

KEL

introducing LIBRASCOPE

SINGER
AEROSPACE & MARINE SYSTEMS



Librascope was founded in 1937. The first Company trademark was a variation of the constellation Libra. It and the name "Librascope" were inspired by the Company's first product. . .



... a weight-and-balance manual analog computer, used to determine proper loading distribution for aircraft. The device was called a "Librascope" -- a combination of the Greek work "Libra" for "balance" and "scope" for "indicator".

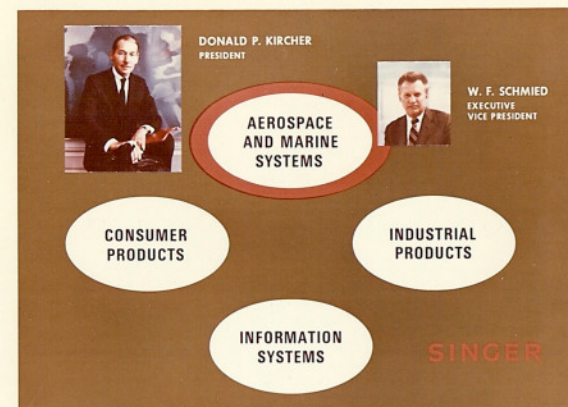


Singer, with sales exceeding \$2.5 billion per year, is engaged in the broad areas of business shown.

Consumer Products include home sewing machines, housing, home furnishings, and power tools. Industrial Products include textile and industrial sewing machines, gas metering and regulating equipment, and controls for heating and air conditioning. Information Systems include retail information systems, data processing systems, office products equipment, and graphic systems.

Librascope is a part of Aerospace and Marine Systems, which supplies navigation and guidance systems, Naval electronic systems, instrumentation, simulation devices, and telecommunications. Kearfott, HRB-Singer and Simulation Products (formerly Link) are other operating elements of Aerospace and Marine Systems.

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Very horizontal structure (minimum of management levels) gives good visibility and fast response.



Librascope features conventional functional organization, with very horizontal structure to shorten communication lines.

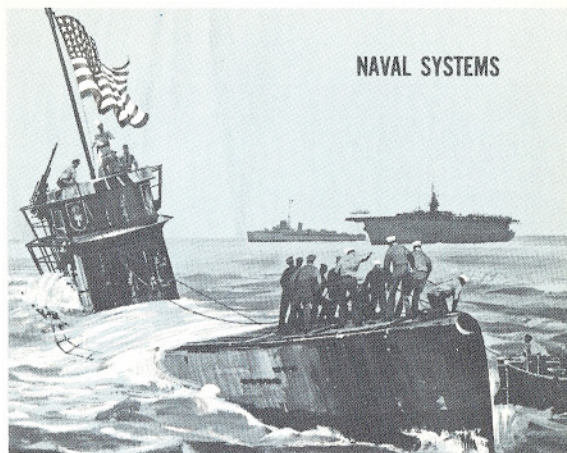


Present-day Librascope, with 400,000 square feet and approximately 1400 people, is located primarily in Glendale, California. The only facility outside Glendale is Instrumentation, in Los Angeles.

LIBRASCOPE AREAS OF BUSINESS

- NAVY
- ARMY
- AIR FORCE
- COMMERCIAL

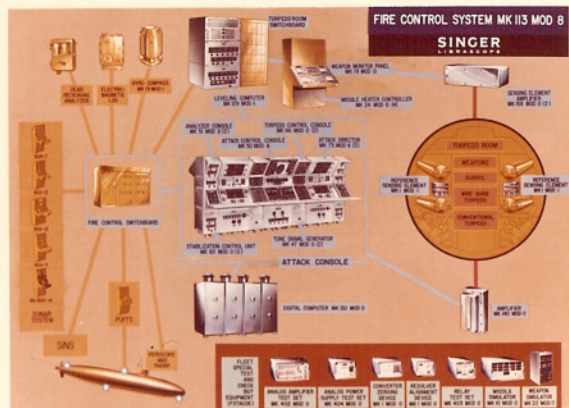
Librascope's present business volume is approximately \$45 million which is derived from the development and production of military electronic systems and instrumentation equipment. Approximately 30% of the volume represents commercial business; of the 70% military business, most is with the Navy.



This has been Librascope's main area of business since 1940.



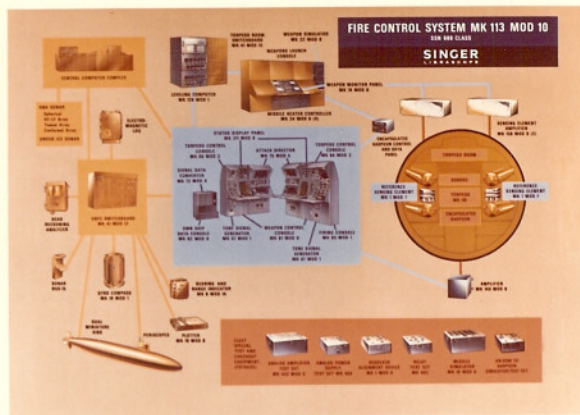
Here is a picture of a typical submarine weapon control system.



This weapon control system is the one most used on our nuclear Attack Class submarines.

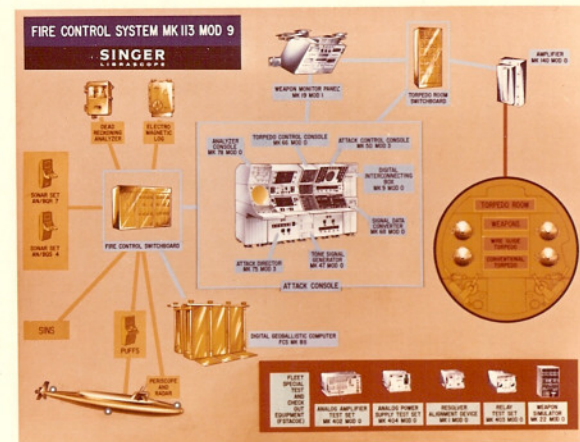
All equipment shown in blue is designed and manufactured by Librascope. This chart shows the high level of integration we perform between sensors and weapons. Each system costs approximately \$2 million.

