combination of skills and experience. These men, working in an environment ideally suited to creative work, are establishing the technological basis for tomorrow's nuclear products.

DR. E. A. ROLLOR, JR. has over 8 years of nuclear experience including design of shielding facilities at Oak Ridge. He also supervised conceptual design of an experimental tower shielding facility for the ANP Program.

F. T. BLY participated in the joint NEPA—ORNL critical experiment facilities design.

He has performed extensive analyses of reactor shielding systems and has taken part in the start-up and operation of nuclear reactor research facilities.

H. E. STERN'S nuclear experience since 1948, includes reactor control analysis, shield system design, and reactor criticality calculations. He has developed original techniques for radiation shield design for mobile reactors.

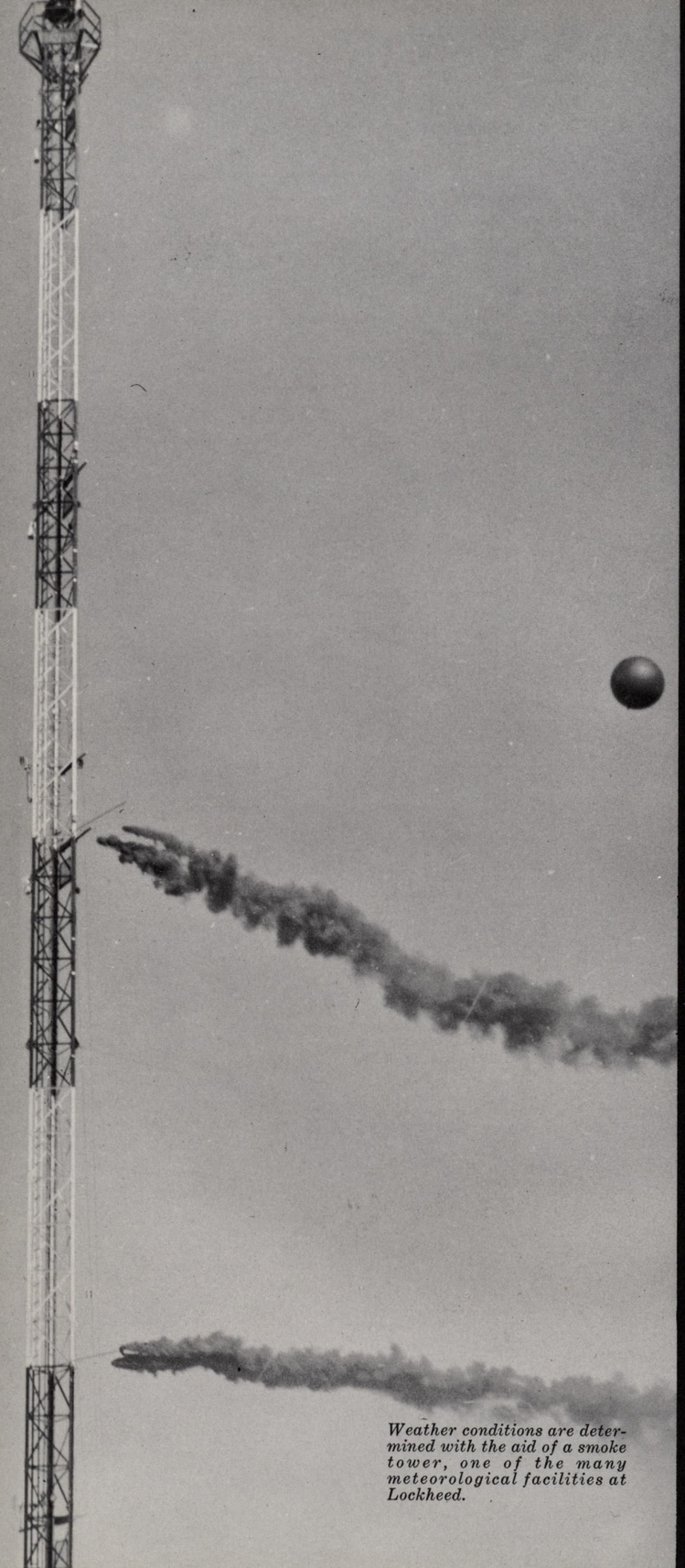
DR. J. S. ROSEN has a broad university background of teaching and research in mathematics and engineering. He has directed studies in neutron transport and diffusion theory and reactor analysis. His professional experience totals over 34 years.

