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# Results in Brief

<table>
<thead>
<tr>
<th></th>
<th>1959</th>
<th>1958&lt;sup&gt;(1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Sales</td>
<td>$1,811,871,384</td>
<td>$1,626,015,489</td>
</tr>
<tr>
<td>Profit Before Taxes</td>
<td>54,156,069</td>
<td>90,738,876</td>
</tr>
<tr>
<td>Net Earnings—</td>
<td>31,056,069&lt;sup&gt;(3)&lt;/sup&gt;</td>
<td>48,395,158</td>
</tr>
<tr>
<td>Per Common Share</td>
<td>3.12&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>3.71&lt;sup&gt;(1)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Common Shares</td>
<td>9,944,488</td>
<td>9,909,822</td>
</tr>
<tr>
<td>Outstanding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Dividends—</td>
<td>19,881,090</td>
<td>19,966,029</td>
</tr>
<tr>
<td>Amount</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Per Common Share</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Capital</td>
<td>265,129,321</td>
<td>222,238,695</td>
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<tr>
<td>Property, Plants and Equipment</td>
<td>182,912,743</td>
<td>171,869,810</td>
</tr>
<tr>
<td>(Less Reserves)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Term Debt</td>
<td>155,101,536</td>
<td>90,498,532</td>
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<tr>
<td>Share Owners' Equity</td>
<td>329,739,363</td>
<td>317,391,881</td>
</tr>
<tr>
<td>Backlog</td>
<td>2,555,000,000</td>
<td>2,095,000,000</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>103,600</td>
<td>97,500</td>
</tr>
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</table>

**Notes:**

1. For comparison purposes, 1958 amounts are shown on a pro forma basis, including Material Service Corporation and subsidiaries. There is no basis for determining pro forma net earnings per common share for years prior to 1959 without making arbitrary assumptions with respect to the convertible preferred stock issued in connection with the merger with Material Service Corporation, which would result in misleading and unreliable statistics. For this reason, earnings per common share shown for 1958 do not include amounts attributable to Material Service Corporation and subsidiaries.
2. Dividends are not payable on the Corporation's convertible preferred stock in 1959.
Events in Brief

Air


Delivered first F-106 advanced all-weather supersonic jet interceptor to North American Air Defense Command.

Produced and flight-tested first of twelve CL-44 long-range turbo-prop transports for the Royal Canadian Air Force.

Rolled out CL-41 primary jet trainer.

Flight-tested first production model of Canadair S-40 medium-range turbo-prop transport.

Received orders for fifteen CL-44 turbo-prop swing-tail freighters from The Flying Tiger Line and Seaboard and Western Airlines.

Awarded contract to produce 200 CF-104 supersonic strike-reconnaissance aircraft for the Royal Canadian Air Force.

Received contract from the United States Navy for the production of the advanced Terrier surface-to-air guided missile.

Continued production of Tartar, solid-fuel guided missile.

Received from the United States Army an initial development contract for Red Eye, shoulder-fired guided missile.

Space

Achieved the 17th consecutive successful firing of the Atlas ICBM.


Received contract to develop Centaur “high energy” space vehicles.

Continued work on Project Mercury program designed to place United States manned capsule in satellite orbit.

Undersea

Launched and delivered USS George Washington, first nuclear-powered, missile-firing submarine.

Launched Patrick Henry, second nuclear-powered, missile-launching submarine.

Launched Scorpion, nuclear-powered attack submarine of Skipjack design.

Delivered USS Skipjack, world’s fastest nuclear-powered submarine.

Delivered USS Triton, world’s largest nuclear-powered submarine.

Laid keel for Ethan Allen, first of new class of missile-firing submarines.

Received contract for Thomas A. Edison, second ship of the Ethan Allen class.

Continued work on Tullibee, first nuclear-powered hunter-killer submarine.

Received contract to design and test models of a nuclear-powered submarine tanker.

Named coordinator by the United States Navy of submarine integrated control program (SUBIC).

Electronics

Developed and installed Azusa Mark II advanced missile-tracking system for Atlantic missile range.

Dedicated world’s largest indoor acoustic test facility.

Developed and began fabrication of a complex electronic reconnaissance facility for the United States Air Force.

Continued production of solid-state electronic switching system for United States Army Signal Corps.

Received contract from United States Navy for design and development of transistorized single-sideband communication system.

Introduced new “Integrity Series” of components and consoles for stereophonic high fidelity sound reproduction.

Developed intensive electric motor quality control program to improve engineering standards and manufacturing procedures.

Continued research and development work on use of alternating current motors in certain specific variable speed applications.

Nuclear Energy

Contacted the John Jay Hopkins Laboratory for Pure and Applied Science.

Installed Triga reactors at the U.S. Veterans Hospital, Omaha, Nebraska, University of Louvain, Belgian Congo, and the World Agriculture Fair, New Delhi, India.

Received contracts for Triga reactors from Cornell University, University of Illinois, Kansas State University, Episcopal Church for St. Paul’s (Rikkyo) University and Musashiki College of Technology, Japan.

Signed contracts with the United States Atomic Energy Commission, the Philadelphia Electric Company and 32 other leading utility companies for development and construction of 40,000 kilowatt prototype gas-cooled nuclear power plant (HTGR).

Continued work on Project Orion, new concept for boosting 1,000-ton vehicle into space by controlled nuclear pulses.


Industrial Products

Acquired the complete operations of former Henschel companies: sixteen industrial and medical gas plants operating in eight states.

Doubled plant capacity at the San Carlos electrolytic hydrogen plant.


Started construction of oxygen and acetylene plants in Vancouver, B.C. Acquired electrolytic hydrogen plant at Toronto, Ontario.

Started construction of Orient #5 coal mine with annual output of 1.5 million tons.

Extended Crown mine contract with Commonwealth Edison for an additional five years, with a fifty percent increase in tonnage.

Completed first year of volume production of Materialite, a light-weight aggregate.
Frank Pace, Jr., Chairman of the Board
TO THE SHARE OWNERS

In 1950, the Corporation's predecessor company, Electric Boat, was a small, highly specialized enterprise reporting sales of approximately $42 million. In 1959, General Dynamics became the nation's leading defense contractor with sales in excess of $1.8 billion. It is not by chance that we have produced the unique Atlas Intercontinental Ballistic Missile, the world's fastest bomber, the world's fastest fighter-interceptor, the world's fastest commercial jet plane, and the world's first missile-launching, nuclear-powered submarines. The Corporation's position of leadership is the result not of chance but of carefully organized long-range planning, research and engineering, low-cost production, integrity of performance and alertness to the meaning of new discoveries.

Defense
In recent years we have advanced our research capabilities in the defense area to a point far beyond anything that ever existed in the past and we will continue to advance them. Our long-range planning which once looked years ahead now forecasts in decades. Our engineers, who have been reaching for the ultimate, will continue to do so. In consequence, we will be continuously increasing our capacity to produce better goods at lower cost to the United States Government. The Directors and I realize that to stay on top in this vital area of service in the defense of the nation will take greater imagination, greater planning capabilities and harder work than it has taken us to get there—and we intend to stay on top. We recognize that this ambition and this goal place on us burdens even greater than those which we have borne in the past.

International
In the decade ahead it is my hope that the share owners will see a broad expansion on the part of General Dynamics into the foreign field. We have been quietly working to organize, assimilate and simplify the vast number of ideas that are being generated by our imaginative company for future leadership in the commercial field. We recognize that with the great flexibility that is ours we have an opportunity to take advantage of the future that lies in the international field. We are continuing carefully and intelligently to organize ourselves to move effectively in this direction.

Commercial
The past year has been marked by a long stride toward meeting the goal of balanc-
and space vehicles, the Corporation has expended, over the past five years, a sum roughly equivalent to its entire net worth as reported in 1955. Although, in a very real sense, research is never completed and in the present changing state of technology may well increase, I do not anticipate for a number of years development programs as extensive as the 880/600 program or the building of facilities on the scale of the General Atomic laboratory or the Convair-Astronautics plant.

Merger
Of major significance to future sales and earnings was the merger of Material Service Corporation into General Dynamics. The merger became effective on December 31, 1959 and Material Service Corporation became a division of the Corporation as of the close of business on that date. In January, Colonel Henry Crown, the former chairman of the Board of Directors of Material Service, Hugo A. Anderson, and Fred G. Sherrill were elected Directors of General Dynamics. A major midwest producer and supplier of building materials, concrete products, lime and coal, Material Service Division provides the Corporation with an important entry into the construction industry. Population growth, urban renewal, significant research in new building materials, new sources and forms of power and new architectural concepts promise increasingly profitable market opportunities during the years immediately ahead. This new division will serve well the Corporation's basic objective of generating commercial earnings that will balance our earnings from defense projects.

Financial
All 1958 financial statistics other than per share statistics include Material Service Corporation and its subsidiaries on a pro forma basis. Consolidated net sales of General Dynamics for the year 1959 were the highest in the Corporation's history, amounting to $1,811,871,384 which compares with $1,626,015,489 for the year 1958. Sales of aircraft, missiles and nuclear submarines increased substantially over those of the preceding year. We can look to these products to supply us with a steadily growing income. In addition, the Corporation's commercial business increased substantially over that of last year; a significant factor being, of course, the acquisition of Material Service. Consolidated net earnings were $31,056,069 as compared with $48,395,158 in 1958. Earnings per share in 1959, based on 9,944,488 shares outstanding, were equivalent to $3.12. In 1958, earnings per common share were $3.71, excluding earnings attributable to Material Service Corporation and its subsidiaries. Earnings retained for use in the business amounted to $11,174,979 as compared with $28,429,129 retained in the previous year. Book value of property, plant and equipment of the Corporation increased to $182,912,743 at the end of 1959, compared with $171,869,810 at the end of the previous year; and net worth increased from $317,391,881 in 1958 to $329,739,363 in 1959. The Corporation's working capital also increased from $222,238,695 in 1958 to $265,129,321 in the year 1959. In the third quarter of 1959, the Prudential Insurance Company of America purchased for $60,000,000 the Corporation's twenty-year promissory note. This, together with the purchase of $75,000,000 of long-term notes in 1958, provided $135,000,000 of additional resources to the Corporation, yet did not disturb our equity position. Estimated backlog of Dynami cs and its subsidiaries, based on contracts, firm orders and letters of intent was $2,555,000,000 at the year end, highest in the Corporation's history. This compared with a backlog of $2,095,000,000 at the previous year end. Contracts under negotiation at December 31, 1959 were estimated at an additional $640,000,000.

Growth
If there has been one consistent aspect of the history of the past decade, it has been the international competition for technical superiority. Coincident with this competition there have occurred breakthroughs in reaction motors, nuclear power, electronics, rockets, and the means to utilize them. During the Fifties, government and private industry spent more than $60 billion on research and development. The specific impact of this enormous sum is already apparent in such systems as the B-58 Mach 2 bomber, the Atlas Intercontinental Ballistic Missile, nuclear-powered ballistic-missile submarines, the near-sonic commercial jet airliners and vast and complex data-processing and control equipment. We have yet to experience the more general impact of these scientific and engineering breakthroughs. In fact, much of the research and development work that was done during the Fifties is not reflected in current production. This research and development backlog in itself would justify a forecast of accelerated economic growth and huge new market opportunities for
the Sixties. We should reckon, in addition, on an indefinite continuation of international economic and technical competition. It is logical, therefore, to assume that a greater investment will be made in research during the Sixties with continuing accelerating effect on our economy equal to or greater than that in the past.

To General Dynamics, all this, of course, means great opportunity. At the same time, it means financial risk and the placing of premiums upon creative planning, analysis and judgment. For the technological revolution of today, as evidenced in the kind of products we are developing, is making research an increasingly complex and costly operation. Large-scale research and development programs are frequently beyond the scope of one operating division. Groups of divisions, as well as outside contractors, must be organized into research, development, management and production teams, involving thousands of highly skilled personnel in many sections of the nation. These programs require also new alignments of technical disciplines, constant recruitment, continuous training and elaborate and expensive laboratory and production facilities.

Research capability of this order enables us to anticipate the technological changes occurring in fields of major interest.

**Sixties**

The Corporation has an important stake in transportation—space, air and the undersea—in electronics, nuclear energy, construction materials and chemicals. These basic industries have been principal beneficiaries of government and private research efforts during the Fifties. Since they involve both our national defense and our economic welfare, I am satisfied that they will continue to be the prime areas of technological advance during the Sixties. Obviously, the scientific race, with its intensive search for new technical applications and techniques, is revolutionizing transportation and communication and is developing new forms and new sources of power. These in turn are stimulating economic growth which contributes to population increase and urbanizing trends. Our population has increased from 151 million in 1950 to an estimated 179 million in 1960. It is now estimated that our population will be about 215 million in 1970, and a higher percentage of our people will be living in cities. Industrial production has increased an average of four per cent per year during the Fifties and is expected to exceed this average rate during the Sixties. Similar growth is being experienced in other continents of the world. These are the reasons why we believe important new markets both here and abroad will open up during the next ten years to those companies with the foresight to prepare for them.

**Profits**

Defense spending has been relatively stable at high levels since 1952 and, considering the state of the world, will unquestionably continue at present or higher levels for the immediate future. However, changes in defense planning, which we must expect due to rapid technological advances, not only make our planning difficult but add elements of risk to long lead-time programs. Moreover, profits on defense business, and particularly on defense research programs, are low when compared to profit margins on commercial sales. We shall, of course, continue to strive for more defense business, not only because the market is a large and exciting one in which we are eminently well equipped to participate, but also because we regard it as an obligation to serve the interest of national security with all the resources we possess. Yet, the prudent management of our share owners' investment dictates that we continue to work for the highest possible return on their money. It is imperative, therefore, that sufficient non-government business be developed so that the Corporation's sales and earnings are not severely affected by the peaks and troughs of government procurement for long lead-time programs. It is for this reason that, in 1957, we decided to seek through external and internal growth a better balance of profits between our defense and our commercial business.

The acquisitions of Liquid Carbonic and Material Service Corporation are examples of external growth. Research and development, production and marketing of the 880/600 jet transports and the CL-44 turbo-prop air freighters, nuclear power and research reactors and direct conversion of heat into electricity are examples of internal growth. In the following pages are more specific discussions of our growth activities. As you read, I believe you will share my confident expectation of the Corporation's continuing progress.

Sincerely yours,

Chairman of the Board
An interacting cycle of urgent defense needs, significant technical advances and rapid economic growth during the Fifties has added new dimensions to air transportation. As the basic circulation medium of any organized human effort, the state of transportation at any given time is not only a measure of a nation's economic potential but also of its military posture. Practically every significant technical improvement in the recent history of transportation on sea, land, and air has been initiated by military requirements and then has achieved broad commercial use.

**Breakthroughs**

Scientific and engineering breakthroughs in propulsive power and its application are literally revolutionizing the means of transportation. Some of these developments, like the jet airplane, have already been applied broadly in civilian transportation. A vast majority, however, are still limited to specialized defense or scientific requirements. Most are so advanced that they are at present uneconomic from a commercial viewpoint. But the experience of the past ten years has indicated that the gap between technical feasibility and commercial use has steadily narrowed. In 1950, jet-powered transports were not even on the drawing boards at Convair; the air cargo industry was not sufficiently developed to warrant serious study of an all-cargo turbo-prop transport by Canadair; and supersonic bombers were only a concept. In 1960, the Convair 880 jet transport has flown coast to coast at an average ground speed of 664 miles per hour, the Canadair swing-tail, turbo-prop CL-44 all-cargo airplane is in production, and the United States Air Force's supersonic B-58 is the fastest and most effective bomber in the world. Further, the knowledge and the capability required to design and produce the 1,500 miles-per-hour B-58 bomber, and the Convair 880/600 commercial jet aircraft, can design and develop transport planes that would fly as fast as 3,500 miles per hour.

**Performance**

Packing maximum mission performance and flexibility into minimum weight and space has been one of the major engineering achievements of the B-58. The technical philosophy of minimum size-weight —required partly by the need of the system to avoid long-range radar detection—led to the development of the disposable pod where payload and extra fuel for long-range operation will be carried beneath the fuselage. Bomb bay and fuel tanks would be jettisoned on return missions. B-58 performance and flexibility have been proven in high-altitude flights at speeds in excess of Mach 2 (1,500 mph) over long ranges and at low-level flights (500 feet above the ground or less) for 1,400 miles at speeds greater than 700 miles per hour. Such high-low capability makes radar detection of the B-58 extremely difficult on the vulnerable target approach phase of its mission. These are only some of the significant breakthroughs in the basic design of the B-58, which, as an operating airplane, currently represents the highest point in aerodynamic achievement.