It is interesting to note that this system includes Librascope's Digital Computer Mk 130, the first digital computer to be deployed aboard a submarine.



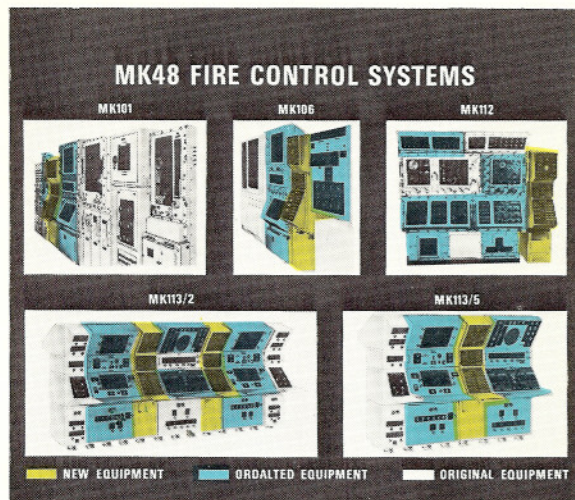
This is the most current weapon control equipment used on board nuclear Attack Class submarines.

Librascope has designed and manufactured all equipment associated with the Weapon Order Subsystem which forms the major portion of Fire Control System Mk 113 Mod 10. Integrated into this system is a new Digital Driven Display and Computer Control Subsystem which provides vastly improved target tracking, weapon control, and tactical capabilities.



This system is in operational use on fleet ballistic missile submarines.

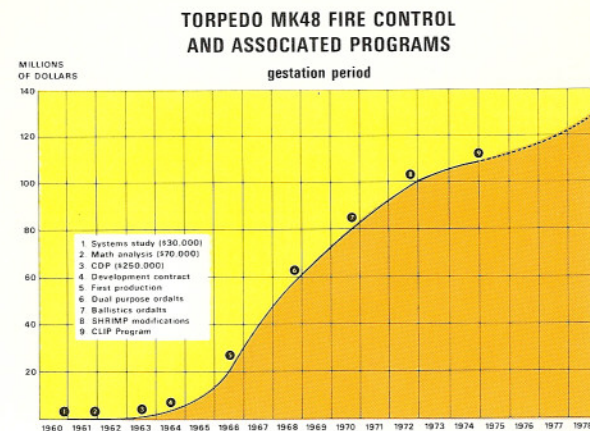
The system was the first to provide a general purpose computer-driven CRT for submarine use.



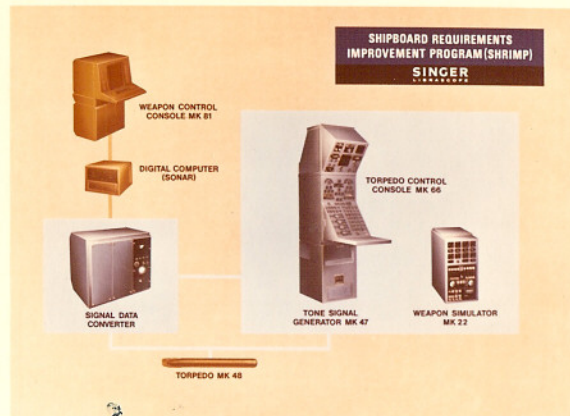
In 1964 Librascope received a prime contract from the Navy to modify the entire submarine fleet to incorporate the new Mk 48 torpedo. This required the design of new equipments and heavy modification of five different systems. We have deployed these modifications throughout more than two-thirds of the submarine fleet. Items in yellow represent the new equipment that had to be added, and parts in blue are those portions of existing equipment that had to be modified.



This series of pictures shows the first warshot launching of a Torpedo Mk 48 from a U.S. submarine against a surface target. The submarine was equipped with a Torpedo Mk 48 fire control system manufactured by Librascope. The torpedo and fire control system functioned as designed, resulting in a successful mission.

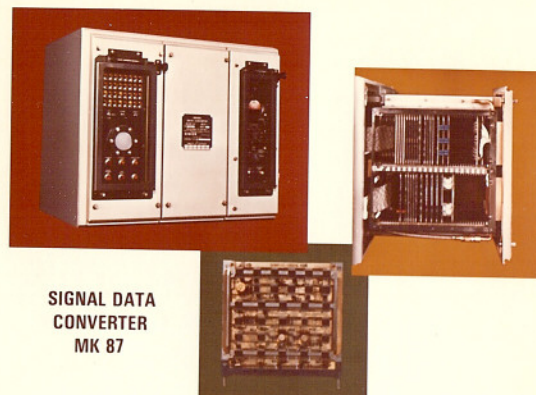


This chart shows the long gestation period typical of our Naval Systems programs. The Mk 48 program started in 1961 when we received a small systems study contract, went on through the year with more analytical studies, and in 1963 we, along with Sperry, were awarded contract definition phase contracts to develop the concept. In 1964 we won the development contract over Sperry and the program has grown to over \$110 million worth of business for Librascope.

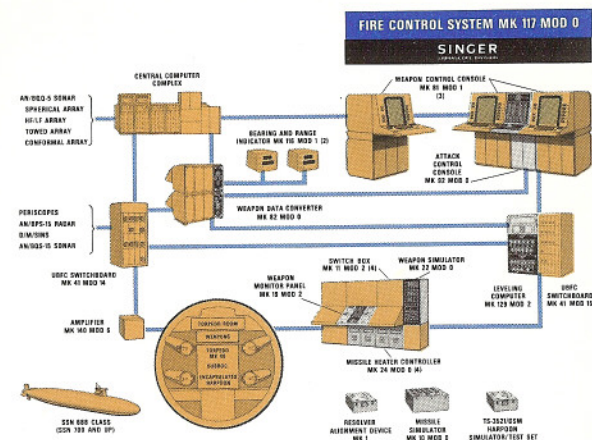


The SHipboard Requirements Improvement Program (SHRIMP) provides system improvements and increased capabilities to existing fire control systems in submarines deployed with Torpedo Mk 48.