DR. J. F. PERKINS has been associated with the field of nuclear physics since 1950 and is a recognized specialist in Monte Carlo techniques. His work in the field of particle physics and fission product decay has gained wide recognition.

DR. W. M. SCHOFIELD has been a specialist in theorectical nuclear and atomic physics since 1950. He has developed computer codes for reactor safeguard analysis, and conducted mathematical studies of reactor shielding and core arrangements.

B. C. RUSCHE was a member of the start up team and research staff for the experimental heavy water reactor at Savannah River. His investigations of reactor fuel cycle costs and design parameters have resulted in refined nuclear constants and optimum techniques for production efficiency.

Bly



Weather conditions are determined with the aid of a smoke tower, one of the many meteorological facilities at Lockheed.

W. E. HARDY, former Head of the Meteorology Department at Oklahoma A&M and Director of USAF Air Weather Service Officers Meteorological Training, has over 18 years experience. He collected, tabulated, and interpreted all meteorological data in support of the reactor installations at the Georgia Nuclear Laboratories. He is former editor of the *Bulletin*, official publication of the American Meteorological Society.

F. E. COURTNEY, JR. was project leader in the establishment of the nuclear laboratories micrometeorological center. His 18 years experience includes weather analysis and consultation in the U. S. and the Far East. At the USAF Cambridge Research Center, he directed a project on numerical model studies of the atmosphere. He has served as staff meteorologist for the Lockheed Operations Research Division.

G. F. COLLINS performed meteorological consultant work for the airline and offshore oil industries. He has conducted studies on the industrial application of meteorology, including site selection and air pollution analyses for large chemical plants. He is a registered professional engineer with over 18 years experience, and has served on national and state air pollution committees.

G. C. TAIT has experience dating to 1953 performing weather analysis and forecasting for the Air Force, the U. S. Weather Bureau, and the Department of Defense. He assisted in research projects and did meteorological map analysis at the National Weather Analysis Center in Maryland.

M. J. ANDRE, honored in 1957 as the outstanding young applied scientist in the Air Force, Washington, D. C. area, has over 18 years experience. He served as senior consultant at Air Weather Service Headquarters, and as Synoptic Analyst at the University of Chicago.

DR. W. W. HILDRETH, JR., has more than 21 years background in meteorology, which includes professional consultation and educational work at MIT, Texas A & M, the University of New Hampshire, and the Air Force Meteorological School. He has participated in significant research projects in long-range weather forecasting and micrometeorology.

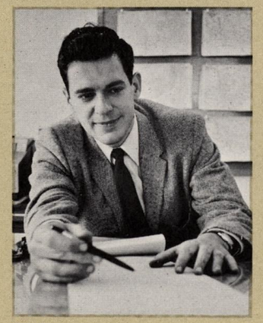
D. A. WHELPLEY, a veteran of over 22 years experience, has served as meteorological officer for aircraft carriers in the Pacific and as forecaster for Atlantic Fleet patrol squadrons. He was Chief Meteorologist for the Flying Tigers. The author of many popular articles on weather, he has performed research and development work in hurricane forecasting techniques.

ATMOSPHERIC PHYSICS

MICROMETEOROLOGICAL SURVEYS
SITE SELECTION
ENVIRONMENTAL HAZARDS ANALYSIS
AIR SAMPLING AND MONITORING

A special group exists within Lockheed Nuclear Products, which provides experts in the field of Atmospheric Physics. The meteorological skills of these scientists, coupled with an intimate knowledge of nuclear reactor requirements, qualify them to solve the problems of site selection, hazards analysis and reactor operations in the most expeditious manner possible.