**B-58**

Yet the greatest value of the B-58 may lie in its influence on the engineering, design and production of future transport aircraft. The technical and management competence necessary to develop such a complex high performance aircraft, while meeting minimum size-weight requirements, has set new design and reliability standards for compatible systems. All aspects of systems engineering, management and production must profit from such advances. And these must, in due time, be translated into improvement of the civilian economy. Integral wing tanks with stretch-weld sealing and coating, for example, found immediate commercial application in the 880 and 600 near-sonic jet transports. Thus, costly maintenance was completely designed out of these structures. The area rule, or coke-bottle configuration, first developed for the U.S. Air Force F-102 fighter-interceptor and now applied in the form of shock bodies or speed capsules on the wings of the Convair 600 will increase its cruising speed to 635 miles per hour, approaching the ultimate economic speed for subsonic aircraft. Due to higher speed and flexibility, the 880 and the 600 will be the most economical commercial jets. Higher speed will give faster turnaround time. Four-across seating insures maximum payload on first-class flights. The ability of the 880/600 jets, the world's fastest, to take off and land from airports designed for propeller-driven aircraft provides airlines with highly flexible routing for both medium-range and long-range traffic.

**Travel**

The over-all increase in productivity of 880/600 four-engine passenger jet transports for medium- and long-range traffic will have an important effect on the oper-
quisitions of the airlines. For example, Convair 880/600 operating costs per ton-mile on all routes over 600 miles are estimated to be from twenty per cent to thirty per cent lower than those of four-engine piston aircraft. As more jet transports go into service and the public becomes accustomed to their greater speed, comfort and reliability, air passenger traffic will increase. Airline records indicate that eight billion revenue passenger miles were flown by domestic airlines in 1950, and in 1959, thirty billion. Population increases and economic growth, possible extended defense requirements over the next ten years, the introduction of supersonic transports before 1970, are all potent factors influencing the growth of air passenger traffic. Forecasts for the next ten years that take these factors into consideration estimate a low of sixty billion and a high of seventy-four billion revenue passenger miles. It is safe to say that the technical advances in aircraft design, speed and operating economy will not be the only advances in air transportation. Anyone who sees how profoundly shopping centers are altering urban and suburban living must conclude that some similar concept of total travel convenience must soon revolutionize passenger air travel. Total travel would encompass credit buying, regional heliport pickup and delivery, hotel-motel accommodations on arrival or pre-departure, resort, recreation-center and tourist planning. Then, air transportation would no longer be—as it now is—a separate and highly specialized method of travel. It would become integrated with all those media serving, in a total travel complex, human recreation-eating-sleeping needs.

Cargo
Promising as the future for air passenger traffic is, the all-cargo aircraft market gives every indication of being the major growth sector in the air transport industry for the next ten years. To meet this market, Canadair Limited, the Canadian subsidiary of General Dynamics, has designed, developed and produced the CL-44 air freighter. This long-range turbo-prop transport—with its unique swing-tail design permitting straight-in mechanical loading of pre-palletized freight—makes optimum use of the entire volume of the fuselage. Cruising at a speed of 400 miles per hour, the CL-44 can fly 36 tons of cargo from New York to the West Coast in seven hours. Efficiency of the CL-44 swing-tail design and integrated mechanical loading systems will cut present piston engine transport loading time by a factor of six. Fuel costs per horsepower for turbo-prop engines are about thirty-six per cent less than for piston engines; the weight of turbo-prop engines is fifty per cent less than that of piston engines, thus adding commensurately to payload and range. Based on actual operating statistics, the turbo-prop engine is seven times more reliable than the piston engine.

Economics
It is a fact that twenty CL-44 swing-tail air cargo planes with integrated loading and unloading equipment will be able to move one billion ton-miles of freight per year. This is considerably more cargo than Canadian and United States airlines carried during the year 1959. Present air cargo rates are relatively the same for all cargo carried without any consideration given to the character of the freight and the service required, or to any of the many complex economic variables that determine flexible pricing. In domestic operations, air cargo rates average 20 cents per ton-mile. Utilizing swing-tail CL-44 cargo planes, operators can cut rates an average of thirty per cent to forty per cent below present rates; and, even with a sixty-five per cent load factor, can still make adequate profits. With a proper tariff structure featuring a sliding scale of rates, a much wider spectrum of the freight market would become available.

Rates
Rates for various commodities over various routes might range from as little as 6 cents per ton-mile to as high as 23 cents per ton-mile. But the average revenue from mixed cargoes will probably be in the neighborhood of from 12 to 14 cents per ton-mile. Since air distances are shorter than ground distances, and since total distribution costs are less by air, these rates will be directly competitive with trucks, railroads and shipping for medium unit value freight on routes over five hundred miles. A recent study of the air freight market assumes that with a fifty per cent reduction in rates, the cargo ton-miles flown by domestic airlines alone will rise from one-half billion in 1959 to approximately forty billion by 1975. Such a phenomenal increase would require the cargo-carrying capacity of more than 1,000 new air freighters. Air freight operators might well need to utilize each other’s equipment on a national or even an international basis, much as standardized Pullman cars are now employed on all the nation’s railroads.
As the nation’s first operational Intercontinental Ballistic Missile, *Atlas* is the prime example of both the military and scientific importance of space flight. And the *Atlas* research, development and production program, in its complexity, its daring innovation, its emphasis on precision and teamwork, reflects the capability essential for further progress in space. *Atlas* is one of the nation’s principal strategic deterrents. It is also of particular importance to scientific progress as a workhorse-booster for lifting men and equipment into space.

**Space**

**Atlas**

Some idea of the *Atlas* achievement can be gained by its performance characteristics. Weighing, with fuel, about 260,000 pounds, the *Atlas* takes off straight up from a stationary position with a thrust of more than 360,000 pounds and within five minutes has achieved a speed of 16,000 miles per hour. Within this period, the missile has thrust through the earth’s atmospheric shell and its skin temperature has risen and fallen over a range of many hundreds of degrees. Yet, the tank structures that withstand these extreme shock and temperature transients have such thin stainless steel skins that the missile must be pressurized internally to retain its shape. While first fully-instrumented test flights called for a six-and-one-half-hour count-down, *Atlas* now has an operational check-out of only 15 minutes. And this highly automated weapon system needs a launch crew of fewer than six technicians.

The electronic programmed check-out equipment quizzes each missile system and sub-system, then makes for each a “go” or “no go” determination. In a completely integrated systems concept such as *Atlas*, ground support equipment is an extension of the missile itself. Thus, an important phase of the *Atlas* program for the future will be not only the manufacture and further refinement of *Atlas* missiles, but the activation of soft and hard ballistic missile bases.

**Booster**

Of great importance, also, is the role that *Atlas* will play in space transportation: initially as a booster for such space projects as *Centaur*, *Atlas-Agena* vehicles, and *Atlas-Mercury*—the nation’s first attempt to put a man into space. Six *Centaur* boosters are on order and many more are planned. These are multi-stage rockets with a modified *Atlas* as the first-stage booster on which is mounted a Convair-built second stage, utilizing newly developed rocket engines burning liquid hydrogen-oxygen fuel. These “high-energy” vehicles will perform a number of different scientific data-gathering missions. *Centaur* space vehicles will be capable of impacting a 1,000 pound payload or soft-landing a 700 pound payload on the moon or placing a four-and-a-half-ton payload into a 300-mile satellite orbit. *Centaur* can also transport a 1,000 pound instrumented probe into deep interplanetary space. A series D *Atlas* will be the booster of the general-purpose *Atlas-Agena* space vehicle for early warning reconnaissance and communications satellites. *Atlas-Agena* will be first employed on the *Midas* and *Samos* military satellites. These satellites will take advantage of their position in space to provide instant early warning of any impending attack. The *Midas* system utilizes the ability of infra-red sensors to detect immediately an enemy ballistic missile launching. The *Samos* military satellite will be equipped with a variety of electronic intelligence-gathering systems. As the first-stage booster for project *Mercury*, the versatile series D *Atlas* will also lift the nation’s manned earth satellite capsule into orbit. Convair-Astronautics will modify *Atlas* for these missions and will conduct pre-launch check-out operations and the launch count-down.

**Spacecraft**

As far as military and scientific space developments for the next ten years are concerned, two fundamental developments should occur which would bring final mastery of the space environment. The human element, which has been designed out of present space vehicles, will again become an essential, not a redundant, control link in the system. The space vehicle of tomorrow will not be just another missile, but actually a spacecraft. This change of function will lead to simplification and improved reliability and flexibility of the system, thus countering the increasing margin of error that comes from over- elaboration of feedback cycles. The other development will be a breakthrough in propulsion. During this decade chemical propellants will reach their highest point of efficiency. But even this power increment will not be sufficient to develop space-flight capability beyond a bare minimum. Nuclear power seems most likely to provide the energy-weight ratio requisite to lift megatons into deep space. Theoretically feasible, such systems are under intense study at General Atomic Division (Project Orion) and elsewhere.

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*Atlas* has recently been launched from Complex 15, Cape Canaveral, Florida. Umbilical boom has just disengaged prelaunch instrumentation and power inputs.
It has long been known that the suboceanic continents have at least as much mineral and organic wealth as the surface continents. But environmental problems of temperature and pressure have made any detailed scientific exploration of these continents an undertaking of immense cost and, until the advent of nuclear submarines, a technical impossibility.

**Ordnance**

The military significance of the undersea has demanded design and propulsion advances necessary for sustained underwater operations and transportation, and as a corollary has stimulated interest in its exploration. The near limitless range of nuclear-powered submarines of advanced hydrodynamic design, their ability to descend to great depths, their maneuverability and high sustained underwater speed, have revolutionized undersea warfare concepts. It was therefore a logical step to combine the devastating power and accuracy of the ballistic missile with the flexibility of the advanced nuclear submarine. The *USS George Washington*, first fleet ballistic missile submarine, is both a high-speed true submarine and a near invulnerable missile-launch complex.

**Hull**

Submarine design is more than a matter of arrangements. The designer is dealing with known quantities, such as propulsion machinery, control systems and habitability requirements. By laying out all necessary components and drawing a hull around them he has a submarine, a practice known as taking the theory of optimum and expanding it geometrically. However, the missile submarine posed a host of additional problems, for designers were faced with the installation of a complete missile base as well as a reactor power plant and living quarters for a hundred men, all within the limited space of a submarine. Because of the high priority of the missile submarine, designers took the plan of the *USS Skipjack*, cut it immediately aft of the sail, and added a 130-foot missile compartment with sixteen missile-holding tubes, which in effect are pressure vessels penetrating the hull. In adding this section, it was necessary to balance weight against displacement and water ballast against hull configuration.

**Navigation**

The nature of the submarine-missile mission demanded precision navigation, since in firing a missile an error of one degree in position can result in the missile being as much as 60 miles off target. As a result, three separate ship-inertial-navigation systems (SINS) were designed into the submarine as a basic reference, each checking the other. SINS is also checked by a comprehensive navigation system that includes a star tracker, housed in a special periscope for submerged celestial fixes; a radiometric sextant which measures radio waves emitted by the sun; a whip antenna which enables the submarine to pick up loran and other radio aids; and a gravity meter which measures the earth's gravitational anomalies. The *George Washington* is also equipped with conventional navigation devices.

**Control**

A major problem in designing the missile-launching submarine was underwater ship control after firing a missile weighing many tons. This was solved by a ballast control panel which enables one operator to compensate for weight differential. Water flooding the empty tube accounts for part of the differential, but other factors must be considered. For example, wave action and temperature gradients must be counteracted. A one-degree temperature change can make a difference of 1,810 pounds in the ship's submerged weight. Since temperatures change at various depths, ballast control must compensate by taking on or blowing out water. A unique feature of the missile submarine is a special torque-resistant gyrostabilizer which offsets roll in heavy seas. A small sensing gyroscope picks up the first indication of rolling motion and activates a hydraulic system, giving the ship a horizontal plane. The gyrostabilizer weighs 62 tons, but the additional weight is compensated for by the increased stability. Work on the first fleet ballistic missile submarine began in December, 1957, and the ship, *USS George Washington*, was launched 18 months later. It was formally commissioned by the Navy on December 30, 1959. The 24-month delivery of this new submarine, particularly in view of its complexity, represents a remarkable record in both design and construction. The Corporation is continuing to seek new advances in submarine technology. Prime among the possibilities during the next decade are the development of small, fast, anti-submarine submarines; metallurgical research leading to submarines capable of operating at greater depths; submarine tankers; and submarines capable of both exploring and exploiting the resources of the undersea continents.
Electronic communication is an all-inclusive term for methods of collecting, processing and transmitting information from one area to another. In all its aspects, electronic communication serves as the communication, coordination and control function—the nervous system—of industrial societies. Like transportation, electronic communication is in a state of rapid and intensive technical development.

Information
Modern communication technique is based on the application of electronic theory—the emission, transmission, behavior and effects of the electron. Utilizing these physical properties, electronic communication provides an infinitely flexible extension of specific “bits” of information into simple or complex situations and hostile or remote environments. Although electronic communication can be exceedingly complex, it is based upon such well-known technical developments as high-speed computers, servo-mechanisms, feedback devices, transducers and amplifiers. High-speed computers store and process information that can solve predetermined problems. Servo-mechanisms are control devices that will respond automatically to computer commands. Feedback devices are automatic regulators that ensure precise control. Transducers and amplifiers utilize the electron not only to extend human control over various environments but to enrich daily life through high fidelity stereophonic reception.

Capabilities
The Corporation’s major interest in communication and control stems from its unique capability to conceive and develop electronic systems that are indispensable in four basic areas of military, industrial and consumer activities. These are: (1) the design of computer-monitored automatic control systems to assist or replace the man-machine link in high-performance aircraft or missiles; (2) the application of these control systems plus electronic sensing devices to act as countermeasures to high-performance aircraft, missiles, and submarines either actively in the form of guided missiles or passively as integrated long-range intelligence systems and anti-submarine devices; (3) use of computer and feedback systems to automatically control simple or complex processes such as air or ground traffic, navigation, and telephonic communications; (4) utilization of solid-state devices, transducers, amplifiers and acoustical components to provide exactly similar stereophonic sound reproduction. A corporate-wide electronics systems capability was generated as an essential by-product of its development of high-performance aircraft and missiles and its long experience in the design of complex telecommunication and sound systems. The Convair F-106 supersonic fighter-interceptor and the B-58 bomber are so fast that the pilot’s reaction time to a given situation frequently must be augmented by specially designed automatic control systems. In the development of the Atlas missile, all flight-test information from the launch pad and from the missile in flight had to be derived from what is termed a remote hostile environment. Therefore, sophisticated telemetry and tracking systems were developed to provide the man-machine data links.

Missiles
Guided missiles, such as the Convair advanced Terrier, Tartar and Red Eye, are extremely effective countermeasures to high-performance aircraft.  They are also examples of the computer feedback principle in association with electronic sensing devices that project control into remote environments. The Terrier, employed by the United States Navy, uses computer-directed radar guidance to its target. With a range of more than ten miles and propelled at supersonic speeds by its solid fuel rocket engine, Terrier is an automatic weapon system. Tartar, half the size of Terrier, has a transistored guidance system; is designed primarily for use aboard Navy destroyers. Red Eye is a shoulder-launched guided missile. All are based on electronic guidance systems that automatically solve target problems. Guided missiles such as these represent the application of the Corporation’s electronic systems capability to the counterattack of alien weapon systems.

Surveillance
The principal method of gathering anti-aircraft and anti-missile information will be through the monitoring of electromagnetic radiation by both ground-based and satellite-based reconnaissance systems. Convair, with its space satellite program, and Stromberg-Carlson Division, which is currently managing for the Air Force the development of a ground passive reconnaissance system, have developed a depth of capability in all aspects of sophisticated, intelligence-gathering systems. A similar capability is required for the detection of fast, quiet, and deep-running
nuclear submarines. The increase in the ability of special-purpose electronic computers to scan complex data, refine them and make logical decisions will be of great importance in solving the currently most urgent anti-submarine-warfare problem. The total electronics, acoustics, aerodynamics, and hydrodynamics capability of the Corporation is engaged in a team effort to improve methods of defense against the alien nuclear-powered missile-launching submarine. Essential to the solution of these problems is a basic understanding of the total underwater environment. Thus, advances in anti-submarine-warfare techniques will make important contributions to such pure sciences as oceanography and marine biology and to such commercial ventures of the future as underwater transportation, underwater mining and underwater oil prospecting and well drilling.

**Control**

During the past ten years, total air operations (take-offs and landings) in the United States increased from 8.25 million to an estimated 19.9 million. It is anticipated that they will number 40 million in 1970. Air traffic congestion over principal airports, already approaching the danger point, will be greatly increased. A major part of the nation's air traffic control is presently conducted by manual means. Data display is non-pictorial, communications are by voice, data-processing is manual, and positional information is obtained primarily by pilot reports. In the Sixties semi-automatic data-processing systems assisted by nation-wide networks of en route and terminal radar will control air traffic. These improvements will greatly enlarge the amount of air space safely available for aircraft operations. Stromberg-Carlson and Convair have developed components for automated air traffic-control systems. These include high-speed data-processing visual display devices, airborne navigation and communication equipment, radar links, and beacons.

**Telecommunications**

In the growth market for large-scale automatic communication and control systems, telephone switching continues to be an area of particular Corporate interest and capability. While improved electromechanical switching systems are in demand, Stromberg-Carlson is developing solid-state electronic switching. Such switching systems are expected to revolutionize world communications. The electronic switchboard is in effect a special purpose, solid-state computer-control system, employing time-division multiplex equipment which makes possible the sharing of one circuit by more than 100 different conversations. Electronic switching is an example of how applied research and development are providing more reliable, more flexible communication links.

