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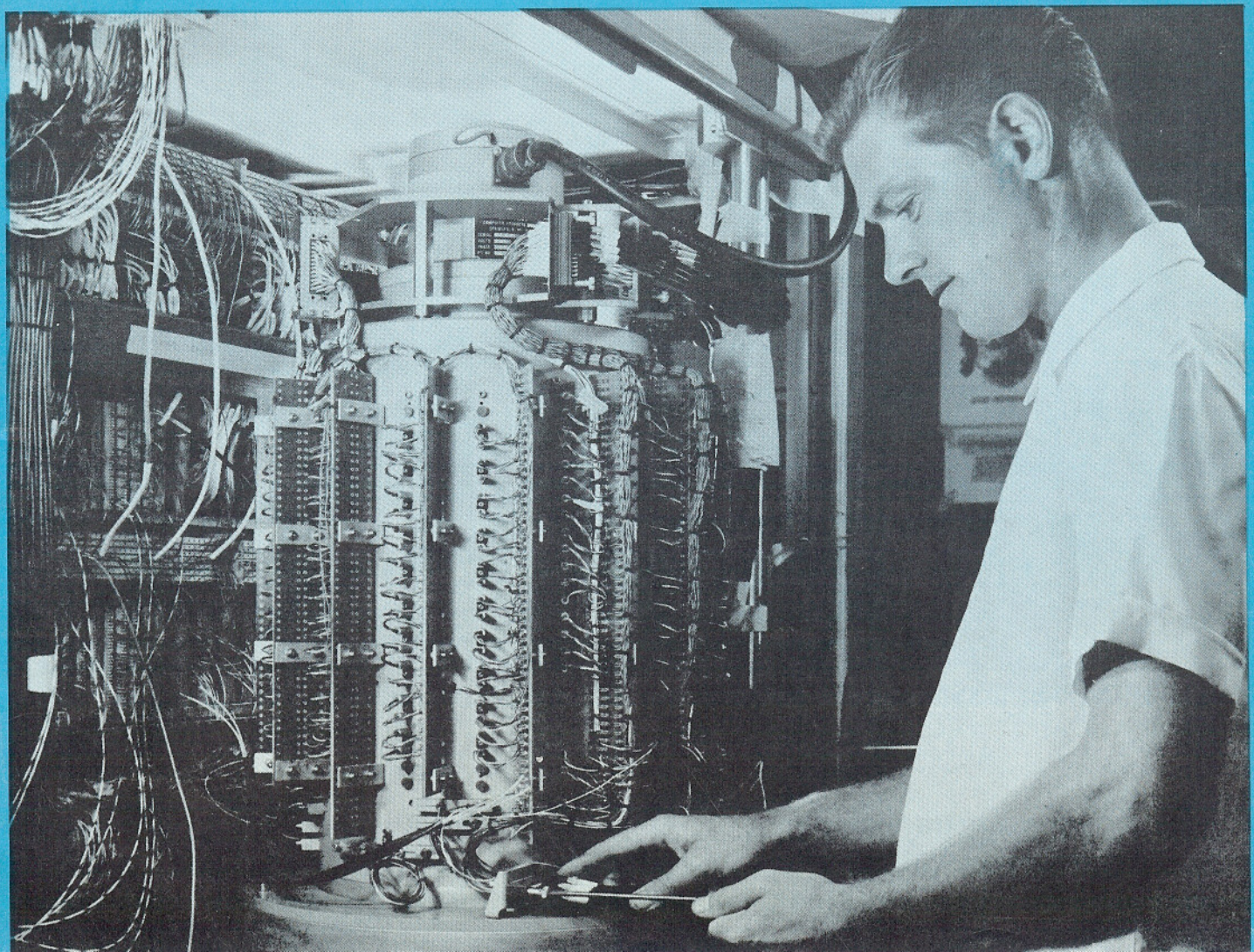
WESCON in Pictures