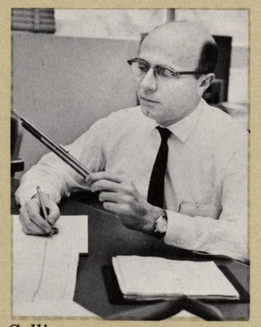
Hildreth *Courtney*



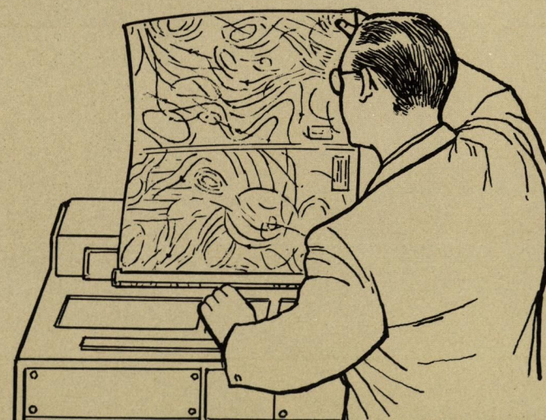
Tait

Whelpley

Andre *Hardy*

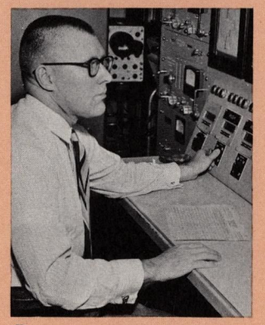


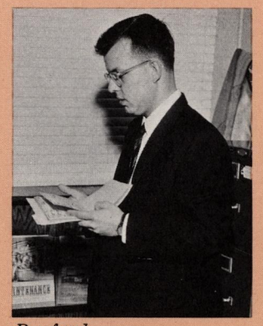
Collins

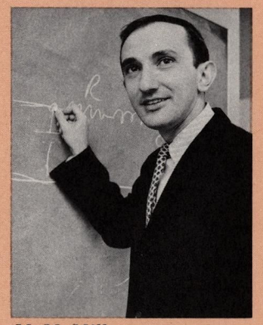


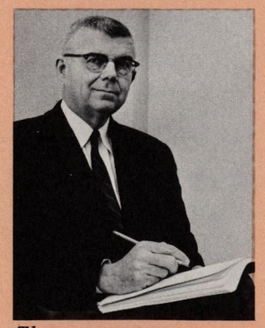
Hessee

E. W. Miller

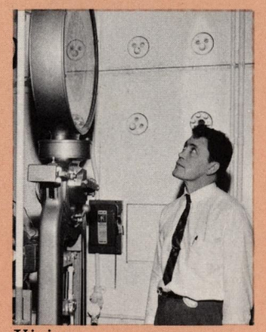

Dewar


Burford


M. M. Miller


Thompson

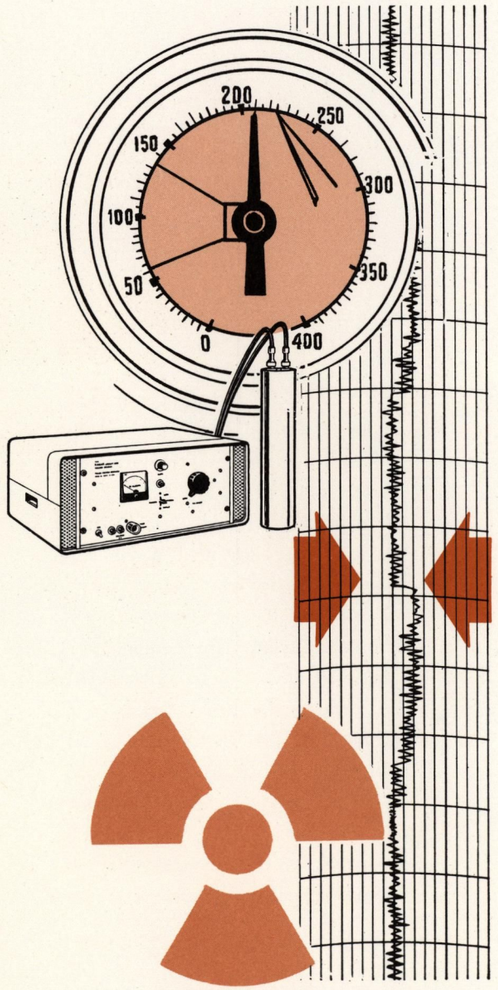
Scarborough


Vivian

Liebschutz

NUCLEAR LABORATORIES OPERATION

RADIATION EFFECTS
REACTOR START-UP AND OPERATIONS
PERSONNEL TRAINING
HOT CELLS



From the actual operation of reactors, hot cell equipment, and other nuclear machines, Lockheed Nuclear Products personnel have gained the experience necessary for the development of new atomic products. This experience is perhaps the most positive assurance of sound future design.

DR. M. M. MILLER has been associated with nuclear work since 1948. He has held positions at Los Alamos and with the U. S. Army involving design of specialized nuclear equipment. He performed experimental work with uranium and plutonium fuel assemblies, including Godiva and Jezebel.

E. W. HESSEE has had over 9 years nuclear experience, including prime responsibility for design, operation and performance of advanced test reactors. He performed reactor shielding and nuclear instrumentation experiments at ORNL.