**Stereophonics**

Application of electronics and acoustics in the form of stereo component ensembles by Stromberg-Carlson is another significant technical advance that reproduces with wide dynamic range the tone of a single musical instrument or that of an entire symphony orchestra. Whether in the form of a large-scale electronic system for the needs of national defense or as a commercial product such as a single-console stereophonic high fidelity sound system, modern communication techniques emphasize the range and challenge of electronics.
In respect of nuclear energy, the goal of the Corporation is the development, through advanced scientific research and engineering, of new concepts and their translation into new and better products. In attacking the many problems of building an efficient power reactor of true economic promise, materials best able to withstand high temperatures and intense irradiation must be found and developed.

**Triga**

The philosophy of a close integration of the various scientific and engineering disciplines, which is basic to the Corporation's activities in the nuclear field, justified itself in the new-concept Triga reactors for training, research, isotope-production, and medical and industrial applications. The Triga was the first research reactor possessing significant power levels, fluxes and versatility to be developed entirely by American private industry. Triga was conceived by the staff of General Atomic Division, developed by the Division's scientists and engineers, and is produced commercially by General Atomic. Triga was invented to meet the ever-growing demands of academic, medical, industrial and other institutions in this country and around the world for a research and training reactor combining versatility, safety, low cost, simplicity, compactness, and economy of operation. The original prototype Triga came into operation at General Atomic's laboratories in San Diego in May, 1958. Today, less than two years later, seventeen Trigas are in operation, or work is underway for their installation, on five of the six continents.

**Competition**

It is more evident now than ever before that the nuclear power systems developed and sold in the Sixties and beyond, whether for central station power generation or for propulsion, must possess technological characteristics which give them sound promise of being competitive, at the earliest possible date, with conventional systems. Competitive nuclear systems for the generation of electricity in the United States, capable of capturing a substantial and continuing market, must be able to produce power in a cost range of six to seven mills per kilowatt hour. If this is to come about in the Sixties, the competitive nuclear plants will be those that conform to modern steam-plant conditions of the electric utility industry—that is, high temperatures and high pressures. They will be systems of simplicity and compactness, high thermal efficiency, low fuel cycle costs and long burn-up times; and, of course, they must be safe. These are the characteristics and goals established for the High Temperature Gas Cooled Reactor (HTGR) for central station power.

**HTGR**

A prototype HTGR plant of 40,000 kilowatts capacity will be built for the Philadelphia Electric Company and 52 other investor-owned utilities comprising High Temperature Reactor Development Associates, Inc. General Dynamics will furnish the nuclear steam supply system including the reactor. Bechtel Corporation is the engineer-constructor of the overall plant. The Atomic Energy Commission will contribute up to $14.5 million to research and development, plus a waiver of use charges on nuclear material. The prototype plant will be completed in 1963 on the Susquehanna river in York County, Pennsylvania. Scaled-up versions of the prototype plant, in size range of 150,000 to 300,000 kilowatts, are expected to produce electricity competitive in cost with conventional, non-nuclear plants in many areas of the United States, thereby accelerating the widespread use of nuclear power. A 300,000 kilowatt HTGR plant could be expected to produce power at less than 6-7 mills per kilowatt hour in the United States at an early date. The HTGR prototype plant will enable the United States to have completed in 1963 the first nuclear power station capable of steam temperature of 1,000°F. and above, and pressure of 1,450 psi or higher, with a net thermal efficiency of about 35 per cent. Since the signing of the contracts for the prototype plant last August, the level of confidence in the economic promise of the HTGR has risen steadily.

**Needs**

The population of the United States may exceed 215 million by 1970. In 1970, with millions more Americans, we will need millions of additional kilowatts of electric generating capacity for our homes and our industries. The electric utility industry must make large additions to its installed capacity in the decade ahead—and keep on increasing it. The costs of conventional fuels meanwhile will continue to rise. As the systems of these companies become larger, so will individual plant installations be larger; there will be more efficient use of fuel. The average-size electric generating plant in the United States today is 100,000 kilowatts; but the...
size of electric generating plants is increasing rapidly. Currently there are only 30 electric generating systems in the United States with capacities of one-million or more kilowatts; in ten years there may be twice that number. Under the pressure of rising fuel costs, new plants of large size will make maximum use of high pressure, high-temperature steam cycles such as are offered by the HTGR. In this way they will seek to offset the rising fuel costs by obtaining maximum heat values from each pound of fuel.

Question
Faced with an almost explosive increase in energy needs and an inevitable expansion of power production to meet those needs over the next decade, the question arises: How can the day of 6-7 mill nuclear power best be speeded? The answer lies primarily in a bold approach which will produce a nuclear generating system that makes use of the most modern steam conditions and affords an opportunity to take a short-cut to the national goal of economic atomic power. The strong technological and economic promise of the HTGR has great appeal for the nation's electric generating industry, with the result that the largest number of utility companies ever to support a single atomic power project has selected the HTGR for prototype construction and operation. The HTGR clearly possesses the characteristics required for the most rapid achievement of truly economic atomic power.

MGCR
The prospects in nuclear ship propulsion are equally as exciting as those for nuclear central-station electrical power. In the Sixties there will be great opportunity for the development of a nuclear system capable of competing favorably with oil-fired merchant ships—particularly tankers. Strong evidence supports the belief that the Corporation's Maritime Gas Cooled Reactor (MGCR) system will attain this goal, and that 1970 will see atomic-powered tankers and other surface ships coming into actual competitive operation. If American ships are to carry a substantial share of the world's seaborne commerce, there is great need for a propulsion system capable not only of matching the economics of oil-fired ships within the briefest possible time, but of achieving even lower costs over the long term. This is the goal of the MGCR now being developed by two of the Corporation's divisions, General Atomic and Electric Boat.

The MGCR, for the first time, brings together in one compact, efficient plant two advanced, high-performance systems—a high temperature, gas-cooled reactor and a closed-cycle gas-turbine power plant. This first sea-going MGCR, of 60,000 deadweight tons and 30,000 shaft horsepower, coming into service in 1967 or 1968, could be expected to operate at a cost equal to or lower than that for conventional tankers. Demonstration of the MGCR's economic performance in the middle or latter part of the 1960's would make it a formidable competitor for new additions required by the tanker fleet, particularly for the large number of new tankers expected to be added in the decade of the 1970's.

Tomorrow
In addition to the accelerated progress in central-station nuclear-power generation and maritime nuclear ship propulsion—both designed to demonstrate economic nuclear power in the decade ahead—three other areas of General Atomic research and development may conceivably have revolutionary economic significance. A breakthrough in any one area could have enormous effects on our present-day concepts of power production. The first is concerned with a concept of space propulsion which involves the use of nuclear pulses developing sufficient thrust to drive a 1,000-ton vehicle through space. The second is in the field of direct conversion of heat into electricity with the prospect of direct-convetion plants with over-all efficiencies in the range of 25 per cent to 40 per cent. This program is supported in part by eight utility companies of the Rocky Mountain-Pacific Nuclear Research Group and the San Diego Gas and Electric Company. The third area in which the Corporation is well established, by means of a joint program with the eleven utilities comprising the Texas Atomic Energy Research Foundation, is the field of controlled thermonuclear reactions. This is the world's first and largest privately financed program in the field. No one can say when we may find the means of controlling and sustaining a fusion reaction; it could come in the near future, or it might require years. Other expanding programs at General Atomic Division include such fields as materials development, advanced reactor concepts, solid-state physics, high-temperature chemistry, radiochemistry, atomic beam studies, high altitude physics, thermodynamics, molecular physics, ceramic research, superconductivity, and electronic specific heats.
In line with the Corporation's objective of achieving a better balance between defense and commercial profits, the industrial gases provided by Liquid Carbonic Division and the coal, lime, and construction materials supplied by the Material Service Division are of special importance.

Discoveries
In the construction industry, conventional concepts of materials are now being enlarged by research in chemistry and physics. Scientific discoveries are giving to the architect a new freedom in designing for beauty and function. Significant research in the molecular remodeling of matter is already well under way. New building materials are being developed having the lightness, the structural integrity and the economy inherent in natural phenomena such as an egg shell, a crystal, a leaf. Again, in the basic field of industrial gases, technical advances in such areas as medicine, electronics, space flight research, high energy fuels, metallurgy, nuclear science and cryogenics (extremely low-temperature research) have extended tonnage requirements and have widened uses. New market requirements have stimulated research and development leading to more efficient production and distribution of industrial and medical gases. Few supplier industries have been so directly affected by such a wide variety of scientific activities in areas of great technological innovation as the compressed gas industry. Many new developments in food processing, medicine, and in a wide variety of industrial production techniques have been made possible by increased knowledge and expanded capabilities in gas dynamics. As a result, sales of industrial and medical gases have increased substantially during every year of the past decade.

Cryogenics
In one field alone—the very active scientific area of cryogenics—there are in progress developments which depend upon certain of the basic industrial gases, especially those liquefying near absolute zero (minus 459.6 degrees Fahrenheit). At such temperatures, materials behave in strange ways; molecular action slows almost to a halt; certain metals become super-conductors; lead coils become resilient as steel springs; low carbon steel becomes five times stronger than normal. In space research, cryogenics is particularly important. Temperatures in the vastness of space drop almost to absolute zero. Before space flight can become a reality, it is imperative that we know how materials will behave in this environment. Cryogenics also has many other unique applications, especially in those industries where high standards of quality control are necessary in research, product development and manufacturing.

Markets
Oxygen is essential to certain modern steel-making techniques; to the generation of extreme temperatures in the fusion of metals; to the make-up of high energy missile fuel systems. As the basic element in the metabolism of all living things, oxygen is indispensable to undersea and space research and to medicine and surgery. Basic applications of nitrogen, which in a free state does not combine readily with other elements, include such diverse usages as testing of pressure vessels and systems, blanketng potentially flammable areas, providing atmospheres for fusing electronic tubes, metal processing, preservation of foods, pressurization of aerosol containers, and the shrink-fitting of machine parts. Argon, a by-product of oxygen production, is used in the manufacture of electronic tubes. Argon also insures oxidation-free arc welding of certain strategic metals such as stainless steel, titanium and aluminum. Entirely new uses for argon are being found in high-temperature research in the fields of thermodynamics and aero-dynamics. Hydrogen is extremely valuable because if ignited in the presence of an oxidizer, it releases very high thermal energy per unit of weight. In addition, hydrogen, under pressure, readily combines with other elements and compounds to yield valuable products. Hydrogen is important as a heating agent in the fusing and forming of glass; as an essential reducing agent in the refining of rare metals; in atmospheric control for special furnace annealing processes; and in the hydrogenation of oils and fats. Liquid hydrogen will be used in conjunction with oxygen as a new super-fuel for space vehicle propulsion, resulting in forty per cent more specific impulse than any fuel currently in use—and at a cost substantially lower than the cost of boron super-fuels. Acetylene, when mixed with oxygen, is used for cutting, welding, and brazing a variety of metals. It is also an important building block in the chemical industry. Many important products, such as vinyl chloride and acrylonitrile, are initially derived from acetylene. The widespread applications of carbon dioxide are commonly known, but what is not so apparent...
is that new applications of carbon dioxide have accounted for more than eighty percent of its increased production over the past ten years. The heaviest tonnages of CO₂ are utilized in processing, packaging and refrigerated storage; in carbonated beverages; the chemical industry; paint and oil processing and a variety of industrial requirements. Among other less commonly used gases marketed by Liquid Carbonate are acetylene, ethylene, nitrous oxide, helium and cyclopropane.

Chicago
In the supply of basic building materials to the construction industry, coal to the electrical power industry and coal and lime to the steel industry, the strategic location of Material Service Division's properties and facilities in the metropolitan Chicago area is vital. Through expert management during the Fifties, the Division added and consolidated extensive holdings in wholly-owned properties, and developed the most modern capabilities for the fast, economical handling and distribution of low unit-value materials in a highly competitive field. The result is a high degree of flexibility for further expansion in a growth industry which is just beginning to be influenced by significant research. Utilizing modern methods of distribution, Material Service provides better delivery for construction materials at lower cost than any similar operation. The forecast of private and public investment for new construction in the next ten years is an astounding three-quarters of a trillion dollars—more than the total of all money spent on new construction since 1925. This demand for new construction means a vast growth market for the supply of construction materials. And in this market Chicago is one of the most dynamic centers of construction activity. Ranking second in size in the United States, greater Chicago has led all other industrial regions in postwar expansion and development. During the five years, 1954-1958, the value of new plants in the metropolitan complex was $1.8 billion which represents long-term growth greater than that of such rapidly expanding urban areas as Los Angeles, Detroit, or Cleveland. Chicago's unique geographical position in relation to raw materials, markets, transportation and water availability is assurance of continued leadership in the building and industrial growth of the country during the decade ahead. A good labor supply, relatively low tax rates and very nearly ideal market diversification are additionally advantageous to business growth. As the nation's second largest port, Chicago's docks presently handle approximately 60 million tons of cargo annually—40 per cent of the total for the Great Lakes region. And for the future, the favorable implications in the port of Chicago's long-range growth program, including the St. Lawrence Seaway, Calumet Harbor and inland waterways developments, offer additional advantages to Material Service's extensive marine facilities. This program contemplates for overseas trade alone an increase from 1.2 million short tons to an estimated 4.5 million short tons by 1965—a gain of 275 per cent. During the next ten years the Chicago metropolitan area will be a key center of growth for municipal, residential and industrial construction in heavy industry and in electrical power consumption.

Construction
America's building progress promises to be extraordinary in character as well as in volume. For the chemical industry is now directing much of its immense research resources into the development of new building materials. Molecular structures, the building blocks of any material, are being analyzed and reassembled chemically to perform functions that have been precisely defined. New materials that integrate form with function offer the architect a great deal more freedom in design than ever before. At the same time, the materials supply industry will develop far greater flexibility and higher unit-value products as more of the construction dollar goes into wall materials rather than conventional supporting structures. Cement and concrete, for instance, have been used for many centuries, but only recently have we begun to study the chemical structures possible within these amalgams. As their chemistry is becoming better understood and controlled, lighter, less brittle, more plastic materials of an entirely new order are emerging. These are developing novel architectural concepts that combine materials into mass-producible modular units. From this it is a logical step to the concept of the sandwich-wall production line in which the inflow of materials, the forming operations, and the incorporation of sub-assembly components would be directed from a master control into which specifications and instructions are fed. As in all other areas of Corporate interest, scientific research is re-directing the construction materials industries into profitable growth areas.
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San Francisco, California
The First National Bank of Jersey City
Jersey City, New Jersey
Montreal Trust Company
Montreal, P. Q., and Toronto, Ontario, Canada

CONVERTIBLE PREFERENCE STOCK
The First National Bank of Chicago
Chicago, Illinois

REGISTRARS

COMMON STOCK
The Chase Manhattan Bank
New York, New York
American Trust Company
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The Royal Trust Company
Montreal, P. Q., and Toronto, Ontario, Canada

CONVERTIBLE PREFERENCE STOCK
American National Bank and Trust Company of Chicago
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COMMON stock listed on New York, Pacific Coast,
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New York, New York

COUNSEL

Kramer, Marx, Greenlee & Backus (General Counsel)
New York, New York
Alvord and Alvord (Special Counsel)
Washington, D. C., and New York, New York

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1710 H Street, N. W., Washington 6, D. C.

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Convair Division
San Diego, California
Electric Boat Division
Groton, Connecticut
Electro Dynamic Division
Bayonne, New Jersey
General Aircraft and Leasing Division
Washington, D. C.
General Atomic Division
San Diego, California
Liquid Carbonic Division
Chicago, Illinois
Material Service Division
Chicago, Illinois
Stromberg-Carlson Division
Rochester, New York
# RESULTS IN BRIEF

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<tr>
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<th>1959</th>
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<tr>
<td>Net Sales</td>
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<td>Cash Dividends — Amount</td>
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<tr>
<td>— Per Common Share</td>
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Notes: (1) For comparison purposes, 1956 amounts are shown on a pro forma basis, including Material Service Corporation and subsidiaries. There is no basis for determining pro forma net earnings per common share for years prior to 1959 without making arbitrary assumptions with respect to the convertible preference stock issued in connection with the merger with Material Service Corporation, which would result in misleading and questionable statistics. For this reason, earnings per common share shown for 1956 do not include amounts attributable to Material Service Corporation and subsidiaries. (2) Dividends are not payable on the Corporation's convertible preference stock in 1956.
By the merger on December 31, 1959 of Material Service Corporation, substantial progress was made toward attaining a management objective of balancing Corporate earnings from commercial operations with earnings from defense projects. In accordance with the agreement of merger, 2,064,516 shares of a new issue of convertible preferred stock of General Dynamics Corporation were exchanged for the outstanding shares of common stock of Material Service Corporation. Material Service and its subsidiaries are engaged primarily in the production and distribution of the following: building materials, principally in the Chicago area; coal and lime in the Midwest; and refractory material (dead-burned dolomite).

Additional expansion in commercial markets in 1959 resulted from the purchase of the industrial and medical gas business of Hench associated gas enterprises. This acquisition, which was a cash transaction, gave the Corporation's Liquid Carbonic Division production and distribution facilities for industrial and medical gases along the important Eastern seaboard.