Librascope Story



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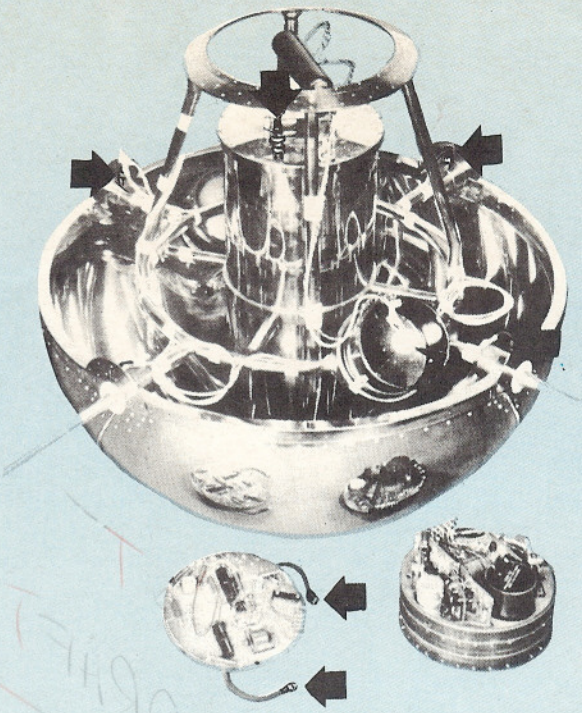

U. S. Army Signal Corp. photo.

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"Find a Need and Satisfy it"

Basic Research and Design Philosophy Guides Librascope

LIBRASCOPE, INCORPORATED has become the west coast's largest producer of computers for control and instrumentation by strict adherence to a very simple, yet basic, research and design philosophy:

Find a need and satisfy it.

Twenty years ago the loading of aircraft in terms of maintaining the proper center of gravity and staying within the maximum load limits was a long and tedious pencil and paper job. Everybody grumbled about it, but, like the weather, nobody did anything about it.

Nobody, that is, until Lewis W. Imm, founder and president of Librascope, and then an aeronautical engineer for the U. S. Bureau of Commerce, (now the Civil Aeronautics Administration), decided in 1937 to devote full time to developing a radically new idea in aircraft weight and balance distribution.

Out of that action came a visual balance indicator that solved the aircraft loading problems of the day. But more important than the solution of a problem was the means by which it was accomplished.

Imm invented a simplified computer to do the job and Librascope was off on a long line of firsts in computer development.

The unique mechanical linkage devised for the original computer is still being used today in modified and improved forms. It was incorporated in a semi-automatic fire control system for Naval anti-aircraft guns in 1940, the first of its kind.

The success of the system generated a sizable order from the Navy. This volume of business was beyond the financial capabilities of the fledgling company. Accordingly, a merger with General Precision Equipment Corporation was negotiated, and Librascope became a subsidiary in a family of companies whose talents and skills cover a wide field of different but related technological endeavors.

The principal producing companies of General Precision Equipment Corporation are: Librascope, Incorporated, Glendale, Calif.; GPE Controls, Inc., Chicago, Ill.; General Precision Laboratory, Pleasantville, N. Y.; Graflex, Inc., Rochester, N. Y.; The Griscom-Russell Co., Massillon, Ohio; Kearfott Co., Inc., Little Falls, N. J.; Link Aviation, Inc., Binghamton, N. Y.; National Theatre Supply, N. Y.; Shand and Jurs Co., Berkeley, Calif.; The Strong Electric Corp., Toledo, Ohio; and the Theatre Equipment Contracts Corp., N. Y.

General Precision Equipment Corporation also organized with Royal McBee the Royal Precision Corporation in 1956. This jointly owned organization combines the computer design and production know-how of Librascope with the marketing experience and the consumer requirement knowledge of Royal McBee, a longtime specialist in the sale, installation and service of office and scientific equipment.

Shortly after Librascope joined General Precision Equipment, Imm resigned the presidency and in a consultive capacity concentrated the major part of his attention to further study and development of naval fire control equipment.

Out of these endeavors came a line of computer-directed control systems for the firing of depth charges and torpedoes that eventually led to virtually every destroyer in the United States fleet today being equipped with Librascope designed, developed and manufactured analog computers.

Work is still continuing on newer and more complex systems in which digital computers are employed to handle the vast burden of intricate calculations required for victory in modern naval warfare.

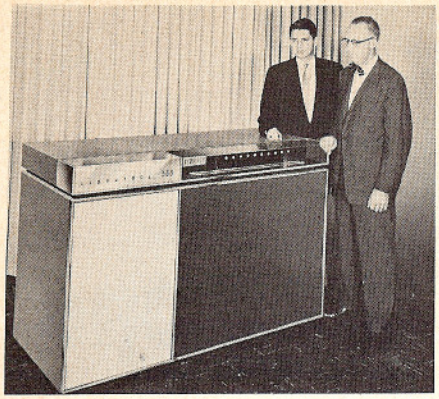
Not all of Librascope's effort has been devoted to shipboard control systems. Equally valuable contributions that have carried Librascope to leadership in computer developments have been made in airborne and space vehicle equipment, and in computers for business, commercial and industrial applications.