W. T. SCARBOROUGH was responsible for the calibration, operation, and maintenance of the Convair Aircraft Shield Test Reactor and associated systems. He has been associated with the ANP reactor program since 1953.

M. A. DEWAR was a member of the operation team on the Aircraft Shield Test Reactor. He prepared reactor safeguard reports and conducted core physics experiments. He is responsible for operation of the Lockheed CER.

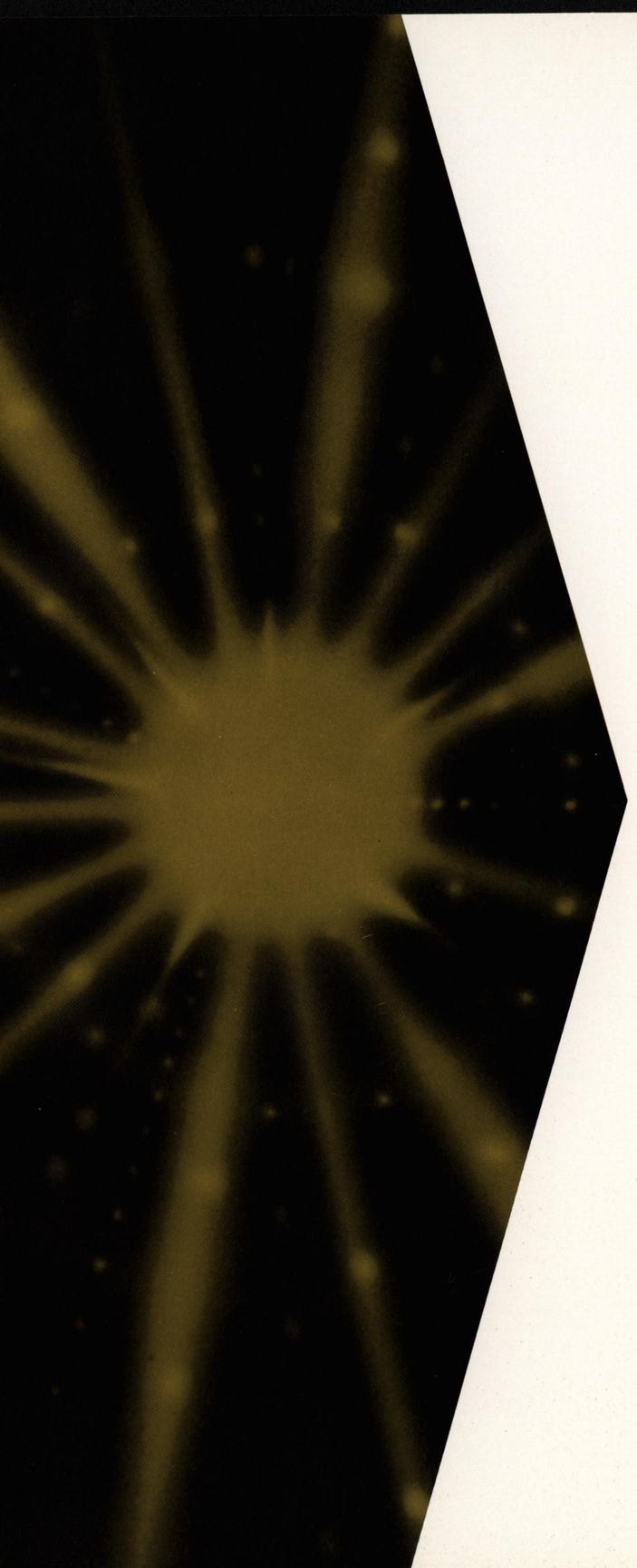
R. A. THOMPSON has 23 years of experience including performance and analysis of experimental tests on aircraft subsystems in a nuclear environment. He directs the operation of Radiation Effects Laboratories.

C. E. VIVIAN has designed, and operated hot-cell equipment for chemical processes in kilocurie hot cells since 1950. With Los Alamos Scientific Laboratory for 9 years he directed design of hot cells and remote equipment.

E. W. MILLER planned and programmed nuclear experiments for aircraft subsystems. His 20 years of professional experience include studies of radiation effects in structural alloys, and aircraft design programs.

DR. A. M. LIEBSCHUTZ is manager of the NASA cryogenic loop project. A solid state physicist, he has been active in radiation damage studies for the ANP program.