The consolidated operating results of General Dynamics Corporation and subsidiaries for the year 1959 include the consolidated operating results of Material Service Corporation and subsidiaries (see note below).

Sales and Earnings
Sales of the Corporation and subsidiaries in 1959 resumed the upward trend which had been interrupted in 1958. Sales in 1959 of $1,811,871,384 exceeded those of the preceding year by $185,855,895, representing an increase of over 11%. A significant part of this increase was attributable to higher missile sales, primarily of the United States Air Force Atlas Intercontinental Ballistic Missile which became operational in 1959. Sales of the B-58 supersonic jet bomber, also to the United States Air Force, reflected significant growth over sales in the preceding year. Delivery of the first of these jet bombers to the Air Force was made in 1959. Production and sales on other major military aircraft programs, including the F-106A and F-106B advanced supersonic jet interceptors for the United States Air Force and the CL-44 turbo-prop transport for the Royal Canadian Air Force, built up rapidly in 1959 and exceeded the levels reached in 1958.

Deliveries of commercial piston-powered aircraft, Convair 440's, continued during 1959 but at a lower rate than in the previous year as this program reached completion. The first delivery of a Convair 880 jet transport was made in February 1960, with a significant number of additional deliveries scheduled for 1960.

Sales of certain other product lines also increased significantly over the preceding year. Submarine construction activity exceeded that of any previous year. Seven atomic-powered submarines were under construction during the year, of which three were launched including two fleet ballistic missile submarines designed to fire Polaris missiles. Sales in 1959 of carbon dioxide and industrial gases to customers in the United States and Canada were substantially in excess of 1958 levels. This was due in part to the acquisition of Hench associated gas enterprises in 1959. By complementing existing facilities, the Hench operations broadened the area being served to enable the Corporation to be a more effective competitive factor in most of the major marketing areas for industrial and medical gases in the United States and Canada.

Sales of telecommunication and electronic products to commercial customers reflected moderate increases over the preceding year; however, sales of these products to the United States Government declined in 1959.

Sales of coal and ready-mixed concrete in 1959 were maintained at approximately the same level as for 1958. Sales of aggregates and prestressed concrete girders decreased as a result of substantial completion of the Northern Illinois Toll Highway in 1959. However, these declines were largely offset by increased sales of other building materials, dead-burned dolomite, lime and fuel oil.

Sales in the nuclear research field increased significantly as a result of work on contracts received in 1959 for development and construction of the General Atomic high temperature gas cooled power reactor (HTGR) prototype plant.

Profit before taxes of the Corporation and subsidiaries totaled $54,156,069 in 1959 as compared with $90,738,876 in the preceding year. Profit before taxes in 1959 was equal to 3.0% of sales as compared with 5.6% in 1958. The decline in profit margin was attributable principally to increased research and development expenditures and other costs and expenses applicable to the commercial jet transport program consisting of Convair 880 and Convair 600 aircraft. Other contributing factors were increased expenses on certain unprofitable government contracts, largely of a developmental nature, and increased interest expense as the result of a higher level of borrowing.

Provision was made to reduce the Convair 880/600 work in process inventory at year end to reflect the estimated proportionate sales value of this inventory based upon the number of aircraft for which orders are reasonably expected. It should be noted that

Note: For comparison purposes, all prior year statistics (other than per share statistics) shown in the following text and charts with respect to operating results as well as financial position have been adjusted to include amounts applicable to merged predecessor companies including Material Service Corporation. There is no basis for determining pro forma per common share amounts for years prior to 1959 without making arbitrary assumptions with respect to the convertible preferred stock (issued in connection with the merger with Material Service Corporation) which would result in misleading and unreliable statistics. For this reason, pro forma per common share statistics for years prior to 1959 have not been shown in the following text and tables.
The net income of Material Service Corporation and subsidiaries and Consolidated Valdor Aircraft Corporation reflected herein have been restated to reflect Federal income tax adjustments in the year to which they apply.
Convair 880/600 aircraft are new products; the market for jet transports is highly competitive; and that the commercial airlines are under considerable financial pressure, partly as a result of previous commitments for jet aircraft. In view of these facts, it is difficult to anticipate the number of planes which will ultimately be sold under this program. Research and development expenses on the jet transport program and the provision made to reduce Convair 880/600 work in process at year end to its proportionate sales value aggregated $43,097,476 in 1959. This compares to research and development expenses in 1958 of $24,012,620.

Reflecting the decline in pretax profits, the provision for United States and Canadian income taxes for the year 1959 amounted to $23,100,000 as compared with $42,343,718 in the preceding year.

Net earnings of the Corporation and its subsidiaries, after provision for United States and Canadian income taxes, amounted to $31,056,069 in 1959, which compares to $48,395,158 in 1958. Earnings per common share in 1959 were $3.12 based on the 9,944,488 shares outstanding at the year end. In this connection it should be noted that dividends on the convertible preference stock were not payable in 1959. Earnings per share in 1958, excluding earnings of Material Service Corporation and its subsidiaries, were equal to $3.71 per common share based on the 9,909,822 shares outstanding at December 31, 1958.

Backlog
The estimated backlog at December 31, 1959 based on contracts, firm orders and letters of intent aggregated $2,555,000,000 representing an increase of $460,000,000, or approximately 22%, over the backlog at the preceding year end of $2,095,000,000. This increase, despite the record high level of sales, reflects the Corporation's continued growth and the expansion of its activities. A significant portion of the increase in the backlog over the preceding year end is attributable to missiles, primarily the Atlas ICBM and related programs.

Military orders received during the year included those from the United States Air Force for Atlas Intercontinental Ballistic Missiles and supporting equipment, B-58 supersonic bombers and F-106A and F-106B advanced supersonic jet interceptors; from the United States Navy for advanced design fleet ballistic missile submarine, for design and testing of a nuclear-powered submarine tanker, and for advanced Terrier and Tartar guided missiles; from the United States Army and the Marine Corps for development of the Red Eye shoulder-fired guided missile; and from the Royal Canadian Air Force for production of CF-104 supersonic strike-reconnaissance aircraft and CL-44 long-range turbo-prop transports.

Commercial orders booked in 1959 included contracts for additional 880/600 jet transports being produced by Convair and initial orders for the swing-tail, rear-loading version of the CL-44 turbo-prop transport being produced by Canadair Limited.

In the nuclear field, contracts were signed for the design, development and construction of the high temperature gas cooled power reactor (HTGR) prototype plant to be built and operated on the utility system of the Philadelphia Electric Company with the support of a group of utility companies. Additional Triga reactors for training, research and isotope production were sold during the year bringing to seventeen the number purchased to date by universities, hospitals and scientific research centers.

In the area of space exploration, orders were received during the year for development of the "Atlas" missile as a vehicle for scientific exploration of interplanetary space and for the continuation of Project Orion, a concept of space-ship propulsion using controlled nuclear pulses.

The backlog does not reflect certain product lines, principally those for commercial distribution. Products not reflected in the backlog include building materials, coal, lime, carbon dioxide, industrial and medical gases and consumer electronic products.

Dividends
The year 1959 marked the twenty-fourth consecutive year that cash dividends have been distributed to common share owners of the Corporation and its predecessor, Electric Boat Company. Four quarterly dividends of $.50 per share were declared in 1959 continuing the rate in effect since the fourth quarter of 1956.

Cash dividends declared in 1959 totaled $19,881,090. This compares to cash dividends in 1958 of $19,966,029, including a dividend of $229,629 declared by Material Service Corporation.

No dividends were payable on the convertible preference stock in 1959. Dividends are not payable and do not accrue on this issue during the years 1959 through 1963.

Working Capital
At December 31, 1959, working capital (current assets less current liabilities) totaled $265,129,321, reflecting an increase of $42,890,626 during the year. Demands on working capital in connection with additions to property, plants and equipment and the modernization of existing facilities continued to be substantial. The increase in working capital was due primarily to the issuance of a $60,000,000 long-term note to an insurance company. Working capital at December 31, 1959, after deducting the liquidating value of the convertible preference stock, was equal to $14.59 per common share.

At December 31, 1959, current assets to-
taled $640,145,435—approximately 1.7 times current liabilities, which ratio is equal to that at the end of 1958. Current assets include cash and government securities of $69,650,430, or 11% of total current assets.

Accounts receivable at the end of 1959 aggregated $81,721,936 and represented 13% of total current assets. Of this amount, $30,103,321 was due in the ordinary course of business from the United States and Canadian governments and $51,618,615 was due from other customers.

Unreimbursed expenditures and estimated profits, principally on aircraft and ship contracts in process, totaled $279,635,448, or 44% of total current assets at the year end.

Inventories, less advance and progress payments, aggregated $205,599,099, or 32% of total current assets. This represented an increase of $78,387,677 during 1959 due largely to the production build-up on the Convair 880/600 commercial jet transport program. Prepaid expenses at the end of the year amounted to $3,538,522.

Short-Term Financing
During 1959, short-term requirements were provided for by borrowing against unsecured lines of credit with a group of banks. The aggregate amount of these lines of credit, $150,000,000, was unchanged during 1959. While the borrowing level varied with fluctuations in cash requirements, by December 31, 1959 notes payable to banks totaled $46,000,000, representing an increase of $11,000,000 during the year.

Subsidiaries Not Consolidated
The Corporation manufactures and distributes carbon dioxide and industrial gases in Central and South America through subsidiary companies whose operations and financial position are not consolidated in the financial statements included herein. These subsidiaries are located in Cuba, Mexico, Brazil, Venezuela, Colombia, Peru, Trinidad and Jamaica, covering most of the major markets in this broad area. Despite economic and political problems in certain of the countries, operating results were encouraging and once again reached record highs in 1959.

In Mexico, bulk shipments of liquid carbon dioxide by railway tank car were inaugurated and production and storage facilities in Mexico City were expanded to improve customer service and to effect operating efficiencies. In Cuba, work was started on complete automation of dry ice production, the first facility of this type in Latin America. In Venezuela, new production and distribution facilities for bulk carbon dioxide were completed. In Peru, construction of a new oxygen plant was completed. In Brazil, the expansion of carbon dioxide facilities in Sao Paulo and Rio de Janeiro was started and construction continued on a new carbon dioxide plant in Belem. Further expansion in the manufacture of compressed gases in foreign markets is contemplated for the future.

In connection with the sale of telephone equipment by the Corporation, the Stromberg-Carlson Credit Corp. provides long-term financing where necessary for the expansion and modification of telephone services of independent telephone companies. Since its inception in 1951, operations of this subsidiary have increased annually. Installment notes receivable aggregated $18,926,820 at December 31, 1959, which compares to $16,386,800 at the preceding year end. To secure funds for its operations, the credit corporation's long-term debt at the end of 1959 consisted of Collateral Trust Debentures held by an insurance company in the amount of $18,070,000 and subordinated notes payable to the Corporation of $935,000.

Dividends and interest from unconsolidated subsidiaries in 1959 totaled $678,542 which compares to $524,915 in the preceding year. The Corporation's equity in the underlying net assets of unconsolidated subsidiaries based on certified financial statements, generally as of September 30, 1959, amounted to approximately $7,400,000. This compares with investments and advances to these companies aggregating $3,947,276 at December 31, 1959.

Long-Term Debt
Long-term debt was increased in 1959 to $155,101,336 (excluding current installments) primarily as a result of the issuance of a twenty-year 5 1/2% promissory note for $60,000,000 to the Prudential Insurance Company of America. This additional borrowing in 1959 raised to $135,000,000 the amount of long-term financing secured by the Corporation in the past two years. The $60,000,000 borrowed in 1959 was added to working capital and applied to reduce short-term borrowing. The high level of additions to property, plants and equipment, expansion of the Corporation's commercial activities, and the volume of government contract work in recent years have placed heavy demands on working capital. The terms of the agreements relating to loans from Prudential provide, among other things, for pre-payments of $2,500,000 in 1963, $4,000,000 annually during the years 1964 through 1977 and $1,500,000 in 1978; require that consolidated working capital be not less than $210,000,000, subject to adjustment under certain conditions; and restrict the amount available for dividends other than those payable in stock of the Corporation (the maximum amount available for such purposes at December 31, 1959 was $35,796,149).

At December 31, 1959, notes payable aggregating $14,675,000 were outstanding in connection with the purchase of used aircraft. These notes mature in 1960 and 1961 and are noninterest-bearing to maturity.
SHARE OWNERS' EQUITY AND LONG-TERM DEBT

AS REPORTED

Share owners' equity
Long-term debt

PRO FORMA

MILLIONS
$400


NUMBER OF EMPLOYEES AND SHARE OWNERS OF RECORD AT YEAR END

AS REPORTED

Number of employees
Number of share owners

PRO FORMA

THOUSANDS
120


THOUSANDS
120


Amounts due to the Canadian Government under plant purchase agreements entered into in prior years aggregated $5,509,737 at December 31, 1959, reflecting a reduction of $773,729 on account of principal payments made during the year. Other long-term notes and mortgages payable were reduced by payments of $1,091,000 during 1959 to $9,973,000 at the year end.

Property, Plants and Equipment
Expenditures for new facilities and the expansion, modernization and improvement of others aggregated $39,772,392 in 1959 which compares to $38,979,881 expended in 1958. Approximately one-half of the amount expended in 1959 was for facilities for the production and distribution of commercial products. The balance was devoted to the expansion and modernization of facilities for the manufacture of military products and for engineering, research and development facilities.

At the Convair Division, capital expenditures were divided approximately evenly between amounts required to support existing production programs and expenditures for the modernization and expansion of engineering research and development facilities. At San Diego, major projects included construction of a new building for the dynamics laboratory, enlargement of the engineering physics and engineering electronics laboratories, rehabilitation of other engineering facilities, and construction of a new employee cafeteria building. At Astronautics, construction started on a building to house laboratories for space electronics, and aerophysics development. Also, a new engineering building was completed.

During 1959, the industrial gas manufacturing and distribution facilities of Liquid Carbonic Division were substantially increased through the acquisition of plants and equipment of Hench associated gas enterprises. A total of sixteen industrial gas plants as well as distribution facilities was included in the purchase. Increased customer demands in 1959 also necessitated substantial outlays for distribution equipment and storage tanks for placement at customer locations.

At Material Service, construction was initiated on a new coal mine in southern Illinois, Orient #5. Production from this mine is expected to begin in the Fall of 1960. Company coal production facilities were augmented by purchase of Orient #2 mine in 1959. Construction of a new kiln for production of high calcium lime was substantially completed at the South Chicago plant of Marblehead Lime. The new kiln began operation in January 1960 and will result in increased capacity for the production of lime used by the metallurgical and chemical industries in the Midwest.

At the Electric Boat Division, work was substantially completed on a program of enlarging and strengthening shipways necessary to accommodate advanced type nuclear submarines, including submarines capable of launching Polaris missiles.

At the General Atomic Division construction began in 1959 on an extension to the laboratory facilities as well as a technical office building at the John Jay Hopkins Laboratory for Pure and Applied Science. In addition, expenditures for engineering and technical equipment continued in order to complete the laboratory as planned.

Substantial amounts were also expended at all divisions on continuing programs for expansion, modernization and replacement of production and distribution facilities.

Share Owners' Equity
The 2,064,516 shares of convertible preference stock issued in connection with the merger of Material Service Corporation were recorded at a stated value of $25 per share or an aggregate of $51,612,900. Convertible preference stock in the event of liquidation is entitled to $58.125 per share plus accrued dividends. No dividends are payable on this stock until 1964 and dividends thereupon are to be at the annual cumulative rate of $2.90625 per share.

Shares of the preference stock become eligible for conversion into common stock in annual increments as follows: 1961 through 1963—309,677 shares, 1964 and 1965—412,904 shares and 1966—309,677 shares. Eligible shares may be converted at the rate of 1.056818 shares of common stock for each share of preference stock, which rate is subject to adjustment under certain conditions.

The Corporation's 81,844 share owners of record at December 31, 1959 had an equity in the net assets as reflected by the accounts of the Corporation and the consolidated subsidiaries of $329,739,363, reflecting an increase of $38,979,881 expended in 1959 to $329,739,363, reflecting an increase of $12,347,482 during the year. This increase was due primarily to retained earnings.

At the end of 1959, the equity of common share owners, after providing for the liquidating value of the convertible preference stock, was equal to $21.09 per share.

Contingencies
While a substantial portion of the sales for 1959 and 1958 are subject to renegotiation, the management believes that neither the Corporation nor its subsidiaries will be liable for refunds under the renegotiation acts of the United States and Canadian governments and consequently no provision has been made therefor.