The year 1952 was a year of decision for Librascope. Advances in electronics had increased the reliability and reduced the size of parts and components to a point where their application to computer functions was practical.

Imm, who had returned to the presidency in 1949, charting the course and establishing a strong organization to carry on the naval fire control program, furnished the dynamic leadership needed for entrance into the relatively unexplored territory of very sophisticated electronic digital computers.

Again the philosophy of finding a need and filling it returned a rich yield of accomplishments. Soon, Librascope was at the fore-front in the pioneering of digital computer development, either in unit applications or in combination systems with analog types.

Imm's decision to enter the digital computer field was all important from a growth standpoint. Without it, it's doubtful that the company could have expanded from the 10-man operation of 1937 to the west coast computer leader employing more than 2,800 that it is today. This position of computer eminence was not easily earned. The strong concentration in the Pacific coast area of aircraft and missile building activity, with its attendant large demands for electronic and electromechanical equipment, has attracted



Libratrol-500 — computerized industrial process control system recently introduced by Librascope.

a large number of talented men and organizations.

To excel in competition with such competent company demanded more than a routine approach to the challenge of electronic and electro-mechanical computer development.

Librascope proved equal to the situation. Imaginative research, bold designing, meticulous manufacturing and an intimate knowledge of customer needs has maintained Librascope at the head of the computer column.

In the variety of its products, Librascope is also predominant. The company produces more than a score of different analog and digital computers used in such diverse operations as air, land and sea fire control systems; air, land and sea navigational systems; complete business, commercial and industrial data processing systems; research and design data processing systems; and control systems applied to the monitoring and direction of automated processes, business transactions and accounting procedures.

The latest addition to Librascope's growing line of electronic products performing monitoring and controlling functions is the Libratrol-500. More than a computer, the Libratrol-500 is a complete information gathering, data evaluating, and command issuing directional complex.

It applies the systems engineering concept to the problem of process control. It deals with the inter-relationship of each progressive step in a production sequence. The brain of the Libratrol-500 is a highly reliable, rapid-response digital computer. The eyes and ears of the system are a wide variety of standard analog input instruments such as amplifiers, thermocouples, strain gages, transformers, analyzers, potentiometers, or digital information suppliers such as shaft encoders, flow meters, parts counters, level gages, digital transducers, etc.

On the basis of the inflowing data, the programmed computer formulates the proper output signals and presents them as typewritten data, monitor display, alarm lights or bells to human operators, or, directly as correcting commands to operating controllers within the processing equipment itself. These correcting signals may be electric, pneumatic, mechanical or hydraulic.

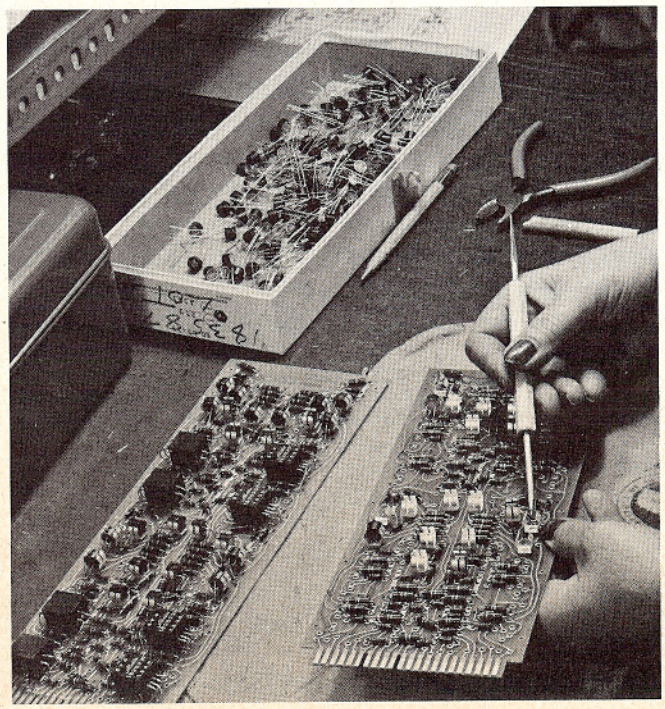
The mainstay in Librascope's large family of computers is the Royal Precision Electronic Computer (Model LGP-30). This is a low price, mobile digital computer equally useful in business, commercial, industrial, processing and military applications. It operates without special wiring or external air conditioning. Efficient design and a 4096-word memory bank permit large-scale engineering and scientific calculation, pilot plant operation, and missile-intercept determination.

Early in 1959, Librascope shipped the 250th unit of the LGP-30, a product selling for $50,000 each.