System improvements enhance equipment operability and expand own ship safety features. Increased capabilities include provisions for an automated environmental assessment with subsequent weapon tactic recommendations, and a closed loop bi-directional communication system with Torpedo Mk 48. Pictured here are SHRIMP modifications applicable to FCS Mk 113 Mods 6 and 8.



Signal Data Converter Mk 87 provides data conversion and signal processing for the inclusion of TATE and TELCOM capabilities in Fire Control System Mk 113 Mods 6 and 8. New packaging techniques are utilized in this equipment to provide cold plates on 5 X 5 circuit boards which are thermally coupled to water-cooled card rack assemblies.



This is the overall configuration for the new FCS Mk 117, scheduled for Attack Class submarines SS(N) 700 and beyond.

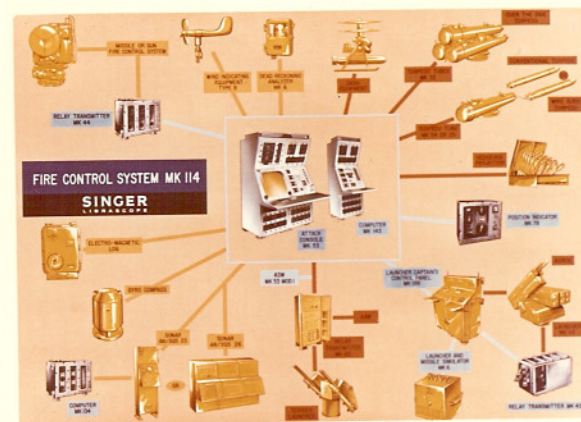


This is the overall configuration for the new FCS Mk 118, scheduled for TRIDENT Class submarines.

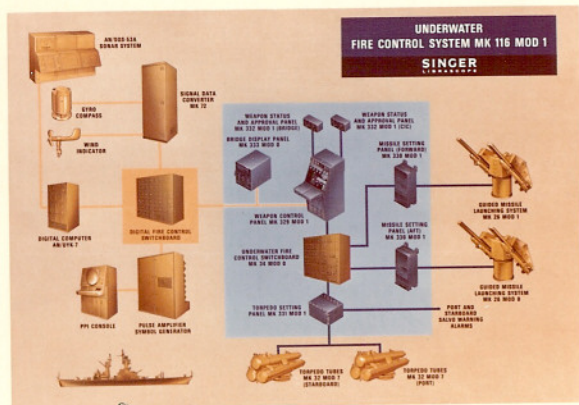


These are examples of new digital equipments being developed by Librascope for use on the new attack class and TRIDENT submarines. They will also be used selectively as part of a planned backfit program for the 594/637 class submarines.

The equipments utilize new packaging, cooling, and circuit-design concepts, and feature high reliability and special self-test diagnostic capabilities. Operationally they provide for real time data processing, conversion, and display. For TRIDENT, they complete the transition from an analog fire control system to an all-digital fire control system.



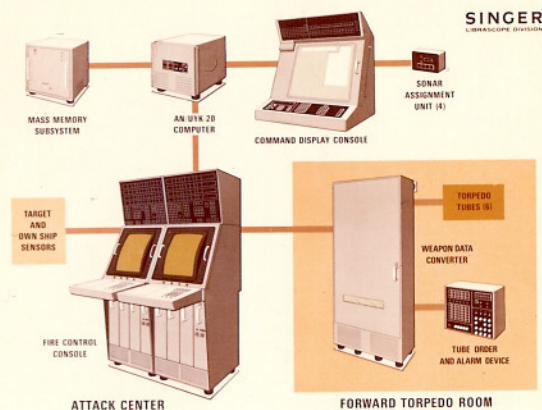
Librascope designed this ASW weapon control system for surface ships. It is the current operational system in the Fleet.



This is the most recent ASW fire control system designed for surface ship use (DLGN 38 class).

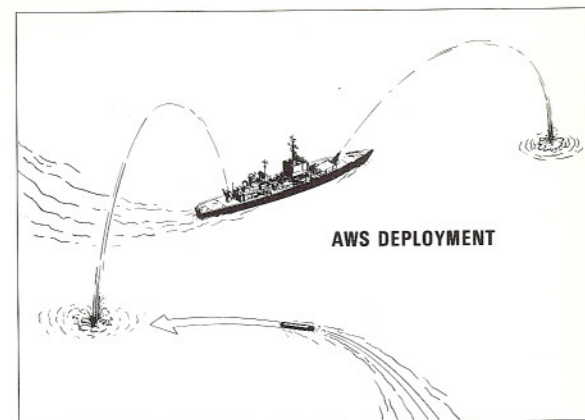
The system integrates a Weapon Control and Setting Subsystem (WCSS) with a shipboard digital computer. The digital computer provides sensor data, fire control problem solution data, and recommended weapon parameters. The WCSS employs this data to select, set, test, monitor, and launch either an ASROC missile or Torpedo Mk 46.

SUBMARINE FIRE CONTROL SYSTEM (AN) MOD 0



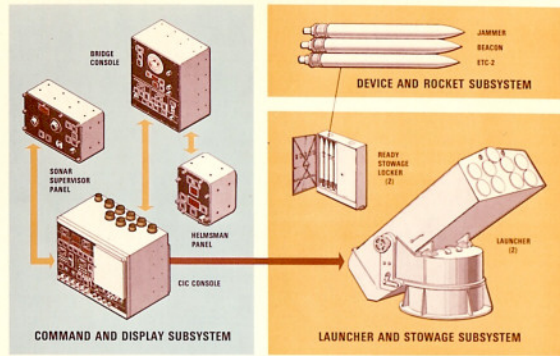
This system, currently being designed for the Royal Australian Navy (RAN), represents a new generation of ASW fire control technology, making use of a small general purpose computer (AN/UYK-20) and advanced interactive CRT techniques. For the RAN, it is designed to be retrofitted into the Oberon Class of diesel-electric submarines for the control of straight running and wire-guided torpedoes. Employing Standard Hardware Program components and modern programmable electronics, system expansion capability for new sensor and weapon types is assured through hardware modularity and computer programming.

This system is highly appropriate for both new construction and backfit applications involving surface ships as well as submarines.



The Acoustic Warfare System (AWS) provides surface ships with the capability of tactical threat evaluation and the deployment of selected acoustic counter-measure devices against torpedo attack.