There were other contingent liabilities at December 31, 1959 consisting of guarantees, discounted notes receivable, purchase commitments, etc., arising in the ordinary course of business but the financial risk involved, in the opinion of the management, was not material in relation to the consolidated financial position.
### FINANCIAL HISTORY 1950-1959

**Dollars in Thousands Except Per Share Statistics**

<table>
<thead>
<tr>
<th></th>
<th>CURRENT YEAR(1)</th>
<th>PRO FORMA(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Sales</td>
<td>$1,811,871</td>
<td>$1,626,015</td>
</tr>
<tr>
<td>Profit Before Income Taxes</td>
<td>54,156</td>
<td>90,739</td>
</tr>
<tr>
<td>Income Taxes</td>
<td>23,100</td>
<td>42,344</td>
</tr>
<tr>
<td>Net Income</td>
<td>31,056</td>
<td>48,395</td>
</tr>
<tr>
<td>Cash Dividends</td>
<td>19,881</td>
<td>19,966</td>
</tr>
<tr>
<td>Earnings Retained</td>
<td>11,175</td>
<td>28,429</td>
</tr>
<tr>
<td>Current Assets</td>
<td>$440,145</td>
<td>$527,014</td>
</tr>
<tr>
<td>Current Liabilities</td>
<td>375,016</td>
<td>304,776</td>
</tr>
<tr>
<td>Working Capital</td>
<td>265,129</td>
<td>222,238</td>
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<tr>
<td>Fixed Assets (Less Reserves)</td>
<td>182,913</td>
<td>171,870</td>
</tr>
<tr>
<td>Long-Term Debt</td>
<td>155,102</td>
<td>49,499</td>
</tr>
<tr>
<td>Share Owners' Equity</td>
<td>329,739</td>
<td>317,392</td>
</tr>
<tr>
<td>Profit as % of Sales—Profit Before Taxes</td>
<td>3.0%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Profit After Taxes</td>
<td>1.7%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Backlog at Year End</td>
<td>$2,555,000</td>
<td>$2,095,000</td>
</tr>
<tr>
<td>Total Payrolls</td>
<td>$ 970,030</td>
<td>$ 602,404</td>
</tr>
<tr>
<td>Employees at Year End</td>
<td>103,000</td>
<td>97,500</td>
</tr>
<tr>
<td>Share Owners of Record</td>
<td>81,844</td>
<td>70,153</td>
</tr>
<tr>
<td>Shares Outstanding—Preferred</td>
<td>2,064,516</td>
<td>—</td>
</tr>
<tr>
<td>Common(3)</td>
<td>9,944,488</td>
<td>9,906,822</td>
</tr>
<tr>
<td>Per Common Share Statistics(2)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Net Income</td>
<td>$3.12</td>
<td>—</td>
</tr>
<tr>
<td>Cash Dividends</td>
<td>2.00</td>
<td>—</td>
</tr>
<tr>
<td>Working Capital</td>
<td>14.58</td>
<td>—</td>
</tr>
<tr>
<td>Share Owners' Equity</td>
<td>21.08</td>
<td>—</td>
</tr>
</tbody>
</table>

**Notes:**

1. To provide a basis for comparison, Pro Forma statistics present the statistics of the Corporation combined with those of merged predecessor companies (Material Service Corporation in 1950, The Liquid Carbonic Corporation in 1957, Stromberg-Carlson Company in 1950 and Consolidated Venus Aircraft Corporation in 1950) for periods prior to their mergers into the Corporation. The net income of Material Service Corporation and subsidiaries and Consolidated Venus Aircraft Corporation included assets have been restated to reflect Federal income tax adjustments in the year to which they apply. Immediately prior to merger, Material Service Corporation distributed certain of its assets with a net book value of $31,111,986 in redemption of certain shares of its common stock. Such shares, together with treasury shares previously acquired were canceled prior to the merger. The financial statistics December 31, 1950 give effect retroactively to the foregoing transactions but the statistics of earlier years shown above do not.
AS REPORTED

<table>
<thead>
<tr>
<th>Year</th>
<th>Shares</th>
<th>Earnings Per Share</th>
<th>Common Stock Dividends Declared Per Share</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 1951 | $411,355 | $1,511,456 | 71,529 | (a) stock split 1-for-2 in 1956 and 2-for-1 in 1958 and (b) the 5% stock dividend in 1951. There is no basis for determining Pro Forma per common share amounts for years prior to 1959 without making arbitrary assumption with respect to the convertible preference stock (issued in connection with the merger with Material Service Corporation) which would result in misleading and questionable statistics. For this reason, Pro Forma per common share statistics are not shown above.
| 1952 | $435,966 | $1,211,456 | 91,829 | Includes the following non-recurring items: (a) in 1956—profit of $2,226,959 on sale of subsidiary less applicable income tax, equal to $3.09 per common share and (b) with respect to Pro Forma statistics 1956—net loss of $1,059,169 due to discontinuance and disposition of Durable Goods Division of Liquid Carbonic, less applicable reduction in income tax and other credits. |
General Dynamics Corporation and Subsidiaries

CONSOLIDATED BALANCE SHEET

<table>
<thead>
<tr>
<th>Assets</th>
<th>1969</th>
<th>1958</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Assets:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>$66,301,747</td>
<td>$56,002,394</td>
</tr>
<tr>
<td>Government securities, at cost</td>
<td>3,346,683</td>
<td>3,445,395</td>
</tr>
<tr>
<td>Accounts receivable—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States and Canadian Governments</td>
<td>$30,103,321</td>
<td>$35,586,191</td>
</tr>
<tr>
<td>Other trade receivables, less reserves</td>
<td>51,618,615</td>
<td>46,864,331</td>
</tr>
<tr>
<td>Unreimbursed expenditures and estimated profits principally on aircraft and ship contracts in process</td>
<td>279,635,448</td>
<td>254,226,282</td>
</tr>
<tr>
<td>Inventories, at the lower of cost or market, less advance and progress payments</td>
<td>205,599,099</td>
<td>127,211,422</td>
</tr>
<tr>
<td>Prepaid expenses</td>
<td>3,538,522</td>
<td>3,678,430</td>
</tr>
<tr>
<td>Total current assets</td>
<td>$640,145,435</td>
<td>$527,014,445</td>
</tr>
<tr>
<td>Other Assets:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investments (at cost) and advances, including unconsolidated subsidiaries of $3,947,276 in 1959 and $4,126,275 in 1958</td>
<td>$14,519,193</td>
<td>$9,306,638</td>
</tr>
<tr>
<td>Receivables not currently due and other assets including used aircraft (at cost less amortization)</td>
<td>23,716,878</td>
<td>38,236,071</td>
</tr>
<tr>
<td></td>
<td>5,927,698</td>
<td>15,234,336</td>
</tr>
<tr>
<td>Property, Plants and Equipment, at cost:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land and buildings</td>
<td>$123,890,642</td>
<td>$113,594,340</td>
</tr>
<tr>
<td>Machinery and equipment</td>
<td>204,053,238</td>
<td>179,797,189</td>
</tr>
<tr>
<td></td>
<td>$327,943,880</td>
<td>$293,391,529</td>
</tr>
<tr>
<td>Less—Depreciation, amortization and depletion</td>
<td>145,031,137</td>
<td>121,521,719</td>
</tr>
<tr>
<td></td>
<td>$861,294,249</td>
<td>$714,118,591</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of the above statement.
<table>
<thead>
<tr>
<th>Liabilities and Share Owners' Equity</th>
<th>1959</th>
<th>1958</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Liabilities:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes payable to banks</td>
<td>$45,000,000</td>
<td>$34,000,000</td>
</tr>
<tr>
<td>Current installments on long-term debt</td>
<td>10,056,201</td>
<td>1,848,934</td>
</tr>
<tr>
<td>Accounts payable</td>
<td>245,298,992</td>
<td>180,444,415</td>
</tr>
<tr>
<td>Accrued salaries and wages</td>
<td>28,293,991</td>
<td>29,879,256</td>
</tr>
<tr>
<td>United States and Canadian income taxes</td>
<td>27,563,023</td>
<td>37,793,896</td>
</tr>
<tr>
<td>Other accrued taxes</td>
<td>5,441,590</td>
<td>5,530,634</td>
</tr>
<tr>
<td>Customers' deposits and advances in excess of related costs</td>
<td>8,390,073</td>
<td>10,323,704</td>
</tr>
<tr>
<td>Dividends payable</td>
<td>4,972,244</td>
<td>4,954,911</td>
</tr>
<tr>
<td><strong>Total current liabilities</strong></td>
<td>$375,016,114</td>
<td>$304,775,750</td>
</tr>
<tr>
<td><strong>Long-Term Debt:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes payable, 5¼% and 5¾%, due in 1978 and 1979</td>
<td>$135,000,000</td>
<td>$75,000,000</td>
</tr>
<tr>
<td>Other notes and mortgages payable, less current installments</td>
<td>20,101,536</td>
<td>155,101,536</td>
</tr>
<tr>
<td><strong>Minority Interests in Subsidiary Companies</strong></td>
<td>1,437,236</td>
<td>1,452,428</td>
</tr>
<tr>
<td><strong>Share Owners' Equity:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convertible preference stock, no par value (liquidating value $120,000,000)— Authorized, issued and outstanding 2,064,516 shares</td>
<td>$51,612,900</td>
<td>$51,612,900</td>
</tr>
<tr>
<td>Common stock, par value $1 per share— Authorized—30,000,000 shares Issued and outstanding— 9,944,488 shares at end of 1959</td>
<td>9,944,488</td>
<td>9,909,822</td>
</tr>
<tr>
<td>Capital surplus</td>
<td>106,428,185</td>
<td>105,290,348</td>
</tr>
<tr>
<td>Earned surplus</td>
<td>161,753,790</td>
<td>150,578,811</td>
</tr>
<tr>
<td><strong>Total Share Owners' Equity</strong></td>
<td>$861,294,249</td>
<td>$714,118,591</td>
</tr>
</tbody>
</table>

The accompanying notes are an integral part of the above statement.
### STATEMENT OF CONSOLIDATED INCOME

for the years ended December 31, 1959 and 1958

<table>
<thead>
<tr>
<th></th>
<th>1959</th>
<th>1958</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Sales</td>
<td>$1,811,871,384</td>
<td>$1,626,015,489</td>
</tr>
<tr>
<td>Cost of Sales</td>
<td>1,754,948,587</td>
<td>1,537,120,599</td>
</tr>
<tr>
<td></td>
<td>Profit from operations</td>
<td>$ 56,922,797</td>
</tr>
<tr>
<td>Deduct:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest expense—net</td>
<td>$ 6,205,385</td>
<td>$ 1,597,204</td>
</tr>
<tr>
<td>Other income—net</td>
<td>(3,438,657)</td>
<td>(3,441,190)</td>
</tr>
<tr>
<td></td>
<td>Profit before income taxes</td>
<td>$ 54,156,069</td>
</tr>
<tr>
<td>United States and Canadian Income Taxes</td>
<td>23,100,000</td>
<td>42,343,718</td>
</tr>
<tr>
<td>Net Income</td>
<td>$ 81,056,069</td>
<td>$ 48,395,158</td>
</tr>
</tbody>
</table>

*The accompanying notes are an integral part of the above statement.*
STATEMENT OF CONSOLIDATED CAPITAL SURPLUS
for the year ended December 31, 1959

Capital Surplus, beginning of year .................................................. $105,290,348

Add—Excess of proceeds over par value on sale of common stock—$1,108,994
on the sale of 34,670 shares of common stock to employees under stock options
and $28,843 on the sale of stock by a Canadian subsidiary .......................... 1,137,837

Capital Surplus, end of year ....................................................... $106,428,185

STATEMENT OF CONSOLIDATED EARNED SURPLUS
for the year ended December 31, 1959

Earned Surplus, beginning of year .................................................. $159,684,048

Merger Adjustments:
Earned surplus of Material Service Corporation and subsidiaries as at January 1,
1959, as adjusted ................................................................. $74,067,515

Excess of cost (including net book value of assets distributed in redemption of stock
in 1959 prior to merger) over par value of canceled shares of Material Service
Corporation common stock ..................................................... ( 31,308,865)

Excess of stated value of 2,064,516 shares of convertible preference stock and
merger expenses over par value of shares of Material Service Corporation
converted in the merger ......................................................... ( 51,863,887) ( 9,105,237)

Amount shown as of December 31, 1958, in accompanying consolidated
balance sheet ................................................................. $150,578,811

Net Income for the Year ........................................................ 31,056,069

Deduct Cash Dividends—$2.00 per share .............................................. 19,881,090

Earned Surplus, end of year ....................................................... $161,753,790

The accompanying notes are an integral part of the above statements.
(1) Merger:
Material Service Corporation was merged with and into the Corporation effective at the close of business December 31, 1959, in accordance with an agreement of merger under which 2,064,516 shares of convertible preference stock of the Corporation were issued in exchange for the outstanding shares of common stock of Material Service Corporation. Immediately prior to the merger, Material Service Corporation distributed certain of its assets with a net book value of $31,411,088 in redemption of shares of its common stock with a par value of $10,911. Such shares together with treasury shares acquired at a cost in excess of par value of $87,887 were canceled and the aggregate excess ($31,308,865) of cost over par value was charged to consolidated earned surplus. This merger constituted a pooling of interests for accounting purposes. Accordingly, the consolidated balance sheet at December 31, 1958, includes the accounts of Material Service Corporation and subsidiaries, after giving effect retroactively to all of the foregoing transactions, and the statement of consolidated income for the years 1958 and 1957 includes the consolidated operating results of Material Service Corporation and subsidiaries.

(2) Method of profit accrual:
Profits are recorded on certain aircraft, ship and other contracts by utilizing all cost reimbursement type contracts, prior to completion thereof, where, in the opinion of management, such profits can be reasonably estimated after taking into consideration stage of completion and estimated final costs and prices.

(3) Commercial jet transport:
Under the Corporation's accounting policy for commercial aircraft contracts, the cost of sales is to be recorded on Convair 880/990 deliveries to commence in 1960 will be based on the relationship between the projected sales price and the estimated production and tooling costs of that number of planes for which firm orders are reasonably expected. Research and development costs on the Convair 880/990 program have been charged to expense as incurred. In addition, provision was made in 1959 to reduce the Convair 880 program in process inventory at December 31, 1959, to reflect the estimated proportionate sales price of such planes. This determination is necessarily subject to uncertainties where a new type of aircraft is involved, including the determination of the number of orders which can be expected and the prices which can be expected to be realized from the sale of such planes. The reduction in process inventory aggregated $43,097,474 in 1959. Research and development costs in 1958 aggregated $24,060,461.

(4) Long-term debt:
The terms of the agreements relating to the $135,000,000 of notes payable due in 1978 and 1979 provide, among other things, for (a) prepayments of $2,500,000 in 1965, $4,000,000 annually in 1964 through 1975, and $1,500,000 in 1977, (b) consolidated working capital of not less than $210,000,000, subject to adjustment under certain conditions in 1964 and 1965, and (c) restricted use of such notes for dividends other than those payable in stock of the Corporation (the maximum amount available for such purpose is $30,000,000). The Corporation, by action of its Board of Directors, is entitled to purchase 600,000 shares of convertible preference stock at $67.00 per share in the period from June 15 through June 30, 1961 or 200,000 shares at any time thereafter from December 31, 1961. In the event the Corporation does not exercise its right to purchase 600,000 shares in the period from June 15 through June 30, 1961, such shareholders may require the Corporation to purchase 400,000 shares at a price of $66.00 per share in such period.

(5) Properties:
Property, plant and equipment at December 31, 1959, included $17,280,870 and fully amortized or fully depreciated plant and equipment of $45,760,015. The provisions for depreciation, amortization and depletion charged to cost aggregated $27,314,643 in 1959 and $24,960,461 in 1958. Substantially portions of plant facilities used in the operations of certain divisions of the Corporation are leased from the United States Government.

(6) Convertible preference stock:
Convertible preference stock in the event of liquidation is entitled to $28.128 a share plus accrued dividends. No dividends are payable on such stock until 1964 and dividends thereon are to be at the annual cumulative rate of $2.90625 per share. Convertible preference stock is redeemable in full or in part beginning in 1954 at a price of $62.4844 per share plus accrued dividends. Thereafter, the redemption price is reduced approximately $2.29 per share annually until 1972 when the price becomes $50.1594 per share plus accrued dividends and remains unchanged for subsequent years. Under the sinking fund provision, 193,225 shares are to be called for redemption in each of the years 1957 through 1964, and 309,677 shares in the following years, subject to adjustment as provided for in the Agreement and Plan of Merger with Material Service Corporation.

(7) Common stock:
Of the common stock authorized but unissued, 2,181,818 shares are reserved for the preference stock conversion and 1,069,448 shares for options outstanding or options issuable under the Corporation's Restricted Stock Option Plan. Options may be granted to employees, subject to certain restrictions. Under the terms of the Agreement and Plan of Merger, holders of Material Service Corporation, the Corporation will be entitled to purchase 600,000 shares of convertible preference stock at $67.00 per share in the period from June 15 through June 30, 1961 or 200,000 shares at any time thereafter from December 31, 1961. In the event the Corporation does not exercise its right to purchase 600,000 shares in the period from June 15 through June 30, 1961, such shareholders may require the Corporation to purchase 400,000 shares at a price of $66.00 per share in such period.