Librascope has been engaged in anti-submarine warfare weapon system development since early 1942. Experimental work with the Navy investigating requirements for depth charge and hedgehog launching equipment led to the concept of the computerized fire control system.

In 1942 Imm, president, developed

Left: Complexity of the electronic circuitry contained in the Air Traffic Control data processor now under development at Librascope is shown in this rear view of the computer console. Below: Component assembly operation.



the first electro-mechanical computer for the ASW weapon system. Incorporated in the attack director of the fire control system, the computer utilized sonar data to compute target course and speed and the ballistic trajectory necessary for the hedgehog and depth charge weapons in use, and determining the time of firing the weapons.

The ballistic portions of the computer utilized linkage techniques and the analyzer portion incorporated the analog velocity analyzing system developed by Imm.

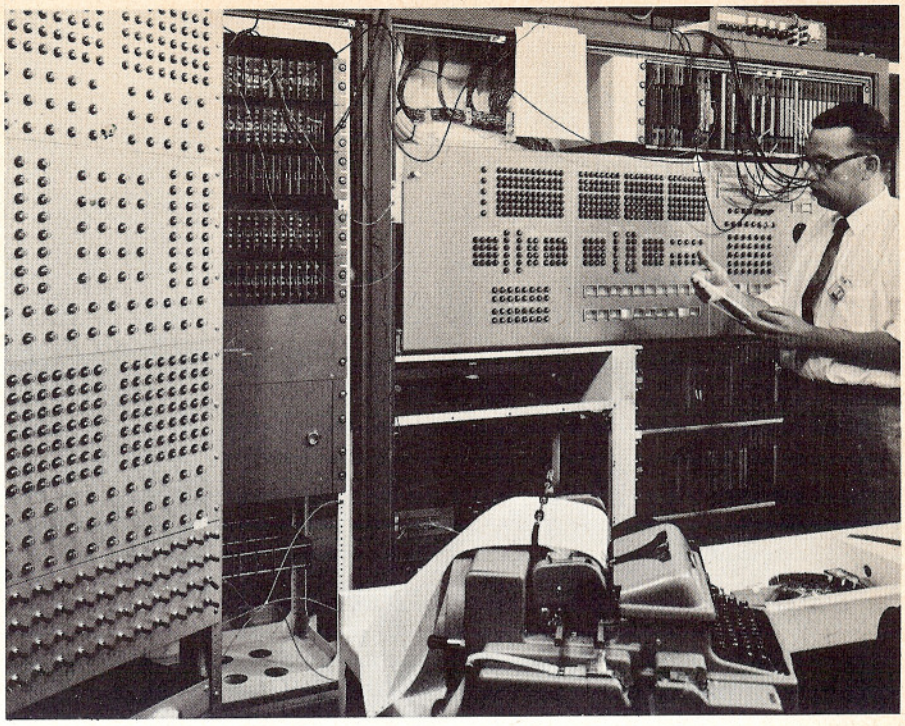
This attack director was designed, developed, and manufactured by Librascope. A highly successful design, the attack director was a tremendous improvement over the previous techniques of determining weapon firing time on the basis of stop watches, guess boxes and prediction elements.

One significant element in the attack director was the improved maintainability. Librascope had, at an early date, realized the tactical, logistic, and human factors which enter into weapon system performance and began to design equipment with these special military factors dictating design requirements. Capabilities of the attack director were further increased to make it compatible with all modern torpedoes.

In 1951 work was begun on a new fire control system to be used on the latest class of destroyer. Included in the system was a geographical plotter using an electro-mechanical optical system to produce the display.

A field in which Librascope has also developed leadership is that of airborne computation. Three major breakthroughs have come from the company's engineering laboratories: the Navy's first airborne digital computer for bombing and navigation CP-209; a miniature dead reckoning analog computer, ASN-9; and the revolutionary new ASN-24 minimal digital computer.

Lewis W. Imm, founder and president of Librascope.



Computer console for Federal Aviation Agency's air traffic control data processor is shown undergoing check out at Librascope, Inc.

One of the early airborne units was the Navy's digital computer (Model CP-209/ASB). The unit integrates bombing commands with aircraft navigational functions. This incremental digital computer with a pulse rate of 238,000 pps employs extensions of digital analyzer techniques to achieve 200 solutions per second.

The computer utilizes Doppler-radar data and memory to give instructions either to a human or an auto-plot. It will control bombing approach and bomb release during level, climbing or descending flight.