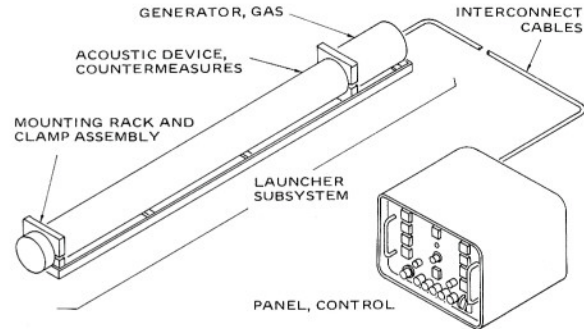
BASIC ACOUSTIC WARFARE SYSTEM (AWS)



A Basic Acoustic Warfare System consists of four countermeasure command and control stations, two launcher and stowage equipments, and three countermeasure types.

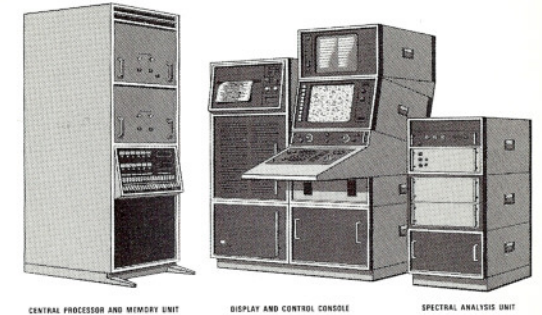
Basic AWS provides for threat evaluation and automatic, semi-automatic, and manual deployment of selected acoustic countermeasure devices.

COUNTERMEASURES SET, ACOUSTIC (CSA) MK 1 MOD 0



The CSA provides submarines with the capability of deployment of an acoustic countermeasure.

SUBMARINE TRANSIENT ACOUSTIC PROCESSOR (TAP)



The Transient Acoustic Processor (TAP) provides the ability to spectrum analyze, identify, and classify transient events of interest in a real time at-sea environment. It also provides the facility to annotate, store, and recall events for further analysis. The system features monochromatic and color CRT displays, a hard copy recorder, and selectable aural processing. It is a software centered system with a PDP-11/45 Computer, two Librascope 107B discs, and a dual channel FFT processor. TAP is the result of a NAVSEA/NUSC/Librascope exploratory development program in the area of the use of transient emissions.

ENCAPSULATED HARPOON

Command and Launch Subsystem Integration

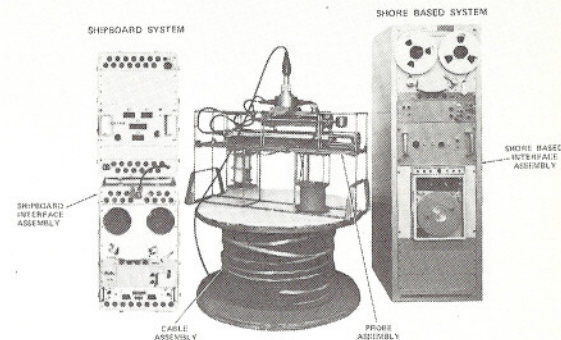


Librascope is responsible for the initial integration of Harpoon aboard Attack Class submarines. This work is being carried out for the McDonnell Douglas Astronautics Co.



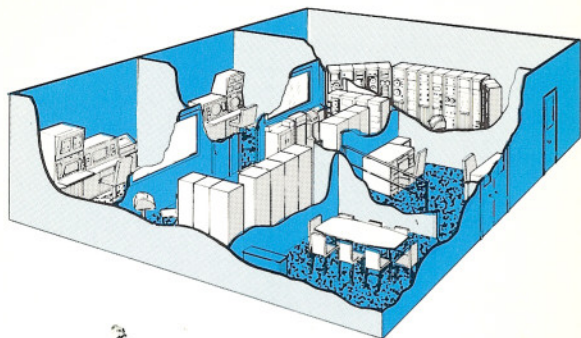
Librascope provides various types of support equipment in addition to prime systems. This portable data collection system provides a means of rapidly collecting data from multiple sources. The system was designed for use on both surface ships and submarines.

DIGITAL OCEANOGRAPHIC DATA ACQUISITION SYSTEM



This is typical of our Oceanographic Instrumentation work. This system measures and records characteristics of the water: salinity, temperature, and other parameters. The information is continuously transmitted by wire to a shipboard data collection system, then by radio to a shore based facility for processing.

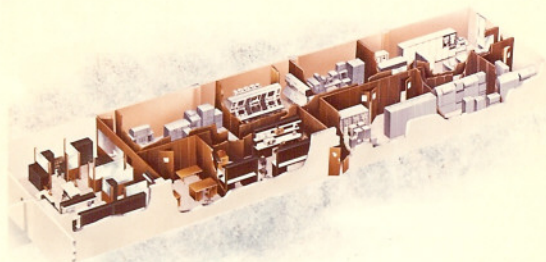
SIGNAL PROCESSING & DISPLAY LABORATORY



The Signal Processing and Display Laboratory is an integrated facility for complete sonar system simulation and sonar design concept evaluation in a controlled environment.

The facility includes a hardware capability for performing real-time spectral analysis of twenty acoustic data channels, for storing and recalling large quantities of sonar data history, and for dynamically displaying, annotating, and analyzing sonar data under multiple operator control on monochromatic and color CRT displays, a 3-D paper chart recorder, and a plasma display panel.

A dual computer system and an extensive software library backed by an experienced staff provide a flexible method for simulating all or portions of a prospective sonar system from the hydrophone input through the display to the operator using sonar recordings made at sea or through sonar data simulation.