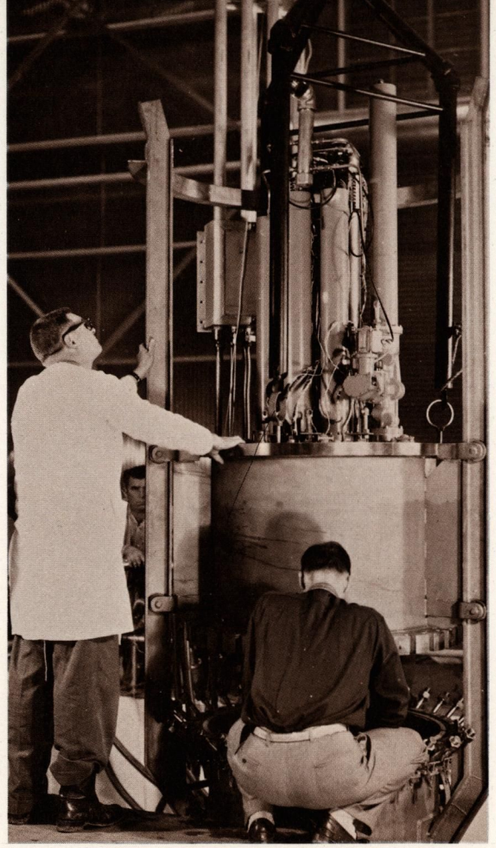
DR. A. O. BURFORD is responsible for radioactivation analysis, and testing for the Georgia Nuclear Laboratories. He performed technical liaison during the construction of these facilities.



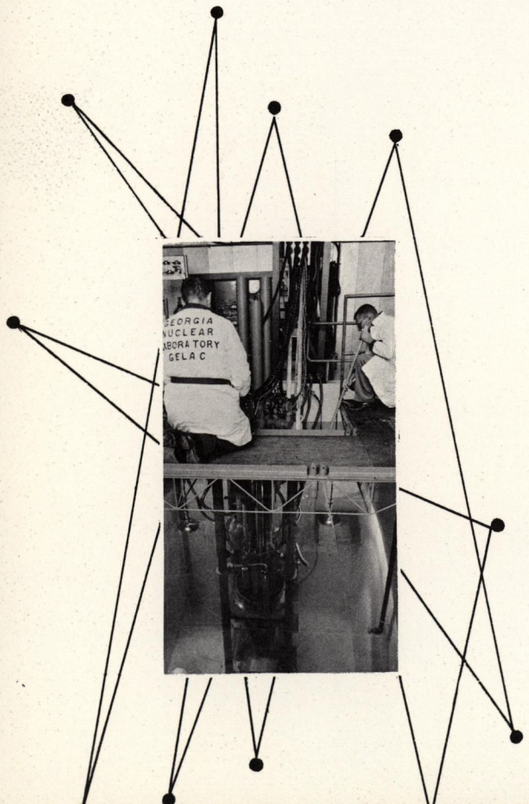
THE GEORGIA NUCLEAR LABORATORIES, located on a 10,000-acre tract near Dawsonville, Georgia, provide the scientific tools which enhance the full utilization of nuclear personnel capabilities. These facilities are equipped for complete nuclear testing, with the unique capability for irradiating full-scale systems and components under simulated operating conditions. They also furnish the means for advanced research programs in radioactive waste disposal, radiological safety, and the application of radioisotopes. The entire complex affords the perfect environment for developing advanced nuclear products.

NUCLEAR FACILITIES

The radiation effects reactor is located in this aluminum structure. A standard gauge railroad system is used to transport test articles from the reactor to the Radiation Effects Laboratory.