A recent development is the airborne special purpose computer (Model AN/ASN-9), another Librascope contribution to America's fighting potential. This airplane navigation computer is an electro-mechanical dead reckoning unit that provides the pilot with steering and position information. Light weight and compact construction permits its use even in light planes and helicopters. The total weight is 6.5 pounds; volume is 0.073 cubic feet.

Since the computer can be used to fly a pre-set course to a predetermined destination, and to indicate at all times the direction and distance to the home base, the pilot can fly a tactical mission without the distraction of continually checking ground points to establish his navigational position.

Weighing only 32 pounds, and occupying only ½ cubic feet of space, the company's unique new Minimal computer (ASN-24) is an aerial jack of all trades. This unit was designed for airborne applications in which space, weight, power, and environmental factors are paramount.

With a magnetic drum memory of 2,048 words, it is the first small and versatile digital computer able to accept such complex computing problems as auto-navigation for aircraft and missiles.

The Minimal computer is applicable to both military and commercial airborne problems.

The simple and functional external appearance of a computer is most deceiving. Beneath its outer shell are housed literally millions of parts and components. These parts and components are a cross section of

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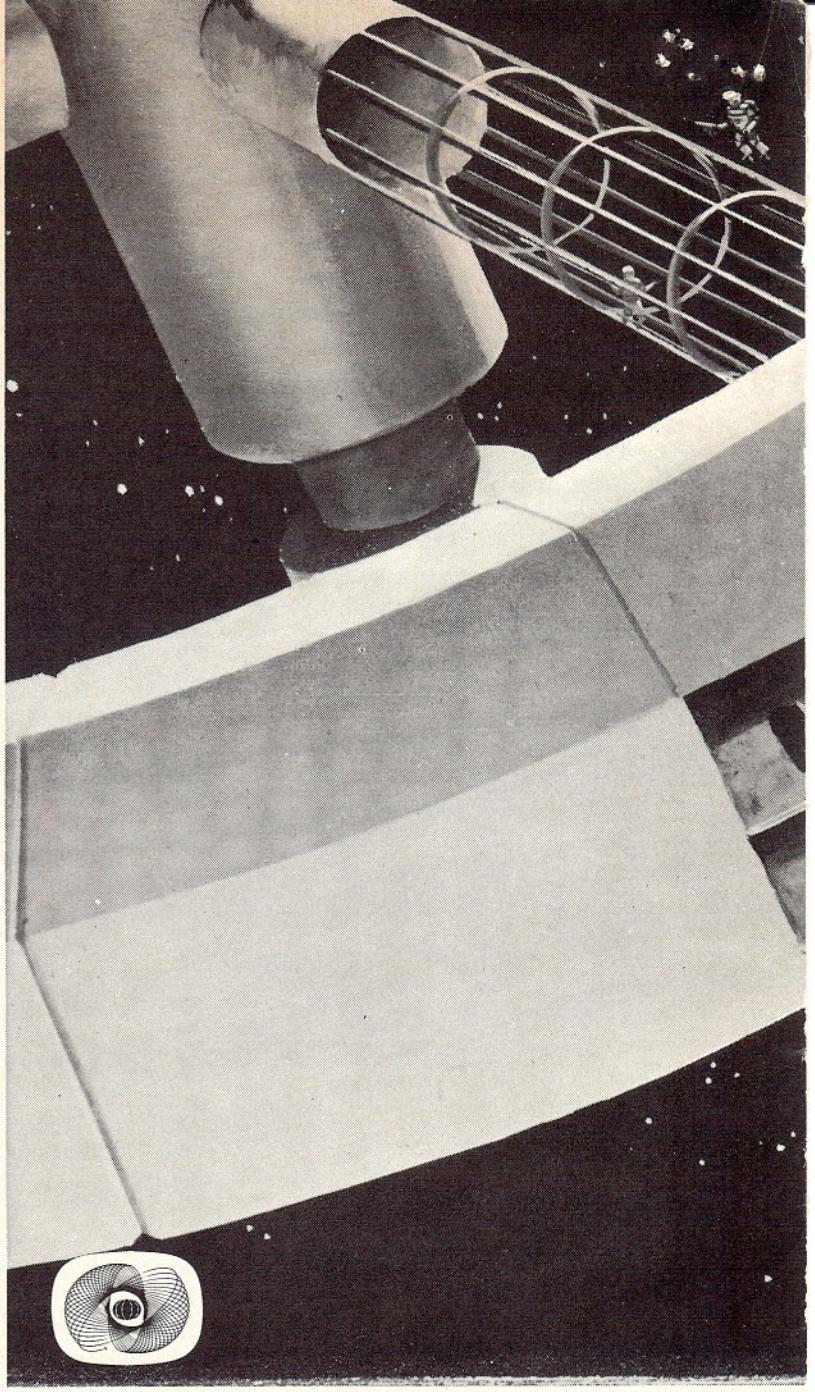


This is our R. L. Lillestrand, Project Engineer. Here he examines a model of his Stellar Aberrascope, a multiple star tracking device which is expected to provide the measurement of space vehicle velocities to accuracies of the order of 100 feet per second. The Aberrascope is designed so that precise alignment of the star trackers is not necessary. His investigations could have a bearing on self-contained guidance systems used in future space vehicles.