U. S. Naval Underwater Systems Center
System Development Laboratory

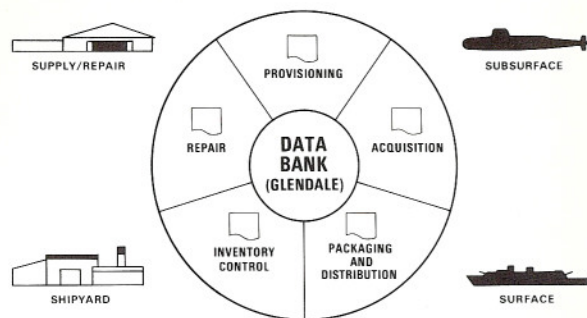
NEWPORT, RHODE ISLAND

An example of our expertise in designing land-based installations for the Navy, this lab in Newport, RI, was developed and put in operation by Librascope under a contract to the Naval Underwater Systems Center. Total shipboard environment on board a submarine can be simulated. It is the first facility of its type within the Navy.

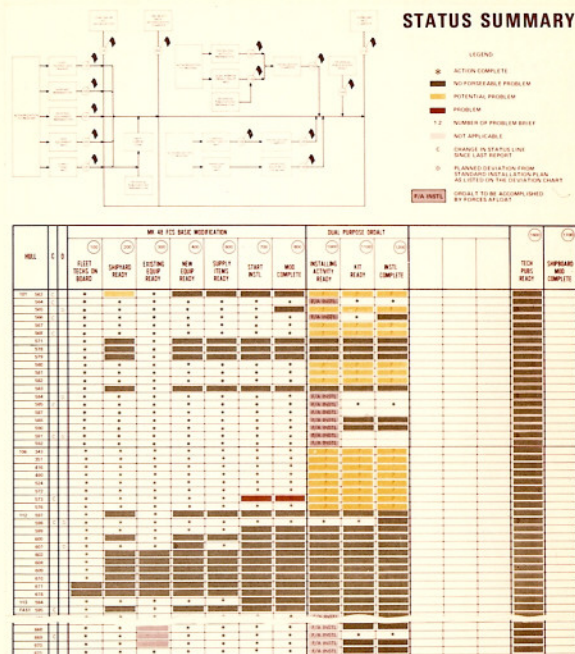


The Librascope Logistics Department employs approximately 200 people. The efficient manner in which we support our equipment in the field is one of the Company's main strengths in the Naval Systems business.

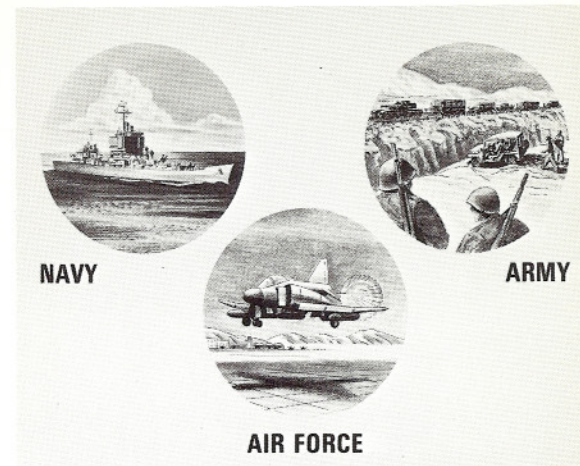
FLEET MATERIEL SUPPORT SYSTEM (FMSS)



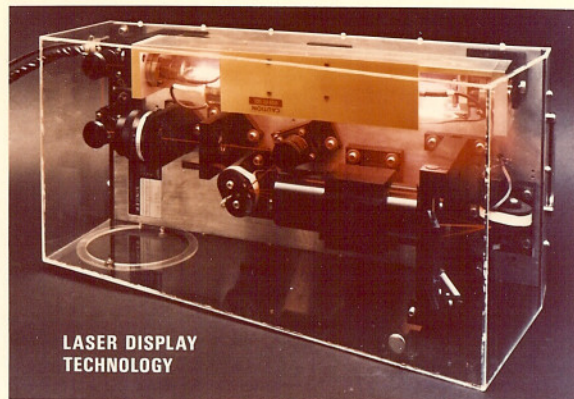
The Fleet Materiel Support System (FMSS) is a unique technique developed for the Navy by Librascope. It is a functional network of information management processes and supporting services for the materiel management of spares. The heart of the system is a large data bank that is maintained in our Computer Center at Glendale. Innovative computer programs and reports are used to systematically maintain spares baseline support for Navy weapons systems located throughout the world.



This is an example of the type of management service that Logistics provides to the Navy. This periodic report is a key management tool for controlling all the activities which the Navy must perform to accomplish a successful installation.



Even though the major portion of Librascope's business is with the Navy, we sell to other areas of the military where we have a strong technology base. When certain systems and subsystems developed for the military are found to have commercial applications, we market these products to commercial sources. Additionally, we are rapidly expanding our activities in international markets.



Librascope is the pioneer in the application of lasers for large-screen displays and recording systems. We are presently developing equipment for use in this country and overseas.

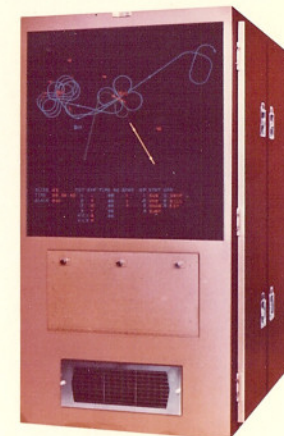
ARMY TACTICAL DISPLAY SYSTEM



The Army Tactical Display System has been developed for field Army use. It consists of a data entry and edit monitor (DEEM), a photochromic film display, an overlay reproducer, and a keyboard.

The DEEM cathode ray tube displays computer-processed data superimposed over a full color map. The photochromic film display provides a 6' x 4½' image of the same computer-processed data superimposed over a full-color military map. The overlay reproducer provides a 28" x 21" hard copy overlay of the tactical information on the DEEM or photochromic film display. Operator control of the markers and tactical symbology employed by the system is accomplished through the keyboard.