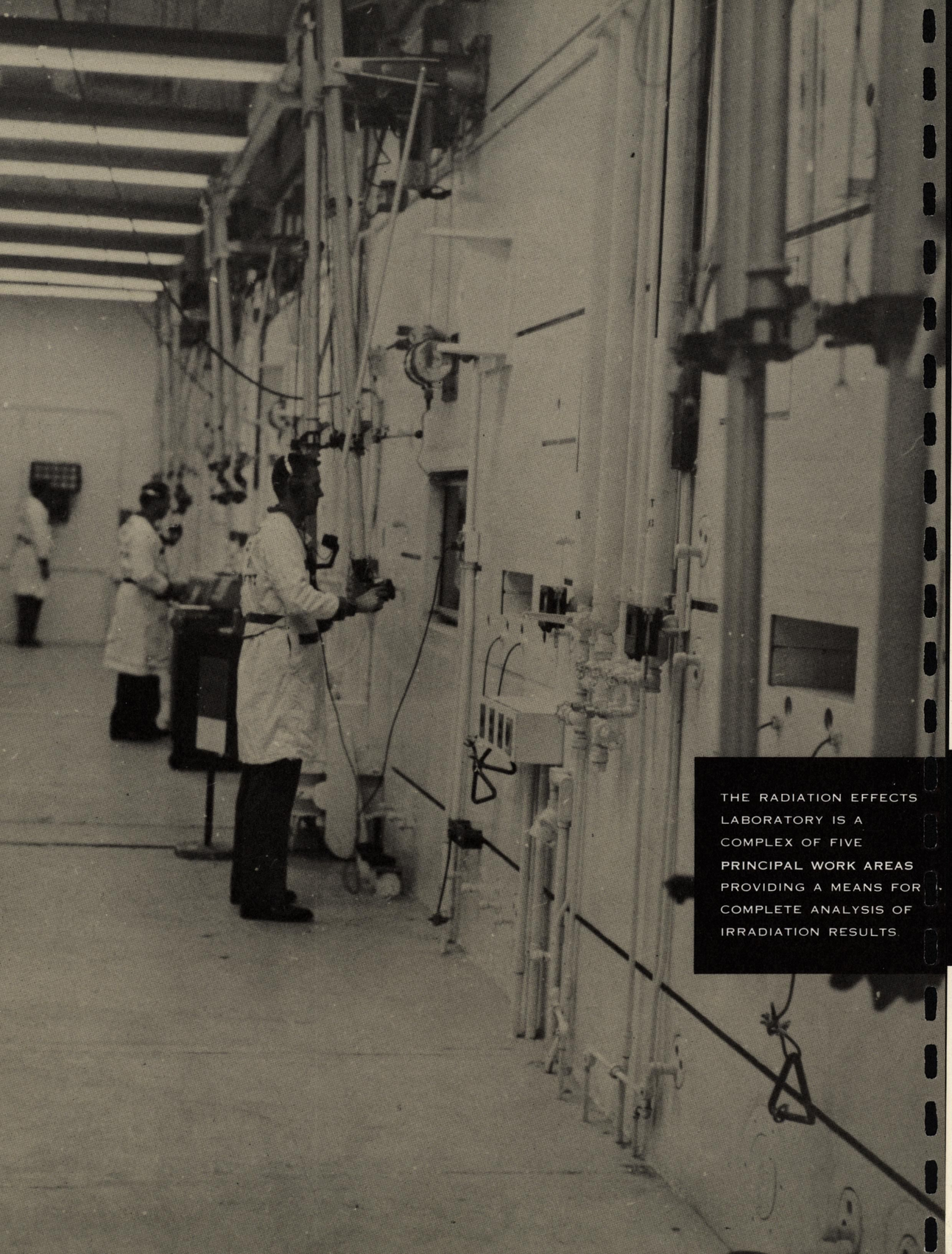


NUCLEAR FACILITIES

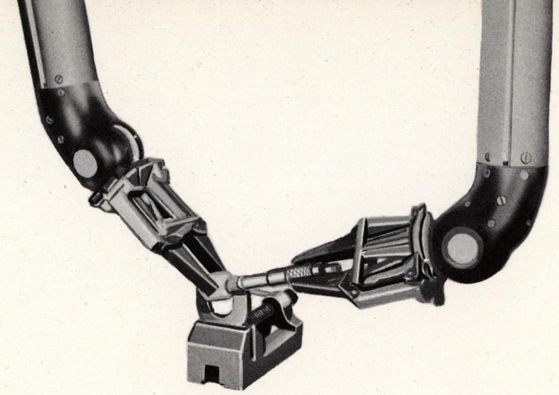


Among the more important facilities available through the Georgia Nuclear Laboratories are the Radiation Effects Reactor and the Critical Experiment Reactor. These nuclear machines are not stereotypes of existing reactors, but rather, they represent a solution to the problems of testing complete operating systems under dynamic conditions and under extreme environments. The RER is a high flux, 10 MW reactor which includes a complete rail-car system to facilitate location of large items to be irradiated directly adjacent to the core face. The CER is an open pool, enriched fuel, low power reactor with flexible grid arrangements to permit a variety of core configurations.

The reactor and its operations are controlled from a console in the operations building where data recorders carry information from signals generated in the test area. Here, through a series of recorders indicating various characteristics of the nuclear reaction, the reactor operating crew can keep a visual check and permanent record of the operation. Closed circuit T V allows visual observation of the reactor and test car positions during the irradiation period.