General Mills is working <u>today</u> to help

Development of a space vehicle guidance system which may one day be a factor in sending manned U.S. space stations into orbit around the earth is just one problem being attacked at the Mechanical Division of General Mills. In research, engineering and manufacturing, we are finding solutions to many problems that have application in the space age.

Our research activities cover broad areas in physics, chemistry, mechanics, electronics and mathematics. Some of the studies representative of these activities are: ions in vacuum, deuterium sputtering, dust erosion, magnetic materials, stress measurements, surface friction and phenomena, trajectory data and infrared surveillance.

In our engineering department, current projects include: airborne early warning systems, micro wave radar test equipment, antennas and pedestals, infrared and optics, inertial

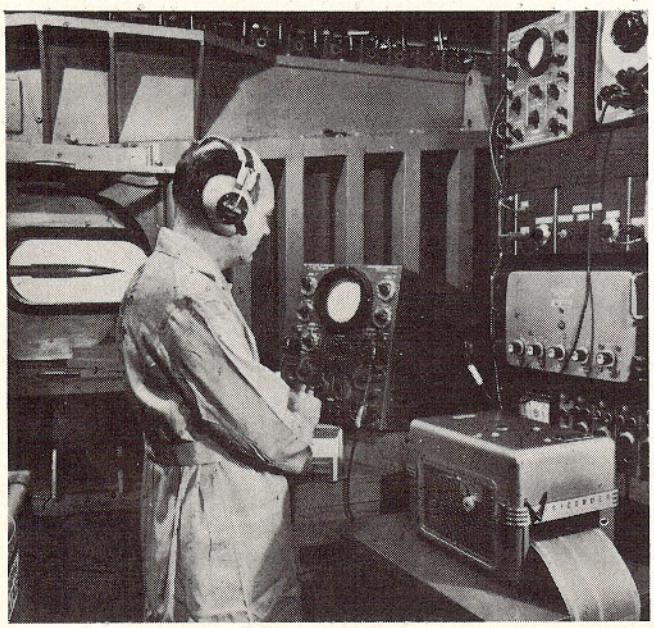
These studies of aerodynamic damping coefficients on an airframe were made by engineers at ARO, Inc. They were conducted in the Gas Dynamics Facility at the U.S.A.F.'s Arnold Engineering Development Center, Tullahoma, Tennessee, wind tunnel center of the Air Research and Development Command.The studies were directly recorded on a Honeywell 906-A Visicorder.

The problem: To measure damping-in-pitch derivatives for a clipped-delta-wing-body configuration over a Mach number range of 2.0 to 5.0 so that these measurements could be compared with the Mach number trend predicted by theory.

The set-up: A model of the delta-wing body, mounted on its cross-flexure pivot support, was forced to oscillate through a linkage by an electro-magnetic shaker. Resistance strain gauges were bonded to the input torque member and to one of the pivot supports. These gauges supplied torque and displacement signals through a carrier amplifier to two galvanometers in the Visicorder. An oscillator, driving a third galvanometer, established a time base for the oscillogram.

The values discovered through this forced-oscillation balance system experiment showed some discrepancies from values predicted by theory, because the theory pertained to simpler bodies than that used in the tests. The experiments provided a new set of data which will result in more accurate predictions for future design.

in aerodynamic research



Z. A. Woodard, Jr., ARO, Incorporated, instrument technician, operates the Visicorder in the measurement of aerodynamic damping coefficients.

The Honeywell Visicorder is the pioneer and unquestioned leader in the field of high-frequency, high-sensitivity direct recording oscillography. In research, development and product testing everywhere, instantly-readable Visicorder records are pointing the way to new advances in product design, rocketry, computing, control, nucleonics . . . in any field where high speed variables are under study.

The new Model 906A Visicorder, now available in 8- and 14-channel models, produces longitudinal grid lines simultaneously with the dynamic traces, time lines, and trace identification by means of new accessory units.