(8) Employees' retirement plans:
Under the Corporation's Restricted Stock Option Plan approved by the shareholders in April 1951, options may be granted to officers and employees of the Corporation and its subsidiaries with respect to shares of common stock in an aggregate amount not to exceed 10% of such shares issued and outstanding at the time of the grant of an option. The plan provides that the price to be paid for the shares covered by such option shall be 95% of the fair market value thereof on the date such option is granted. Certain of the options are exercisable in whole or in part at any time during the option period, other options become exercisable in installments over a five year period from the date of grant. At January 1, 1959, restricted stock options were outstanding with respect to 28,545,000 shares. For the year 1959, options for 144,000 shares were issued, options for 10,000 shares were exercised and options for 10,000 shares were canceled. At December 31, 1959, there were 56,000 restricted stock options outstanding with respect to 317,576 shares of common stock at varying prices for amounts aggregating $17,771,693.

(9) Contingent liabilities:
While a substantial portion of the sales for 1959 and 1958 are subject to renegotiation, the management believes that neither the Corporation nor its subsidiaries will be liable for refunds under the renegotiation acts of the United States and Canadian Governments and consequently no provision has been made therefor. There were other contingent liabilities at December 31, 1959, consisting of guarantees, discounted notes receivable, purchase commitments, etc., arising in the ordinary course of business. The financial risk involved, in the opinion of the management, is not material in relation to the consolidated financial position.
To the Share Owners and the Board of Directors of General Dynamics Corporation:

We have examined the consolidated balance sheet of General Dynamics Corporation (a Delaware corporation) and subsidiaries as of December 31, 1959, and the related statements of consolidated income and surplus for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. It was not practicable to confirm receivables from the United States and Canadian Governments but we have satisfied ourselves as to such accounts by other auditing procedures.

In our opinion, the accompanying consolidated balance sheet and statements of consolidated income and surplus present fairly the financial position of General Dynamics Corporation and subsidiaries as of December 31, 1959, and the results of their operations for the year then ended, and were prepared in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

New York, N.Y.
February 18, 1960.

ARTHUR ANDERSEN & CO.
Westinghouse Graphics Identification Manual
The Look of Excellence

Westinghouse has committed itself to a long-range design program. This program will touch upon nearly every aspect of the Corporate organization.

Before this design effort can have meaning for our customers, however, the people on all levels of management must see and understand its purpose. In resolving a simple definition for this broad undertaking, it is necessary first to define the scope of the Westinghouse organization.

Westinghouse is a unique company, in the things it does, in the things it makes; and the design program seeks to express that quality to our public. Yet it should be added that this program is not limited to external appearances. Rather, it is a visual reference to something deep in the Westinghouse tradition.

We are trying here to reach into the company and bring out something which is genuine and natural and a true expression of the company itself.

Up to this time, Westinghouse has not had a conscious policy that says, in so many words, that this is what we want the company to look like, and that this is the face we want to present to the world.

But now Westinghouse has such a policy. And there is a need to have everyone understand what that policy is and make every attempt to conform to it, so that everything we do, contributes to a single statement of what Westinghouse is and what it means to the nation.

We want to make it plain that ours is a company whose aim is excellence in all things. We want to make it plain that we never want to produce a second-class product...that we never want to have any but the best people we can get...that we are deep in research and are working on the outer edges of present knowledge...that we are one of a handful of companies which are involved in all the real issues of our times: in scientific development; in defense; in the safety and well-being of the country; even the ordinary routine of daily life—from the cup of black coffee in the morning to the late show on TV at night.

Everything we are undertaking in this design program, therefore, is based on the existence of certain standards of excellence and performance. We must elevate our objectives in the fields of architecture, graphics, product design, packaging, and advertising. The standards we are introducing, and will maintain through the years ahead, are recognized by able designers and businessmen as the only logical approach to our responsibilities.

How then to achieve what we are after? In essence, we should strive to have every creative job done by the best people we can find; to have our work accepted everywhere as the highest level of competence.

We should be just as advanced in the design field as we are in the field of technology. Our attitude should be that we will strive for the very best in everything...that the look of Westinghouse must always be the look of excellence.
Use of the Manual

In the effort to unify and improve all Westinghouse graphics, it is necessary that certain standards and practices be understood by those involved in the creation and production of printed material. The purpose of this manual is to describe these standards and show how they work.

There are five basic elements of the Westinghouse graphic style:

1) the circle W...
2) the logotype...
3) the selling statement...
4) the standard color, Westinghouse Blue...
5) the Westinghouse Gothic type face

These few elements are merely tools for creating a cohesive corporate identification. They are not meant to hamper individual initiative and creative thinking but to encourage it.

This manual should serve as a constant reminder that if each division were to go off in a different direction, introducing its own designs and interpretations, the overall visual appearance of Westinghouse would suffer. On the other hand, if we succeed in unifying our approach to design, our graphic look before the public will also be unified and strengthened.
The Trademark

A trademark is an arbitrary word, term, or design used by a manufacturer or seller on his product, or on the container in which it is shipped...to identify the name of product and to distinguish it from the products of competitors.

How does a Trademark differ from a Patent and a Copyright?

A patent is a right granted to an inventor to prevent others from making, using, or selling his invention. It is granted by the Federal Government in return for the disclosure of his invention to the public.

A statutory copyright is a similar right granted to the creator of a literary, artistic or musical work, who has sold or distributed the work with the required copyright notice thereon.

A trademark, on the other hand, is an exclusive right to use a distinctive mark. It differs from both a patent and a copyright in that it is not a governmental grant. It is acquired by actual use of the mark on the product, and it can be registered with the United States Patent Office.

The use of the circle R character, which indicates registration of the trademark, is not mandatory. Because it complicates the basic trademark design, it may be avoided where the mark is used in display. It is desirable, however, to use it in all non-decorative areas, such as on rating plates.

What are the Selling Functions of a Trademark?

First, a trademark on a product indicates the maker or seller of that product. Second, it is a guarantee to the buyer that this particular product is the same quality as similarly marked products he has purchased in the past, and finally, it facilitates selling and it is the connecting link between the product and the sales and advertising literature.

Trademarks should be used wherever practical to gain every commercial advantage. But they should be used properly. Trademarks are a valuable business asset.

Those who require more detailed information may obtain the booklet, "Trademarks, the Tangible Merchandisers," from the Westinghouse Patent Department.

There are Two Primary Westinghouse Trademarks:

1) The circle W...2) the logotype.
The Circle W

The circle W is the key to Westinghouse's graphic design program. Every attempt should be made to place this symbol before the public in a manner commensurate with good design.

1: The circle W may be used in the following ways, in black and white, or in color:

- positive
- reverse wide border circle
- reverse narrow border circle
- reverse square

2: When the circle W is used three-dimensionally, the discs on top of the W should be flat, like a checker, and never concave or convex.
Light bulb package showing use of logotype, circle W and Westinghouse Gothic
The Logotype

The logotype was specially designed for Westinghouse. It has two distinguishing characteristics: the 'st' ligature and the lower case 'g'. These letters and the relative proportions of the capital 'W' to the lower case are the basis for the Westinghouse Gothic, which will be discussed later. To insure continuity and recognition of the corporate name, the logotype (in other than text) must be used in no other style.

There are both light and heavy versions of the logotype and, like the circle W, it may be used in positive or reverse, in black and white, or in color.

Use of the Circle W with the Logotype: The circle W and the logotype will become Westinghouse standard bearers through consistent use in advertisements and other printed material, on products, packaging, motor vehicles, and property identification. Listed here are some basic principles by which this can be accomplished:

1: The circle W and the logotype must appear in every advertisement, on products, shipping cartons, labels, and all other printed material.

2: Wherever possible, these devices should be used as companion pieces, as shown by some of the variations in this manual. However, the overall design is ultimately the determining factor.

3: The circle W should be used emphatically, generally larger than the logotype.

4: The circle W and logotype should be kept clean and distinctive by avoiding the use of additional border decorations, divisional symbols, or insignia, tune-in plugs, industry slogans, etc. If it is necessary to consider the use of extra elements, such use must be cleared through the office of the Director of Advertising.

Reproduction proofs and/or electrotypes of both the circle W and the logotype are available from Westinghouse, Printing and Nameplate Department, Trafford, Pa.

(Sizes in inches): Positive circle W: 2 to ¼ B-7975 Heavy logotype: 7½ to 5 B-7971
Reverse circle W narrow border: 2 to ½ B-7976 Heavy logotype: 4½ to ¾ B-7972
Reverse circle W square: 2 to ¼ B-7977 Light logotype: 7½ to 5 B-7973
Reverse circle W wide border: 2 to ½ B-7978 Light logotype: 4½ to ¾ B-7974
The Selling Statement

For some time, Westinghouse management searched for a distinctive term that would give expression to the Company's attitude toward its products and toward its customers...a statement that would unify, integrate and augment advertising, sales promotion, and manufacturing activities. After much search, "You can be sure...if it's Westinghouse," was introduced. Years of application have made this statement familiar to most Americans.

1: Unlike the two primary trademarks, the type style of the selling statement may be altered to fit the situation. The product name, or a division's name, must never be associated directly with the selling statement.

2: The selling statement must be used in every advertisement. It may be isolated in a given place, or preferably used as the last line of body copy. Use of the statement in areas other than advertising is not mandatory.

3: When the selling statement is used as the last line of body copy, the typeface should match the body type, in italic or bold face of the same typeface.

4: When the selling statement is isolated in a given place, as in a signature, the word, "Westinghouse", must appear in the new logotype style. The typeface selected for the remaining words in the selling statement should be in contrast with the logotype or exactly the same typeface as the logotype.

5: The old hand lettered style of type for the selling statement should never be used, nor should the word, "sure", be emphasized in any way.

6: Use of the new circle W with the selling statement is optional. Good design should be the determining factor.

7: The logotype may also be used as part of the selling statement in the last line of body copy, if it is not repeated elsewhere on the page, eg., you can be sure...if it's Westinghouse.
Westinghouse Blue

An important aspect of the Westinghouse graphics program is the use of color. The principal color, which replaces the old orange and blue, is Westinghouse Blue. This color is compatible with many other colors, particularly the primary ones, and it should be used whenever possible for the Westinghouse trademarks.

For corporate identification, Westinghouse Blue should always be the predominant color in letterheads, calling cards, banners, binders, labels, signs, vehicle markings and name plates.

For industrial packaging, standardization is essential. Westinghouse Blue should serve as the basic color. However, a secondary color may be used in combination with the blue, if necessary.

Consumer packaging presents an entirely different problem. The package must be designed for a particular product and for a specific audience. Choice of color is therefore dependent upon each problem. If however, a free choice does exist, Westinghouse Blue should be used.

Printed advertising is another area in which the use of color is not limited. Every advertisement presents its own special problem and color must be chosen to suit each situation; however, here too, if possible, Westinghouse Blue should be considered.

Swatches of these Westinghouse colors should accompany all orders for materials to be produced in color. The printer should furnish a color swatch and a sample of the stock on which it will be printed to the ink manufacturer, with instructions to furnish ink which will reproduce this color on the specified stock.

Color sheets may be ordered from the Identification Section, General Advertising Department.

You can be sure... if it's Westinghouse
Westinghouse Gothic Typeface

An exclusive typeface, designed especially for Westinghouse, is available. Some of its distinguishing features are:

1. Smaller capital letters, (in comparison to the lower case) than are found in other typefaces, as well as short ascenders and descenders.
2. The forms of the lower case f, g, r, t, $, ¢.
3. The ligature "st." (Note: this "st" may not be used for any word but "Westinghouse.")
4. Short ascenders and descenders permit large size type in small areas.

Use of Westinghouse Gothic in advertising, TV, packaging, and other printed material has demonstrated its practicability. It is one more factor which helps to distinguish Westinghouse graphics from hordes of other printed material. Primarily, the typeface should be used in display, rather than text matter.

Westinghouse Gothic comes in two weights: heavy and light. Type sizes range from 8 point to 72 point, and it may be obtained from Westinghouse Electric Corporation, Printing and Nameplate Department, Trafford, Pa., from your local supplier of Prototype, or from Photo Lettering, 216 E. 45 St., New York (MU 2-2346).
Left: Two distinguishing features of the Westinghouse logotype: the ligature "st" and g.
Product Packaging

The Westinghouse package, like its advertising, must reflect the Corporation and the quality of its products. An attractive package that will motivate a customer to buy is thus a most important sales factor at the point of purchase.

The main objective for a package is to indicate the manufacturer and to stipulate what product is contained inside. These elements should, therefore, receive primary emphasis. Sales information and specifications are secondary and should be given a less important position on the package.

Four different shaped packages are illustrated here, to cover as many packaging situations as possible. These are primarily designed for industrial products, and in some instances may be adapted for consumer products.

The use of color on these packages is important. Westinghouse blue is the basic color. Red is the complementary color. Each face of every package is divided into a blue area and a red area, separated in all cases by a white border. Because there are no overlapping colors, printing is greatly simplified.

Typography must be carefully handled. The use of all caps should be avoided unless they are legally mandatory. Word spacing should be close to permit smoother reading. Type should be limited to two or three sizes only. Westinghouse Gothic should always be used.

The Westinghouse logotype and the circle W in white appear on a field of blue. Primary information, or the identification of contents, appears on the red field. This carries the same type size and face as the word "Westinghouse" and it is in white.

Secondary information must be handled judiciously. Where this concerns important information such as type and quantity, position this on the front panel in a smaller size of the same type face. If this is printed in blue on the red panel it will have the effect of black, or a third color, for the package.

Instructions, where possible, should be positioned on the side panels. If these are too small, the back display panel can be used for this purpose.

Diagrams may be included on packages when necessary. These can be positioned in the red panel either on the side or the back of the package.

Descriptive matter, code numbers, patent numbers and imprints have in the past been located on the top of the package. This tends to detract from the sales impact of the package. Every effort should be made to locate such information on the bottom of the package. This provides a more impressive appearance at the sales counter.

Code numbers for the printer, as well as "Printed in U.S.A." and "Westinghouse Electric Corporation," should be confined to an inconspicuous panel and set in one line in the smallest size Westinghouse Gothic, or in 6 point Lightline Gothic.
The Westinghouse selling statement is not mandatory. In most cases, when used, it will be white on a blue field.

Each division carries the responsibility for designing and printing the packages it needs. Because there is no such thing as a foolproof guide for package design, the examples shown here can serve only as a point of beginning from which to adapt these divisional requirements. Each situation must be evaluated in terms of specific conditions and accorded imaginative interpretation. Should questions arise concerning the application of corporate graphic standards they may be referred to the Identification Section, General Advertising Department, where assistance is available with layouts and the preparation of final art.

All package designs originating in the divisions should be submitted to the Identification Section for approval of the graphics.

**Identification Labels**

*Standard Sizes:* To speed up delivery, simplify handling and reduce cost of labels, certain sizes have been established as standard and printing plates are stocked at Printing and Publications Division, Trafford, Pa. The standard sizes shown on opposite page should be used wherever practical. The labels are divided into three groups, according to shape: A, B, and C. Each size in these groups is given a number. Through the use of a letter and number such as A-1, B-1, C-1 etc., the printing plate required to print any label can immediately be determined. These numbers do not replace carton label form numbers, and do not appear on labels.

*Ordering:* Select size from opposite page. A sketch in triplicate should be prepared, listing the standard label number given on opposite page, along with all information which is to be printed on the label. Where one label is used to identify a product which is available in various styles, the sketch should include a table showing all variables.

Contact Trafford for carton label form numbers. These numbers should appear on the layout.

One copy of the sketch or paste-up should be held by department originating the label order; one copy should be included with the order for printing. Use Form 21236 when ordering either reprints or new labels. Forward the hecto copy, together with a sample label or sketch, to the Printing and Nameplate Department at Trafford.
Special Labels: For packages requiring product illustrations, or other special treatment, it may be desirable to develop labels which are not standard.

In referring to the dimensions of a label, the width (horizontal) dimension should be given first. Considerations should be given to the extra cost involved before proceeding with special labels.

For assistance in layout, get in touch with the Identification Section, General Advertising Department.

Ordering: Use Form 21236 when ordering either reprints or new labels. Forward the hectar copy, together with a sample label or sketch, to Trafford. A photographic print or accurate sketch of the product should accompany the order.

Standard Carton Imprinting

When an individual product is packaged in a standard corrugated carton for shipping protection only, and where activity does not warrant special product identification, standard imprinting has been developed.

Printing plates incorporating the Westinghouse graphics are available in four styles (ten sizes) for box manufacturers. These are used for imprinting on two sides of the carton. Two color imprinting is recommended in Westinghouse blue and white. Color should match the Westinghouse blue in the section on color. Each set of plates consists of two each of the blue and white dies. They are available at cost from the Identification Section, General Advertising Department.

<table>
<thead>
<tr>
<th>Style and Die No.</th>
<th>Per Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$ 17.90</td>
</tr>
<tr>
<td>1A</td>
<td>6 1/4 x 3 3/16</td>
</tr>
<tr>
<td>1B</td>
<td>3 1/2 x 1 3/8</td>
</tr>
<tr>
<td>2</td>
<td>12 x 4</td>
</tr>
<tr>
<td>2A</td>
<td>9 3/4 x 3 3/4</td>
</tr>
<tr>
<td>2B</td>
<td>17 3/8 x 6</td>
</tr>
<tr>
<td>2C</td>
<td>22 7/8 x 7 3/4</td>
</tr>
<tr>
<td>3</td>
<td>9 1/4 x 9 1/4</td>
</tr>
<tr>
<td>3A</td>
<td>12 3/4 x 13</td>
</tr>
<tr>
<td>4</td>
<td>6 3/8 x 4 1/2</td>
</tr>
</tbody>
</table>
Shipping Banners

Large industrial equipment, normally shipped on flat cars or open trucks, provides an excellent opportunity for displaying Westinghouse identification to the public. In fact, there is no better way to show the scope of Westinghouse manufacturing capabilities than the association that comes with the shipment of massive equipment. The colors selected for the shipping banners are Westinghouse Blue and charcoal grey. Order by style and number from the Identification Section, General Advertising Department. There is a nominal charge for shipping banners and quantities ordered should be limited to actual requirements. Enter order on Trafford Form 30650 E.
Vehicle Identification

The Standards for Westinghouse truck painting suggest restraint and good taste yet offer immediate identification for vehicles in highway use.