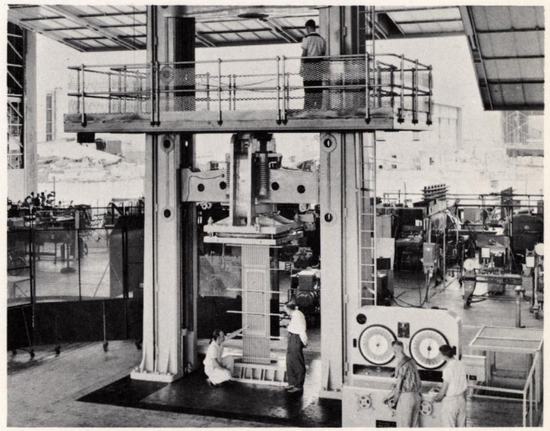
THE RADIATION EFFECTS LABORATORY IS A COMPLEX OF FIVE PRINCIPAL WORK AREAS PROVIDING A MEANS FOR COMPLETE ANALYSIS OF IRRADIATION RESULTS.



Associated facilities . . .

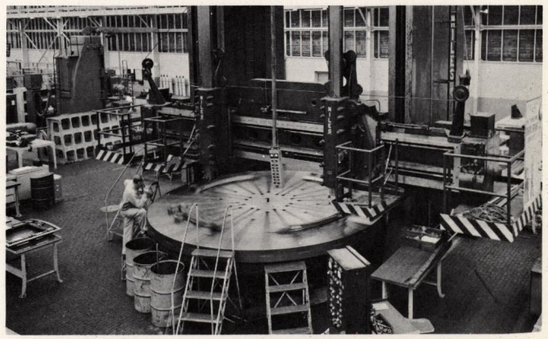
include separate laboratories for calibration, general chemistry, radio-chemistry, counting, physical testing, meterorology, environmental testing and photography. A complete system of hot cells, hot cell mock-ups, warm laboratories and system build-up areas is provided as auxiliaries to the reactors. A special laboratory is used for the design and construction of nuclear instruments.

This universal testing machine, with a capacity of 1,200,000 lbs. is used to determine static properties.

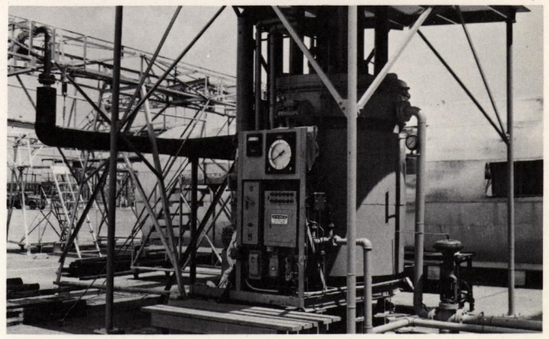


The environmental test chambers have testing capabilities extensive enough to meet all the anticipated requirements.

The Niles heavy vertical boring and turning mill, with its maximum swing of 16 feet 4 inches and its bar travel of 84 inches represents another manufacturing capability.



A gas-fired heater producing 4,000,000 Btu/hr (1.2 megawatts) is used for low-pressure, high-temperature pneumatics testing.