To record high frequency variables—and monitor them as they are recorded—use the Visicorder Oscillograph. Call your nearest Minneapolis-Honeywell Industrial Sales Office for a demonstration.

Reference Data: Write for Visicorder Bulletin
Minneapolis-Honeywell Regulator Co.,
Industrial Products Group, Heiland Division
5200 E. Evans Ave., Denver 22, Colo.

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Administration and engineering headquarters of Librascope in Glendale.

the output of every segment of the electronic industry.

To bring them all together in a single, harmoniously operating entity is as much an art as a science.

Librascope's formula for leadership in the exacting field of researching, engineering, developing and producing highly precise and reliable computing and control systems is simple in principle. It is to combine highly original directed thinking in creative design with craftsmanship in manufacturing.

With the statement of principle, the simplicity ends. Translating the principle into practice is an extremely complicated process. It demands a delicately balanced blending of many talents and skills in the personnel, an infinite variety of tools and facilities, and an administrative organization that controls without impeding.

Over the years, Librascope has developed an effective formula for translating the basic company principle of matching advanced design thinking with quality production into standard day-by-day practice.

The formula calls for locating the right people in the right areas of activity, for supporting them with the facilities, equipment and tools their work requires, and for establishing organizational and administrative services tailored to needs.

The opinion is firmly held at Librascope that any idea eventually evolving into a successful working product must be based on sound fundamental knowledge.

The years of creative design effort for computers are always preceded by an equal amount of time expended in basic research. It is research that keeps a computer manufacturer ahead, not only of next year's requirements, but of the needs that will develop the next 10 years.

In the field of memory techniques, Librascope is now working on the products that will not reach the market for another 10 to 15 years.

Librascope's research and development staff is divided into five specialized departments. This organization of the engineering division is based on the basics of good management that particularized assignments permit the delegation of clearly defined areas of authority with consequent localized assumptions of authority.

By limiting the field of activity for any one group, it is also possible for its members to become intimately acquainted with the needs and the problems of a specific set of users of a particular family of products.

Although each department has an area of specific interest, all have equal access to the company's extensive research test facilities and equipment.

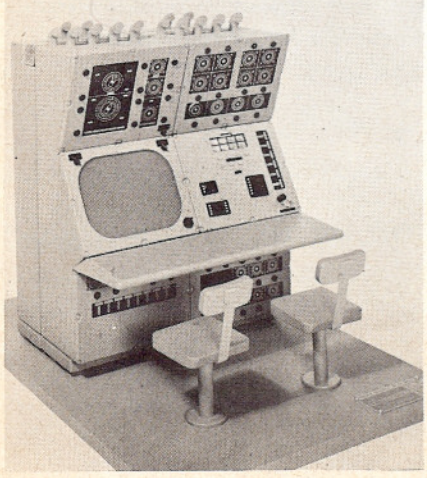
Through the informal interchange of ideas at the working level, and through the more formal interchange of information at the management level, all units of the engineering division are aware of company progress in research and development. In this way, no department engages in the wastful solving of a problem already investigated by another.

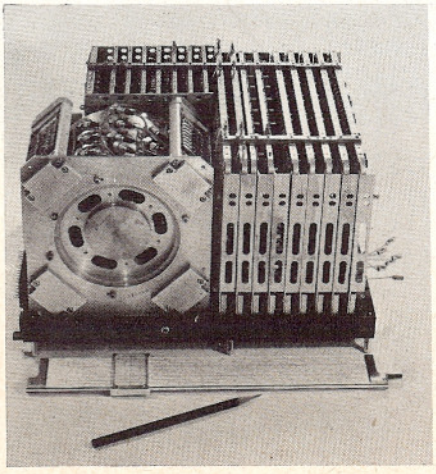
COMMERCIAL ENGINEERING is concerned with the design and development of computers, data processors, process control systems and computer components for business and industry.

SPECIAL DEVICES is concerned with the design and development of ground-based computer systems and with optical and photogrammetric equipment and other devices and equipment not related to specific designated function or environments.

AIRBORNE EQUIPMENT is concerned with the design and development of fire control systems, bombing and navigational computers for aircraft and missiles and for components and sub-systems applicable to airborne use.

SHIPBOARD EQUIPMENT is concerned with the design and development of fire control systems for both surface and submersible vessels. Librascope entered this field with the design and development of the first electro-mechanical computer for an anti-submarine warfare system in 1942. Further refinements





Left: ASN-24, Librascope-developed miniature airborne digital computer designed for aircraft navigation and missile guidance and control. Right: Advanced digital weapon control computer developed and manufactured by Librascope for the U. S. Navy.