All vehicles are to be painted in standard colors of Westinghouse Blue and white. Size and placement of the circle W and the logotype, "Westinghouse," should be uniform wherever used.

The circle W trademark for vehicles is limited to four sizes. The first three are white on a gray solid circle for use on blue backgrounds (9", 12", and 15"). The fourth is white on a blue solid circle for use on gray backgrounds (18" only). The logotype, "Westinghouse," is limited to three sizes for vehicle identification (24", 36", and 48"). The logotype should always appear in white. Either decal or silk-screen may be used for the application of these elements. Individual variations are keyed by letter according to truck types:

a) Light Delivery Van: 36" Westinghouse logotypes on both sides and also on the rear if space permits. If space is limited, follow the design suggested for the rear of panel trucks (c). 15" circle W's on both sides and rear as indicated. Local address positioned below circle W on side door panel of both sides is optional.

b) Pickup Truck: 24" logotypes on door panels of both sides, and if space permits, a 36" logotype on the tailgate. Follow the corresponding panel of the light delivery van (a). 15" circle W's on both sides and tailgate. Local address is optional; if used, place under logotype on door panels.

c) Panel Truck: 36" logotypes on both sides and if space permits on the rear doors. Position as on corresponding panel in van (a). 15" circle W's on both sides and rear as indicated. Local address is optional; if used, place on both sides to the rear of door panels and positioned as shown in respect to circle W.

d) Stake Truck: 36" logotypes to be positioned as shown on plaques and mounted on both sides and on the rear of Stake body. 18" circle W's placed on the cab door panels of both sides. Local address is optional; if used, place under circle W's as shown.

e) Medium Van: 48" logotypes on both sides of van body and centered on the rear doors. 18" circle W's on front, sides and rear of van. Local address is optional; if used, place on cab doors both sides.

f) Trailer Truck: Because of the variety of surface textures, the trailer section is left in the natural silver aluminum. The logotype and circle W elements are applied in plaque form to the front and sides. The rear doors are to be painted blue and the logo and circle W painted on. Front and rear of the trailer section take 21" circle W's. The door panels of the cab section have circle W's of the 15" size.
a) Light Delivery Van

b) Pickup Truck

c) Panel Truck

d) Stake Truck
Ordering: Decals for the circle W and the logotype are available for vehicle identification. They are economical and simple to apply. The circle W decals are white reversed on charcoal. They are for opaque surfaces only. In the case of the logotype, individual white letters are grouped on a band for application as a unit. Both types are available from the Identification Section, General Advertising Department. Enter order on Trafford form 30650E.

<table>
<thead>
<tr>
<th>Sizes in inches</th>
<th>Circle W Decals:</th>
<th>Form Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DC-498</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>DC-499</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>DC-500</td>
</tr>
<tr>
<td>Logotype Decals:</td>
<td></td>
<td>DC-501</td>
</tr>
<tr>
<td>24 x 3</td>
<td></td>
<td>DC-502</td>
</tr>
<tr>
<td>36 x 4½</td>
<td></td>
<td>DC-503</td>
</tr>
</tbody>
</table>

Standard Paints: Ditzler  
Blue DQE12475  White DQE8238  
Dupont 93-95344  93-94126
Nameplates consist of two types: **Rating Plates** which carry data; **Dress Plates** which are fundamentally decorative in their use and appearance.

**Rating Plates:** The Rating Plate is by necessity a functional element on the product. It carries a product rating or capacity, its serial number, patent protection, and other information essential to the use and servicing of the product. When a product carries a Rating Plate, both trademarks must appear on it. The trademarks may also be used elsewhere if they fit the design of the product. Source Material on Rating Plates can be obtained from Standards Department, Materials Laboratories, Westinghouse Electric Corporation, Pittsburgh, Pa.

**Dress Plates:** The Dress Plate is a means of product identification for the manufacturer, particularly in consumer products. When done with restraint, this can add prestige to the company's line. When done in a garish manner, it detracts from both the product and the company itself. It is the plan of the graphics program to keep Dress Plates consistent with corporate identification. It is not satisfactory to employ the word "Westinghouse" in some "artistic" manner other than the logotype. The circle W must always be applied to the product.

Some examples of standard Dress Plates are shown here. The plates are available from Trafford.
Binders

Binders in a number of sizes and materials are listed as standard and available from the Trafford Printing and Nameplate Department. The basic color is the Westinghouse Blue and they come fully embossed with the circle W and the logotype. The circle W may be specified either in white on blue, or in white on a gray circle.

When imprinting is required, either from Trafford or a local supplier, these standards should be followed:

1: Identification of the particular binder should appear underneath the word "Westinghouse", lining up on the left.

2: The same typeface (Westinghouse Gothic) should be specified, either in 18 or 24 point, depending on the amount of type and the number of lines.

3: This lettering should be silk screened, or stamped, in white.

Calling Cards

The design for calling cards is uniform throughout the entire Westinghouse organization. It conforms both in format and type style to corporate graphics standards and all divisions must adhere to it. To simplify ordering, the Printing and Nameplate Department has contracted an outside supplier to handle all calling cards. No other source is to be used.

Your supplier for Calling Cards: R. O. H. Hill, Incorporated
270 Lafayette Street
New York 12, New York
Care of R. G. Donahue
Telephone: WOrth 6-4100

1) Order in standard 250 card lots. The price is based on this number and is not altered by quantity... 2) Furnish supplier a marked sample showing name, title, address and division name. Your business phone can be included if desired. Supplier will arrange copy to fit but you must provide the correct information... 3) Deliveries take two weeks for the first order of any one card. Repeat orders for standing cards requires but one week... 4) Supplier will bill Trafford on a monthly basis. Trafford, in turn, will bill your division that same month... 5) No purchase order is required for ordering cards. The division stationery department should issue regular Form 21236. Attach a sample card for each person and mail to supplier:
John Doe

Executive Assistant to Vice Presidents
Apparatus Products
Westinghouse Electric Corporation

3 Gateway Center
Pittsburgh 30, Pennsylvania
EXpress 1-2800
Match Books

Westinghouse, over the years, has used match books as an inexpensive and effective form of advertising. Three sizes are available with the circle W and logotype: a. Regular; b. Aristocrat; c. Billboard. To assure consistent design and minimum costs, this program is supervised by the Identification Section, General Advertising Department. This office offers a brochure describing charges as well as complete details about imprinting. Design "A" may be ordered without imprint in quantities less than 1,000. Any special die cut will be quoted on application.

All orders should be complete with imprint and shipping information. They must also include account numbers to cover charges.

Postmark Advertising

Correspondence from Westinghouse exposes countless customers to millions of impressions of the corporate name. Postmark advertising is therefore an important part of the total graphics program.

Postmark advertising plates are available at cost to all offices. These carry the circle W, the selling statement and the logotype. Two sizes are available. Model and serial number of your Pitney-Bowes postal machine must accompany an order for these ads. Write the Identification Section, General Advertising Department.

Window Decals

Westinghouse offers a series of inexpensive decals to meet the need for corporate identification on doors and windows. The decals are square and carry the circle W and logotype reversed in white on a blue background. Decals are double-faced so they may be read from both sides when applied to clear glass. They may also be used on opaque surfaces.

Decals are available free of charge when they are used for identification of Westinghouse locations. Free distribution is not intended for application on tool chests,
construction hats, or equipment. However, they are available at cost for such purposes. Minimum quantity in any size is 10 to a package. Use Trafford stationery requisition form 30650E and order by style and number from the Identification Section, General Advertising Department.

<table>
<thead>
<tr>
<th>Circle W and logotype decal:</th>
<th>DC-494</th>
<th>25¢</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 1/2 x 3 3/4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 x 7 3/8</td>
<td>DC-495</td>
<td>30¢</td>
</tr>
<tr>
<td>9 x 9 3/4</td>
<td>DC-496</td>
<td>35¢</td>
</tr>
<tr>
<td>12 x 13</td>
<td>DC-497</td>
<td>50¢</td>
</tr>
</tbody>
</table>

Properties Identification

The circle W is the most effective single device with which to identify company property and should be displayed conspicuously. The logotype, "Westinghouse", should be used in conjunction with it. When these designs are an important part of the architectural scheme, an architect should be consulted. When less emphasis is called for, the following will be useful:

- **Standard Metal Signs:** In many cases a standard sign is suitable for identifying a Westinghouse installation. A number of such signs, in a variety of sizes and finishes, are available at cost from the Identification Section, General Advertising Department.

- **Lawn Signs:** A pedestal type sign, featuring the circle W, has been designed for use on the grounds surrounding a Westinghouse building. These signs, however, must be custom made for the sites they will occupy. Construction details are available upon request.

- **Painted Signs:** As a rule, painted signs should not be used for building identification. Though initially low in cost, they require frequent repainting to retain a clean, fresh appearance. Painted signs should be used, however, on structures such as water towers, where the shape of the object would not permit other means of identification.

- **Illuminated Plastic Signs:** A double-faced illuminated plastic sign is available at cost from the Identification Section, General Advertising Department. The upper part of the sign has a circle W and the logotype in white on a blue background. The lower part provides for local identification. These signs are 5' x 6', meet all safety codes and can be used for either primary or secondary identification.

Another manual will cover in detail the subject of property identification and the proper use and design of all types of signs.
For information on the subject of Company identification, write or call:
The Identification Section
General Advertising Department
Westinghouse Electric Corporation
P.O. Box 868
Pittsburgh 30, Pennsylvania

All visual material as well as the design of this manual are by Paul Rand.
The typefaces used are Garamond #3 and Westinghouse Gothic.
The paper is Strathmore Impress.
Printed by photo offset.
Le Secrétaire
des Chemins de fer Nationaux du Canada,
C.P. 8100, Montréal (P.Q.),
enverra sur demande
le texte français

Copies of the 1963 Annual Report in French may be obtained, upon request, from:
The Secretary,
Canadian National Railways,
Box 8100, Montreal, Que.
<table>
<thead>
<tr>
<th>Board of Directors</th>
<th>Donald Gordon, C.M.G., LL.D.</th>
<th>J.-Louis Levesque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chairman, Montreal</td>
<td>Montreal</td>
</tr>
<tr>
<td>G. E. Ayers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lachute Mills</td>
<td></td>
</tr>
<tr>
<td>R. A. Brown, Jr.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calgary</td>
<td></td>
</tr>
<tr>
<td>Guy Charbonneau</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Montreal</td>
<td></td>
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<tr>
<td>J. R. Griffith</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Saskatoon</td>
<td></td>
</tr>
<tr>
<td>W. C. Koerner</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Vancouver</td>
<td></td>
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<tr>
<td>A. McD. McBain</td>
<td></td>
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<tr>
<td></td>
<td>Toronto</td>
<td></td>
</tr>
<tr>
<td>C. A. Pippy</td>
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<tr>
<td></td>
<td>St. John's</td>
<td></td>
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<tr>
<td>H. I. Price</td>
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<td></td>
<td>Toronto</td>
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</tr>
<tr>
<td>J. B. Sangster</td>
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<td></td>
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<tr>
<td></td>
<td>Regina</td>
<td></td>
</tr>
<tr>
<td>W. G. Stewart, Q.C.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moncton</td>
<td></td>
</tr>
</tbody>
</table>
To The Honourable
The Minister of Transport
Ottawa, Canada

The Board of Directors submits hereunder the Annual Report of Canadian National Railways for the year 1963.

Financial Review

General
An upward movement in Canadian business activity generated heavy demands for transportation services in Canada in 1963. This activity gave Canadian National an opportunity to demonstrate its ability to maintain a determined sales effort for competitive traffic in a busy market, while at the same time meeting strenuous, above-normal demands for rail services. The overall result was that the System handled its second highest volume of railway business (as measured by revenue ton miles) in its history, and gross revenues from all services increased $27.9 million over the previous year to an all-time high of $800.0 million. The following table compares gross revenues in 1962 and 1963:

<table>
<thead>
<tr>
<th></th>
<th>1963 (Millions of Dollars)</th>
<th>1962</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Operating Revenues</td>
<td>$725.2</td>
<td>$701.6</td>
<td>$23.6</td>
</tr>
<tr>
<td>Telecommunications (Commercial Services)</td>
<td>37.2</td>
<td>36.7</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>762.4</td>
<td>738.3</td>
<td>24.1</td>
</tr>
<tr>
<td>Hotels (Excluding The Queen Elizabeth and Hotel Vancouver)</td>
<td>12.6</td>
<td>12.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Separately Operated Trucking Companies</td>
<td>25.0</td>
<td>21.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Gross Revenues</td>
<td>$800.0</td>
<td>$772.1</td>
<td>$27.9</td>
</tr>
</tbody>
</table>

Railway operating revenues increased $23.6 million or 3.4 percent to $725.2 million, while expenses, at $720.2 million, were $12.8 million or 1.8 percent higher than 1962. The resulting net railway operating income of $5.0 million represented a $10.8 million improvement over the $5.8 million operating loss in 1962. Other income, together with net income from hotels, telecommunications and separately-operated trucking companies amounted to $16.2 million, producing a surplus of $21.2 million. This surplus fell short by $43.0 million of the amount needed to meet interest charges on outstanding debt. However, the outcome was an improvement of $5.9 million over the 1962 results, and $5.3 million better than that forecast in the System Operating Budget.
Railway Operating Revenues

Revenues from freight services totalled $573.5 million, an improvement of $25.7 million or 4.7 percent over 1962. Principal contributors to higher revenues were new movements of potash, export grain shipments and increased shipments of automobiles and parts. Most of the increase in revenues from potash shipments represented new business for CN and came from the first full year of production at the potash mining development at Yarbo, Sask. While revenue ton miles were up 12.9 percent to 40.2 billion, the average revenue per ton mile declined 7.5 percent.

Revenues from freight services included $10.1 million related to the Freight Rates Reduction Subsidy which reduces for shippers, on certain classes of traffic, the full effect of the last freight rate increase authorized by the Board of Transport Commissioners in 1958. The payments under this subsidy increased $0.6 million mainly due to increased movements of commodities covered. For the same reason, there was a $1.1 million increase in the East-West Bridge Subsidy which provides reduced rates to shippers on certain traffic moving between Eastern and Western Canada. There was also an increase of $0.4 million in the amount received under the Maritime Freight Rates Act which reduces rates to shippers on traffic moving within and out of the Atlantic Provinces. Interim payments related to the recommendations of the Royal Commission on Transportation were $1.1 million lower, reflecting the fact that the 1962 figure included adjustments in respect of 1961. The following table compares subsidy payments in 1962 and 1963:

<table>
<thead>
<tr>
<th>Subsidy</th>
<th>1963 (Millions of Dollars)</th>
<th>1962 (Millions of Dollars)</th>
<th>Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Rates Reduction Subsidy</td>
<td>$10.1</td>
<td>$9.5</td>
<td>$0.6</td>
</tr>
<tr>
<td>Maritime Freight Rates Act</td>
<td>11.3</td>
<td>10.9</td>
<td>0.4</td>
</tr>
<tr>
<td>East-West Bridge Subsidy</td>
<td>4.3</td>
<td>3.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Total included in freight services revenues</td>
<td>25.7</td>
<td>23.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Interim Payments</td>
<td>29.1</td>
<td>30.2</td>
<td>(1.1)</td>
</tr>
<tr>
<td>Newfoundland and P.E.I. Steamship Services</td>
<td>16.8</td>
<td>16.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>$71.6</td>
<td>$70.4</td>
<td>$1.2</td>
</tr>
</tbody>
</table>

Railway Operating Expenses

Expenses were higher in 1963, arising in the main from an increase in the total compensation to employees. Improved wages and pension benefits and contributions to a job security fund amounted to $12.5 million. Depreciation charges, taxes and material prices were also higher. Through close attention to controllable expenses, the higher costs were partially offset and despite an increase of 10.3 percent in the freight work load, as expressed in gross ton miles, railway operating expenses were held to an overall increase of $12.8 million or 1.8 percent.

Depreciation charged to rail operations was $87.2 million, up $1.2 million from 1962. This constitutes the major portion of the total system depreciation of $99.0 million for 1963, which exceeded 1962 by $3.1 million, primarily due to increased investment in depreciable property.
System taxes increased by $1.4 million to $26.6 million in 1963 of which $22.8 million was charged to railway operating expenses. Included in the System total were $5.5 million for unemployment insurance, $18.5 million for Canadian provincial and municipal and state taxes, and $2.6 million for payments under the U.S. Railroad Retirement Act. Other taxes which were included in the purchase price of materials, amounted to $19.3 million.