4-COLOR TACTICAL SITUATION DISPLAY



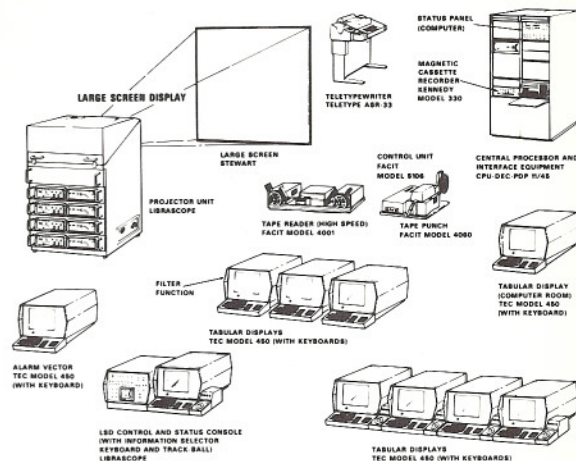
The 4-Color Tactical Situation Display System is a high-speed, real time, permanent recording, multi-color projection display system using a laser writing technique and a metallized 35mm film as the recording mechanism. Input is delivered from an external computer through a digital interface at a writing rate of forty characters per second. The System is presently in operation at North Island Naval Air Station, San Diego, in the S-3A ASW Weapons System Trainer and Part Task Trainer.

SWEDISH LARGE SCREEN AIR DEFENSE SYSTEM

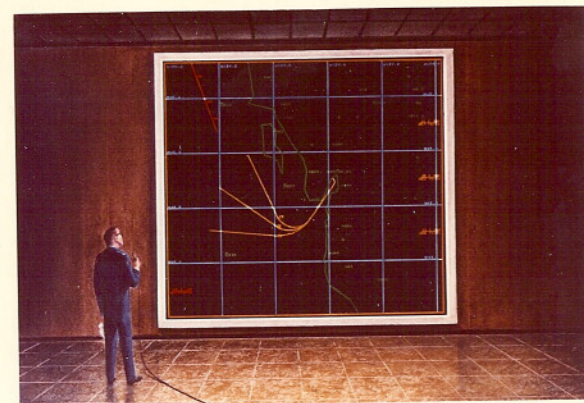


This is a depiction of how the various operational equipments of the large screen display system might be deployed in an amphitheater arrangement for tactical use.

SWEDISH LARGE SCREEN AIR DEFENSE SYSTEM



The various hardware elements of the large screen air defense system include: a PDP 11/45 computer and interface with 64K of core memory serviced by an ASR 33 teletype, a Facit high-speed tape reader and punch, and a Kennedy cartridge recorder; TEC Model 450 CRT displays and special-purpose keyboards for operator I/O; and a large screen four-color laser inscribing display.



Tactical situation display systems designed and manufactured by Librascope are capable of projecting high-speed random-access multicolor displays up to 14 feet square.

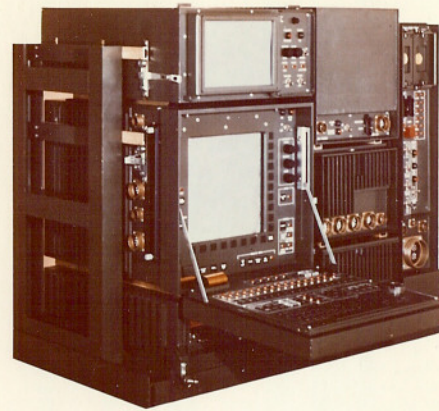
The display system can be constructed in various configurations dependent upon the application. The projection head (Plotter-Projection Assembly) can be mechanically independent from the driver electronics. The projection head may be mounted in an overhead structure and the electronics in a separate cabinet.

The programmable pulsed argon laser can activate a wide variety of reversible, permanent non-processed or dry-heat processed film materials placed in the image plane. Reusable media with real-time selective erase features are in development.



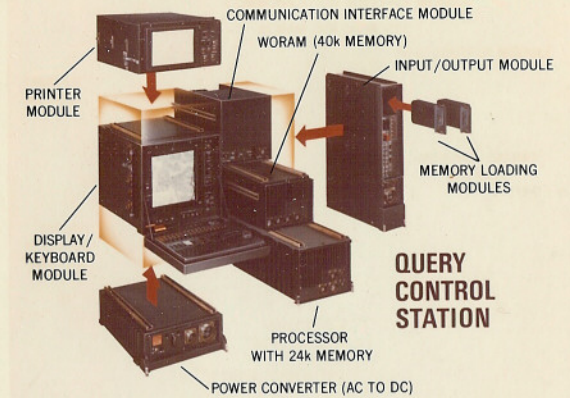
QUERY CONTROL STATION

QUERY CONTROL STATION



A close-up view of the fully assembled QCS.

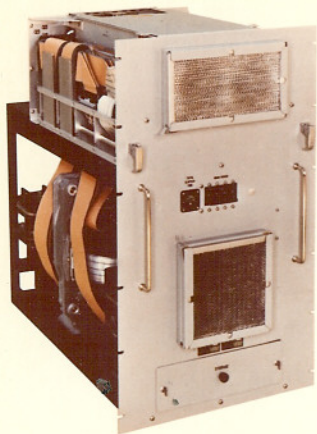
The Query Control Station (QCS) is a stand-alone programmable data processing station intended for tactical data and communications applications as a part of the Army Tactical Data System (ARTADS). Designed to operate on Army vehicles and in air transportable shelters, QCS can function as a miniaturized artillery computer, a remote access to the Army's large data processing centers, and as a communication link via radio, wire line, high-speed computer data nets, and voice. Security is provided against electronic warfare operations that could degrade communications, data lines, and the equipment.



The QCS is modularly structured to provide for the servicing of one to five operator stations with interactive display/keyboard modules and/or high speed printers, and with one to sixty-four tactical communication channels that provide for radio and wire integration.

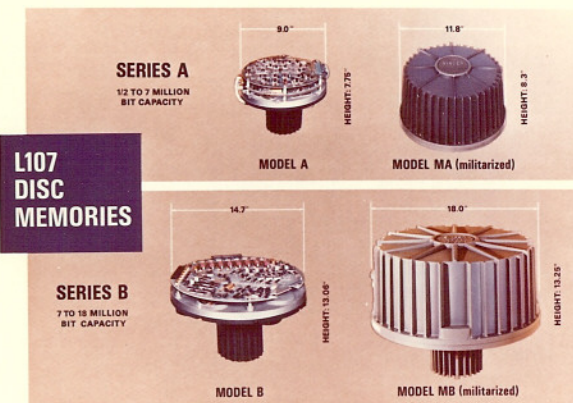
QCS modularity provides for a multi-processor configuration of up to four processors where each processor can support a full complement of QCS peripherals and communication channels. (The full complement includes the sixty-four channels and hardware described in the preceding paragraph.)