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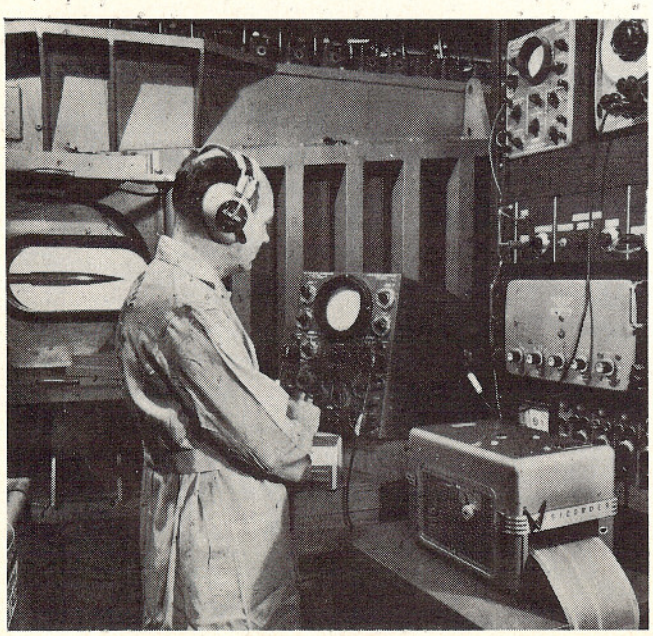

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of this basic system have maintained its battle integrity and improved models are still being delivered to the Navy in quanity. Underwater fire control systems are among its other assignments.

PRECISION TECHNOLOGY is concerned with explosive ordnance devices, nuclear fusion devices, reactor instrumentation, high temperature instruments, special electronic cameras, proximity devices, and similar ultra-precision products.

The excellence of Librascope's research and development personnel and equipment is matched by its production machinery and the craftsmanship of its personnel.

Librascope's machine shop, for example, has received widespread recognition as an outstanding producer of high precision parts. Many of the machine tools are either original Librascope designs or have been modified by Librascope for the high degree of precision required in making company products.

An example of the rigid progressive inspection program at Librascope is found in the printed wiring processing department, which produces printed wiring boards for the company's electronic computers. There can be no substitute for quality here as these boards form the basis of the "logic card" intelligence of computers.

In order to maintain complete quality control of its printed circuitry, Librascope makes all of its own boards, buying only the "sandwich" of copper-clad epoxy glass laminate. Each board is given a total of 17 between-stage inspections during its production to insure maximum quality and reliability.

In the sub-and-final assembly of Librascope's products, the same careful craftsmanship with precision tools is practiced.

Over 100,000 feet of air conditioned space is devoted to assembly. The assembly lines are manned by highly skilled men and women with long experience in working with electronic, electro-mechanical, mechanical, optical and magnetic assembly techniques.

To insure maximum reliability in the assembly of printed circuit boards, automated and semi-automatic equipment is extensively used. Automatic eyeletters, punches and drills prepare the boards for the miniature electronic components.

Complex machines sort components, align them and automatically insert the parts in the prepared circuit boards. Automatic feeding mechanisms are used to carry the boards into precise alignment for each of the miniature parts, the machine inserts leads through the proper openings in the boards, and bends the wires to hold them in place through the soldering bath where each component becomes an electrical part of the printed circuit.

Among the tools used in the assembly lines are such varied devices as multimeters, microscopes, watchmaker's equipment, torque testers, lathes, drill presses, and jigs of every sort. Much of the assembly equipment was designed, developed and fabricated by Librascope. But the final question to be answered about any product is: Will it work?

There are two locations at which this answer may be determined. One is in the actual operating environment. The other is in the test laboratory. To await the answer from the field is expensive, and sometimes fatal, if the reply is in the negative.

Librascope, therefore, has concentrated on the establishment of development and production testing techniques that will equal, and often exceed, the environmental rigors of actual field service conditions the products will encounter.

More than 5,000 sq. ft. of floor space is devoted to these testing activities. Simulations of temperatures, humidity, radio interference, shock, salt spray, vibration, pressure, and many other degenerating environmental conditions are available. If a product can survive the testing tortures of the Librascope laboratories, the equipment is ready for field use.

Lewis Imm originally defined the basic philosophy upon which Librascope has based its spectacular growth through contributions to the increasing state-of-the art when he said: "find a need and fill it." Over the years the Librascope organization under his dynamic leadership has added just one word to round out that declaration. The word is: "satisfactorily."

This is the strength of Librascope.

Aerial view of Librascope's Glendale headquarters.