SUPPORT FACILITIES

BURBANK, CALIFORNIA

SUNNYVALE, CALIFORNIA

LOS ANGELES, CALIFORNIA

PALO ALTO, CALIFORNIA

VAN NUYS, CALIFORNIA

ATLANTA, GEORGIA

ONTARIO, CALIFORNIA

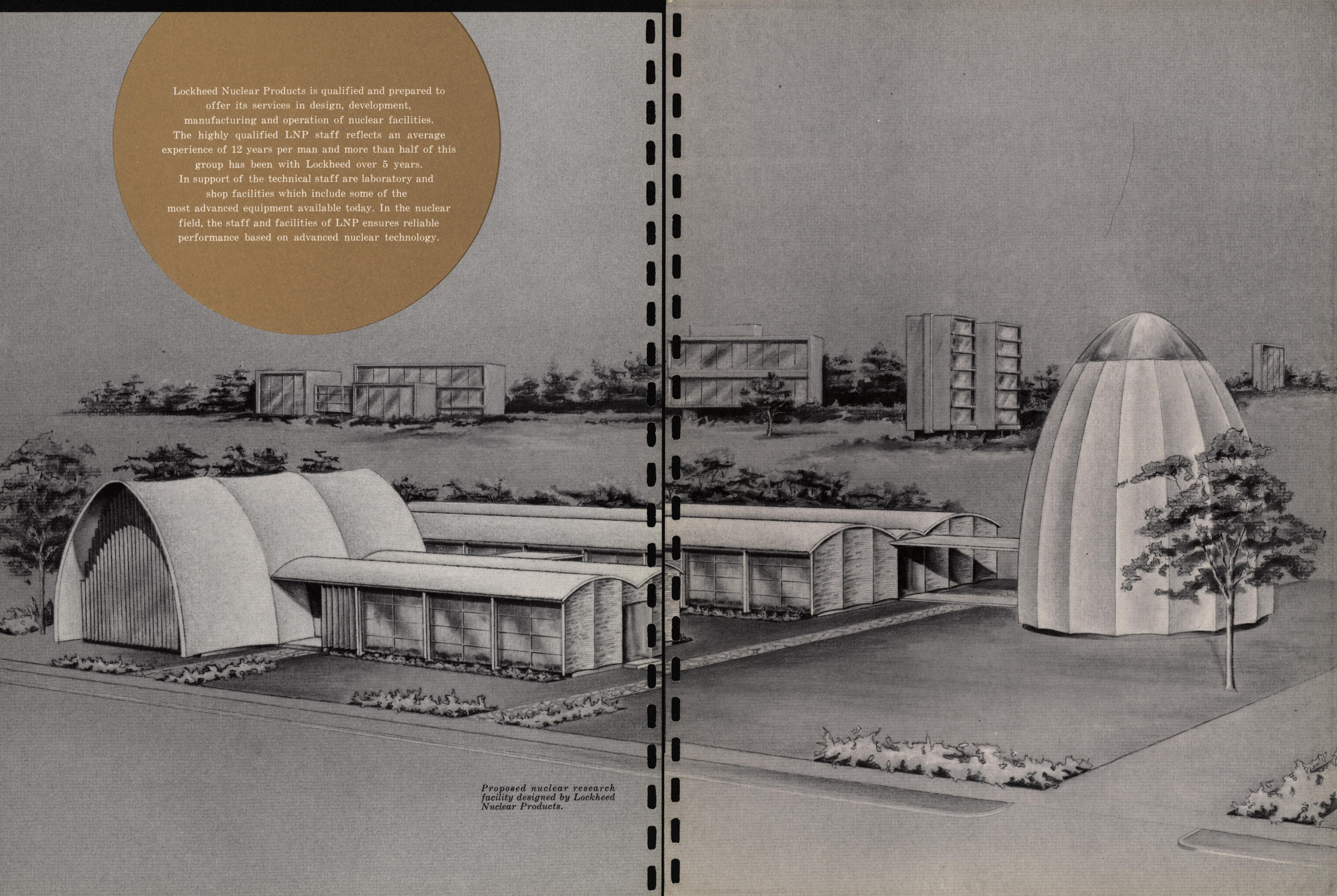
PLAINFIELD, NEW JERSEY

DAWSONVILLE, GEORGIA

MARIETTA, GEORGIA

Imaginative minds and a scientific climate need the machinery of production to achieve positive results. Lockheed Nuclear Products has at its disposal the total Lockheed manufacturing resources. Pictured here is only a representative selection of the vast supporting facilities which provide the calalyst for transforming ideas into products. Every conceivable tool, from the most delicate electronic measuring device to massive metal forming equipment, can be made available from somewhere within the Lockheed complex. Complete testing and experimental facilities, research laboratories, computer and electronic analysis equipment, chemical, metalurgical and mechanical laboratories . . . are all a part of Lockheed. These skills and facilities augment the efforts of Lockheed Nuclear Products, assuring competent prosecution of any project which it undertakes.

Lockheed Nuclear Products is qualified and prepared to offer its services in design, development, manufacturing and operation of nuclear facilities. The highly qualified LNP staff reflects an average experience of 12 years per man and more than half of this group has been with Lockheed over 5 years. In support of the technical staff are laboratory and shop facilities which include some of the most advanced equipment available today. In the nuclear field, the staff and facilities of LNP ensures reliable performance based on advanced nuclear technology.



Proposed nuclear research facility designed by Lockheed Nuclear Products.

LOCKHEED NUCLEAR PRODUCTS

LOCKHEED AIRCRAFT CORPORATION · GEORGIA DIVISION