QCS modularly also provides for reduction in hardware within the modules for use at lower echelons and for specific applications requiring a minimal hardware configuration.



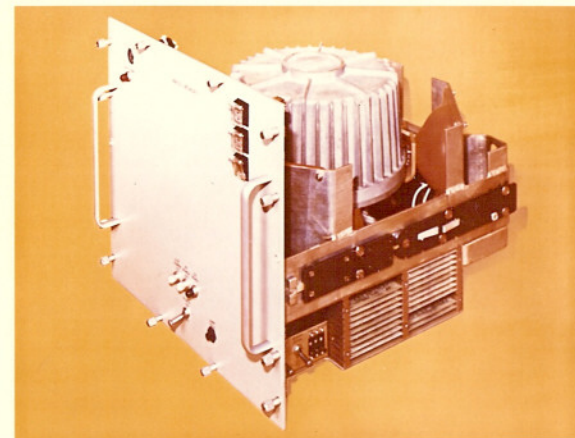
L-516 DISC FILE

This is one of Librascope's disc memory systems, used in intelligence processing applications. The Company is a pioneer in the head-per-track disc memory field.



The L107 head per track disc memories, all with identical electronics interfaces, are specifically designed to meet commercial, industrial and military storage needs to 18 megabits capacity.

MODEL CL107MA FULLY MILITARIZED CONTROLLER AND MEMORY



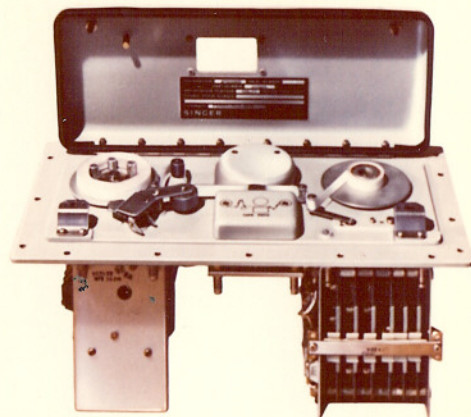
Model CL107 fully militarized controller and memory is the first on the market to meet the specifications of MIL-E-16400, MIL-S-901C (the drop hammer shock test) and MIL-E-5400.

Existing controllers interface Navy Tactical Data System (NTDS) Computers AN/UYK-20, AN/UYK-15, AN/UYK-7, Univac 1616 and USQ-20B.

Interface for the Rolm 1602, the processor selected for the Army's QCS program, features full RDOS (Real-Time Disc Operating System) compatibility.

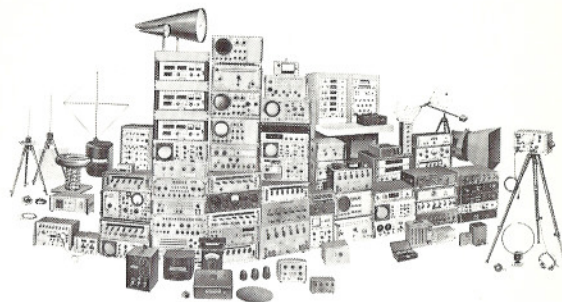
Storage capacities range from 40,000 to 8 million words.

LINE PRINTER



This is a line printer we have designed and manufactured for Boeing on the SRAM program. The line printer is deployed in a ground installation and provides profile printouts of weapon performance during tests.

SINGER INSTRUMENTATION

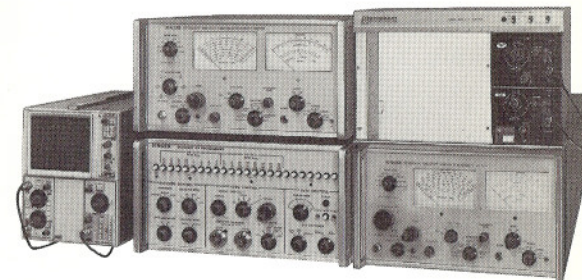


Singer Instrumentation, located in Los Angeles, provides a complete line of sweep oscillators, network analyzers, spectrum analyzers, signal generators, RFI/EMI instrumentation, and communication test instrumentation.

Singer Instrumentation supplies equipment for commercial laboratory/communications, electronic warfare, weapon control, navigation and flight control, and other systems requiring specialized frequency measurement and analysis.

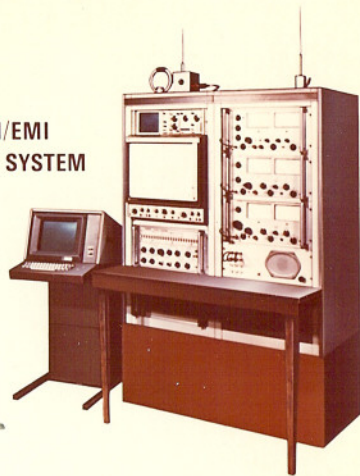
Products include manual, semiautomatic, fully automatic, and computer-controlled test systems.

AUTOMATIC FREQUENCY MONITORING SYSTEM



This automatic EMI data collection system consists of modularized, independent EMI meters and a programmer for automatic EMI measurement, recording, and display. It covers up to 16 bands in the range of 10 kHz to 1 GHz by simple push-button programming.

AUTOMATIC RFI/EMI MEASUREMENT SYSTEM



This system functions as a computer-controlled frequency selective voltmeter, providing a voltage measurement range of 160 dB over the frequency range of 20 Hz to 1 GHz. Its applications include MIL-STD-461 testing of radio frequency interference, frequency management, and spectrum surveillance.



INTEGRATED CIRCUIT TEST SYSTEM

This automatic integrated circuit test system developed for the Air Force performs full DC parametric testing, data plotting, data logging, and data analysis on integrated circuits. Test capability is to the wafer level.

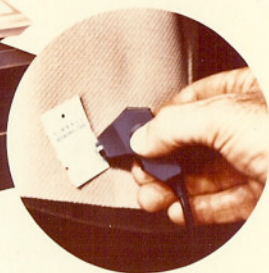
ENCODERS



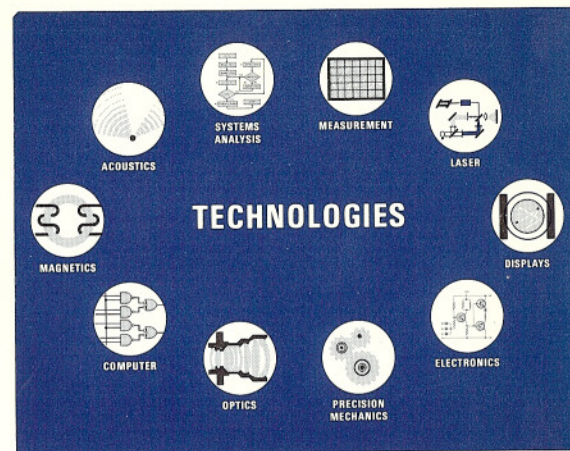
The shaft-to-digital encoder, one of the Company's earliest product lines, originated about 1956. A complete line of contact and magnetic encoders is available for both military and industrial use.



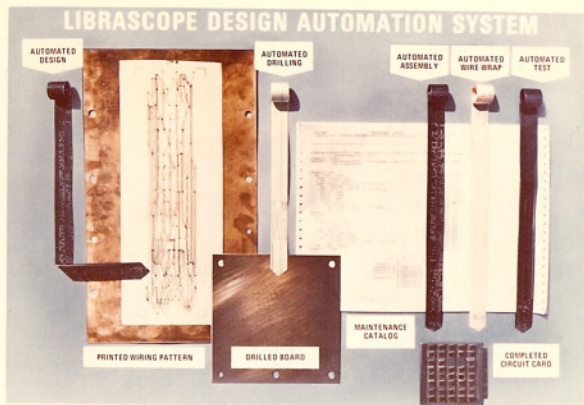
**MAGNETIC
MEDIA READER**



Librascope developed the magnetic media reader for Singer Business Machine's Modular Data Transaction system. The media reader is a hand held, magnetic sensing device with an associated electronics package. The media reader is passed over a magnetically-encoded merchandise label, automatically performing cash register operations previously requiring keyboard manipulations.



To do our business, Librascope maintains competence in a broad spectrum of technologies.



All digital design has been automated through use of the computer. This provides very efficient and fast digital design capability. Input to the system is basic logic or the equations to be implemented. The system provides tapes and printouts for design, assembly, test, and maintenance.

AUTOMATED DRAFTING SYSTEM



Librascope uses a computerized drafting system to increase productivity, shorten response time, and simplify the control and modification of drawings. The system automates the generation of mechanical and schematic drawings, printed circuit board artwork, and tapes for numerically controlled machine tools.

Eventually the system will be tied into our CDC 3300 computer and will handle the preparation of all product technical data, including technical manuals, at a cost savings to the customer.

System elements at present include: (1) an automatic drafting table (34" x 56"), (2) a CRT design console with an interactive tablet, (3) an automatic photo-plotter, and (4) a mini-computer and associated peripherals (magnetic tape cassette, teletype, paper/mylar tape punch).

LABORATORIES



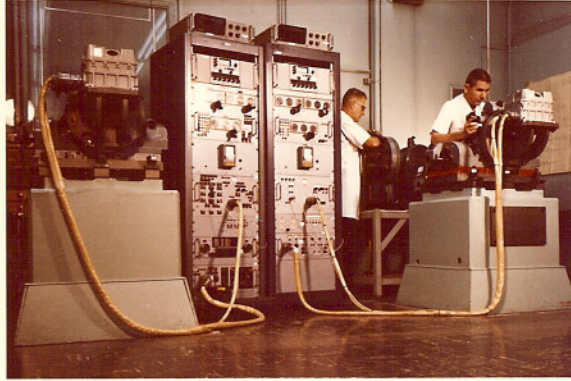
The Company has a number of specialized laboratories in addition to general electronic laboratory facilities.

ENVIRONMENTAL LABORATORY



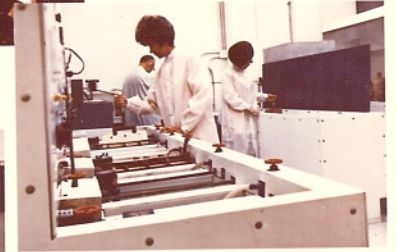
Here equipment is tested in the various types of environments encountered in military use.

INERTIAL CALIBRATION LABORATORY



In this laboratory we align inertial units that preset submarine-launched missiles.

MICROELECTRONICS PACKAGING LABORATORY



The Microelectronics Packaging Laboratory develops new methods of interconnecting integrated circuits.



OPTICS LABORATORY



This laboratory gives us a fast reaction capability for the development of optical elements used in our display systems.

COMPUTER CENTER



Librascope's Computer Center (CDC-3300) is used extensively by Engineering, Manufacturing, Finance, and Logistics.



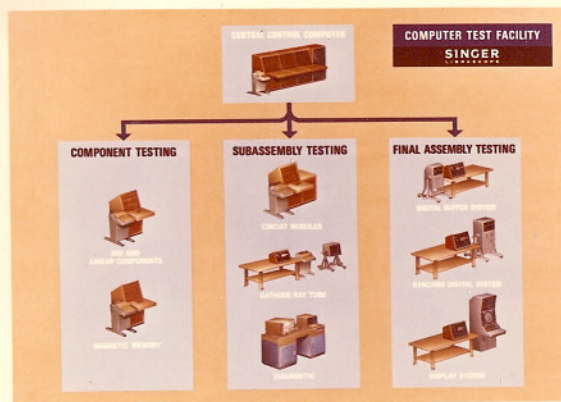
The Company has approximately 175,000 square feet of modern manufacturing facilities for machining, electronic assembly, optical fabrication and test.



Automatic Production Control System reports and measures the pulse of the factory . . .



All activities in the factory are reported through transactors to our Central Computer. This gives us real-time status on up to 10,000 job orders at one time.



The Computer Controlled Automatic Test Facility has the capability to handle incoming components, sub-assembly, and final assembly tests with speed and economy. Flexibility of the system to accommodate current program changes and new programs is accomplished through simple software changes.