Equipment and joint facility rents were $3.8 million, higher by $0.7 million than in 1962 mainly because of increased use of leased cars.

Debt and Interest
There was a reduction of $51.1 million in the total interest-bearing debt made possible mainly from the excess over capital expenditures of the funds derived from the company's own resources including the sale of preferred stock. However, interest charges increased $1.7 million to $64.2 million due to higher interest costs arising from refunding of outstanding debt.

Capital Expenditures
Capital expenditures chargeable to property investment account in 1963 and 1962 appear, by major categories, in the table below. They were financed entirely from funds generated internally and from the sale of preferred stock.

<table>
<thead>
<tr>
<th>Category</th>
<th>1963 (Millions of Dollars)</th>
<th>1962 (Millions of Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Property</td>
<td>$ 66.0</td>
<td>$ 55.3</td>
</tr>
<tr>
<td>Large Terminals</td>
<td>13.6</td>
<td>10.3</td>
</tr>
<tr>
<td>Branch Lines</td>
<td>3.8</td>
<td>5.6</td>
</tr>
<tr>
<td>Equipment</td>
<td>14.0</td>
<td>28.8</td>
</tr>
<tr>
<td>Telecommunications Facilities</td>
<td>27.3</td>
<td>11.7</td>
</tr>
<tr>
<td>Hotels</td>
<td>2.3</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$127.0</strong></td>
<td><strong>$113.5</strong></td>
</tr>
</tbody>
</table>

Development

Research
Construction of a new laboratory adjacent to Montreal Yard was undertaken in 1963 in response to growing demands for increased facilities for research programs into improved technology, methods and materials in the provision of transportation services. The laboratory also provides inspection and testing services for materials and supplies purchased by the System. Through its services, continuing attention will be given to such areas of research as soil mechanics, track material and structure, equipment design, lubrication, fuel, corrosion control and low temperature operations. Meanwhile, rewarding results emerged in 1963 from earlier studies. Reaching completion, for example, was the development of a special car equipped with sensitive electronic devices for measuring track conditions under normal train speeds and loads. The data obtained are used for setting track standards and judging the performance of track mainte-
nance machinery. Another technical achievement was the perfection of an electronic scale capable of weighing freight cars travelling at speeds up to 15 miles per hour. This scale, which is the first of its type to meet the rigid requirements of the Federal Government, is being installed in major classification yards. Advances were also made in the improvement of protective coatings for railway equipment and property by adapting new synthetic resins to railway uses. The improved protection provides more economical painting, reduced maintenance costs and longer life for equipment and structures.

**Branch Lines** Construction moved ahead on the Great Slave Lake Railway which, when completed, will extend 377 miles from Roma, near Grimshaw, Alta., to Hay River, N.W.T., with an additional 53-mile branch line to Pine Point Mines. At year-end, 226 miles of track had been completed, while clearing, grading, bridge and trestle work progressed on the remaining portion of the line. Also, administrative and operating facilities were built at Roma. The line is being opened as construction proceeds and some revenue traffic has been moving over portions of the line since 1962.

In October, the 61-mile rail extension to the Matagami Lake region of Northwestern Quebec was formally opened. The line serves zinc-copper mining developments. In New Brunswick, a 15-mile branch line was completed from Nepisiguit Junction, near Bathurst, to a zinc-lead-copper mining property. Also, an eight-mile extension was completed from Chisel Lake to Stall Lake in Northern Manitoba to transport ore from new copper-zinc mines.
**Real Estate** Urban development projects were advanced in several centres across Canada in 1963 in accordance with the System's program to redevelop its real estate holdings in co-operation with municipal authorities and private developers.

In Edmonton, Alta., agreement was reached with private interests for construction of a 26-storey building to house commercial offices and a passenger station. The structure will also provide accommodation for the railway's Mountain Region and Edmonton Area headquarters' staffs. Construction is scheduled to start early in 1964.

Proposals were invited in mid-1963 for the redevelopment of approximately 24 acres of Canadian National property in downtown Saskatoon, Sask. Earlier, general agreement had been reached with the city for the ultimate use of the property. For CN, the plan involves moving almost all of its facilities to Chappell on the southwestern outskirts of the city where a new freight yard, passenger station and Express Freight terminal are being built.

In Montreal, work will begin in 1964 on a 28-storey commercial office building east of the Queen Elizabeth Hotel on Dorchester Boulevard. Being built by private interests, it is another project in the overall redevelopment of Canadian National's property surrounding Central Station. Meanwhile, proposals were invited for the development of the air rights over the railway tracks south of Lagauchetiere Street. This area is a large city block in size and is the last of three major sections of property in the terminal area to be redeveloped. Also, in Central Station the concourse was enlarged to provide additional commercial space and expanded restaurant facilities, and a new and faster system for handling checked baggage was installed.

**Industrial Development** Canadian National continued to provide existing and prospective customers with a comprehensive industrial location service aimed at attracting new resource, industrial and commercial development in areas served by the System. During 1963, a total of 356 resource developments, manufacturing plants and major warehousing and distributing facilities were established in locations served by Canadian National freight services. An additional 181 industries, already served by CN, expanded their facilities. Of these new plants and expansions, some 248 required private sidings. A total of 38 miles of private sidings and industrial spurs was constructed during 1963.

**Operations**

**Yards** Construction moved ahead during the year on Toronto Yard, an electronically-controlled hump classification yard, and 34 miles of access lines. Scheduled for completion in 1965, the yard will divert and speed up freight operations, thereby relieving much of the current congestion in the centre of Toronto. Similar to yards already in operation at Moncton, Montreal and Winnipeg, the Toronto Yard will incorporate the latest developments in semi-automatic classification. It will be capable of receiving, classifying and despatching 6,000 freight cars a day and will have standing capacity for 10,300 cars.
A new flat-type classification yard and associated diesel locomotive and car repair shop is under construction in Saskatoon as part of the program to remove railway operations from the centre of the city. In Newfoundland, the reconstruction of freight yards at Corner Brook and St. John's was substantially completed by year-end.

**Track and Signals**

As part of continuing track maintenance and improvement programs, more than 600 miles of new rail was laid on principal lines in 1963. About 100 miles of partially worn rail was laid on light traffic lines, while more than 1.4 million ties were installed across the System.

Centralized Traffic Control signalling was installed along about 500 miles of mainline track in 1963. The work was carried out principally in Western Canada and brought the mileage of CTC-equipped track on the System to 3,209. A centrally-controlled signalling system, CTC expedites train movements and increases track capacity.

**Data Processing**

A comprehensive data processing information system, covering all freight and passenger train movements, went into operation on the Atlantic, Mountain and Prairie regions. This computer-based information system assists management in improving customer services and in strengthening managerial controls to produce more economical and efficient operations. It is expected this system will be extended to the St. Lawrence and Great Lakes regions in 1964. This is one example of CN's efforts to realize the full potential of present-day data processing techniques.
Work Study  Increased productivity is being achieved regularly through work study programs which seek out the most efficient use of men, materials and equipment. One of many examples is the recent introduction of a modern production planning and control system in main shops at Point St. Charles, (Montreal) and Transcona, Man. The results from this method of control have been encouraging and it will be applied to other repair facilities on the System.

Freight Services

Sales  In many respects, the high volume of business obtained by Canadian National in 1963 represented concrete rewards from long-range sales-development programs that have been implemented as part of the System's comprehensive, market-oriented approach to the sale of railway services. This approach, adopted in 1960 and which involves adapting railway services to meet customer requirements, is growing in importance as a key to expanding CN's share of what promises to be a more openly competitive transportation market in the future. The freight sales organization is currently reviewing the system's competitive position in anticipation of greater freedom in pricing which may result from Federal Government legislation based on the recommendations of the Royal Commission on Transportation.

Customer Research Service, a new concept in customer relations and service, was offered on a System-wide basis in 1963. It makes the various technical and research groups within the railway available to customers to assist in developing systems for shipping or materials handling, and in seeking solutions to general distribution problems.

Services  Productivity of freight trains reached a new peak in 1963 with an average of 56,800 gross ton miles per freight train hour for all types of freight trains. This was more than double the figure of 27,800 recorded in 1950. Scheduled fast freight trains alone averaged 83,500 gross ton miles per freight train hour.

A new fast freight train was inaugurated in October between Toronto and Winnipeg, with connections to points in Western Canada and the Pacific Coast. This was the third consecutive year in which a new fast freight train was placed in service to improve shipping schedules between Eastern and Western Canada.

"Aquatrain", the freight car ferry service inaugurated in 1962 between Prince Rupert, B.C. and Whittier, Alaska, was extended in 1963 by the addition of a rail car barge to serve the port of Saxman, on Ketchikan Island, Alaska.

The use of containers was expanded in certain operations, while studies were undertaken to find further specific uses for them, especially in the Express Freight field. One hundred and twenty-seven all-steel containers were built in railway shops to meet growing requirements in the shipping operations between the mainland and Newfoundland. The containers allow cargo to be transferred quickly and efficiently between train and ship at the loading and unloading points.
Piggyback services expanded in 1963 with tonnage increasing by 5.9 percent and revenues by 6.3 percent over 1962. Additional points in Ontario and British Columbia were included in Plan 1 piggyback under which commercial trailers are carried. In Montreal, a modern terminal was established in part of the old Turcot classification yard to facilitate piggyback operations.

**Equipment** Growing requirements for special-purpose freight equipment were met in 1963 through conversion programs and the purchase of new equipment. In order to increase the supply of cars for wheat traffic, 1,000 hopper cars, normally used for hauling gravel, were equipped with plywood tops in CN shops and placed temporarily in grain service. Modifications were made to 100 gondola cars and 50 box cars to make them suitable for handling wood chips, while another 100 gondola cars were equipped to carry pulpwood. Bulkheads were installed on 130 flat cars assigned to pulpwood or lumber traffic. One hundred and five ore cars were modified to handle pelletized ore. Doors were widened on 500 standard box cars in response to a growing demand for cars which can be loaded and unloaded by fork-lift trucks. Programs were started to convert 100 ice refrigerator cars to mechanical refrigeration through a method developed by CN, and to install underframe cushioning devices on 100 newsprint cars to protect loads from damage. New equipment orders included 55 tri-level automobile transporters, 100 covered aluminum hopper cars and 100, 70-ton flat cars.

**Express Freight** Express Freight, the System's co-ordinated road and rail service for package and non carload shipments, was further developed in 1963. The new service is emerging from the gradual consolidation of Express and LCL (less than carload) freight services across the System, and is based on trains handling the long haul, between centrally-located road-rail terminals, and highway vehicles performing pickup and delivery services in the districts surrounding these central points. An integral part of the development of Express Freight is the application of the master agency concept which provides customers in smaller and scattered communities with the advantages of urban-type railway communications and service. The master agency plan was tested in 1963 in the Atlantic Region where it has been well received by customers and community interests. A similar test is under way in the Mountain Region. Also, Express and LCL operations were integrated at a number of points on the System, including Bonaventure Terminal in Montreal, a modern streamlined Express Freight terminal capable of handling 9,000 parcels an hour. In Hamilton, Ont., tracks were re-arranged and other work carried out preliminary to construction of a large Express Freight terminal, to begin in 1964.

**Trucking Subsidiaries** Net operating profit for the eight separately-operated trucking companies and two associated terminal companies, whose stock is owned by Canadian National Transportation, Limited, was $1.3 million.

**Passenger Services**

**Sales** Revenues from passenger services were $44.4 million compared to $44.0 million the previous year. This result was achieved despite a 6 percent reduction in the number of passenger train
miles operated and it maintained the position attained in 1962 when a prolonged decline in revenues was halted.

The System extended its comprehensive marketing and sales program in 1963. Directed toward expanding Canadian National's share of the travel market, it involves modern pricing concepts, improved schedules and equipment and expanded services for passengers.

The Red, White and Blue fare plan, in which ticket prices vary by days according to traffic demands, was extended following a one-year experiment between points in Quebec and the three Maritime provinces. The experiment indicated that passenger business could be substantially increased through this form of pricing and the new fare plan was extended to include Newfoundland, the transcontinental route, lines in Southwestern Ontario, four western provinces and, in cooperation with the Ontario Northland Railway, between Toronto and points in Northern Ontario.

Schedules Coincident with the extension of Red, White and Blue fares, improvements were made to schedules, equipment and on-train services. The schedule of the Super Continental between Montreal-Toronto and Vancouver was shortened by almost three hours, providing more convenient departure and arrival times at all principal cities across the country. At the same time, smartly redesigned equipment was introduced. Coaches were refurnished and a refreshment lounge for coach passengers was added, while a club lounge was provided for passengers with sleeping accommodation. Coach accommodation was placed on a reserved basis, at no extra cost, and attendants were assigned to see to the needs of coach passengers.

Free coach reservations and services of attendants were also introduced on the Ocean Limited between Montreal and Halifax.

Other improvements in service included a reduction in the schedule and better equipment for the Scotian between Halifax and Montreal to provide a service comparable to that of the Ocean Limited and especially timed to make connections in Montreal with trains to and from Toronto and Southwestern Ontario. In New Brunswick, the conventional trains between Moncton and Saint John were replaced by self-propelled railiners to provide faster schedules.

Other travel features introduced in 1963 included charter coaches and sleepers for groups, and "Car-Go-Rail", whereby passengers' automobiles are transported in conjunction with their rail trips. A CN-funded "Charge-A-Trip" plan for travel on the System's lines in Canada went into effect early in 1964.

Administration In an administrative change in the sales organization at System Headquarters in January, 1964, the passenger sales and services function was given the status of a full department, headed by a vice-president. This move was in recognition of the growing importance Canadian National is attaching to its passenger business and acknowledges the public's response to CN's efforts to enlarge its share of the travel market.
Hotels

Financial Results Net income from hotel operations in 1963 was $1.4 million, a decrease of $0.9 million from 1962. While revenues of Canadian National Hotels were higher than in 1962, this increase was more than offset by increased operating expenses, the most significant of which was the cost of major exterior repairs to buildings. The decrease in the net return from the Hotel Vancouver is attributable mainly to a decline in revenues from 1962 when this hotel had the benefit of the Seattle World’s Fair. The net return from The Queen Elizabeth Hotel was less than in 1962. This was due to the combination of lower revenues and increased expenses in the hotel and high expenses during the early operation of the new Place Ville Marie restaurants. The following table compares net income in 1963 and 1962:

<table>
<thead>
<tr>
<th>Hotels operated by Canadian National:</th>
<th>1963</th>
<th>Income or (Loss) 1962</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income before major repairs</td>
<td>$331,114</td>
<td>$156,557</td>
</tr>
<tr>
<td>Major repairs to buildings</td>
<td>354,947</td>
<td>—</td>
</tr>
<tr>
<td>Net Income or (Loss)</td>
<td>(23,833)</td>
<td>156,557</td>
</tr>
<tr>
<td>Hotel Vancouver</td>
<td>(247,842)</td>
<td>116,496</td>
</tr>
<tr>
<td>Queen Elizabeth Hotel</td>
<td>1,622,393</td>
<td>2,012,918</td>
</tr>
<tr>
<td>Net Income from Hotels</td>
<td>$1,350,718</td>
<td>$2,285,971</td>
</tr>
</tbody>
</table>

Improvements A five-year program to modernize the hotels was begun in 1963. Plans call for air-conditioning, expanded parking facilities, refurnishing, redecorating and improved dining and other guest facilities. During the year, major projects included the continuation of the rebuilding program at Jasper Park Lodge, where nine multiple-unit cabins were built to replace 12 outdated structures; air-conditioning at the Fort Garry, Winnipeg, and the replacement of the cafeteria at the Chateau Laurier, Ottawa, by a new restaurant. Also at the Chateau, preliminary work was carried out for the renovation of the lower level and air-conditioning of the hotel. Improvements to guest rooms and public rooms were made at The Newfoundland, St. John’s; The Nova Scotian, Halifax; The Charlottetown, in P.E.I.; and The Macdonald, Edmonton. A total of $2.1 million was invested on these projects during the year.

Other Developments In July, Canadian National acquired Canadian Pacific’s interest in the Vancouver Hotel Company Limited which operated the CN-owned hotel. Subsequently, an agreement was entered into with Hilton of Canada Limited for the management and operation of the hotel, an arrangement similar to that under which the Queen Elizabeth Hotel in Montreal is operated. A major renovation and modernization program will be carried out on the property over the next three years.
Telecommunications

Net income from all Telecommunications services was $5.4 million in 1963, down $0.2 million from 1962. While there was an increase in total revenues, this was offset by increased expenses resulting from higher depreciation and total wage costs. Higher revenues were recorded in Telex, telephone and leased wire services, while revenues from telegrams and broadcast facilities were lower.

Growth in plant capacity amounted to 64,000 carrier telephone channel miles and 66,000 carrier telegraph channel miles, for percentage increases of 11.5 and 5.2 respectively. Six new Telex exchanges were opened, bringing the total to 67 exchanges serving 614 communities across Canada. The number of subscribers rose to 6,000 from 4,600 in 1962.

Two new microwave systems were completed, the larger being the Montreal-Vancouver system built jointly by Canadian National and Canadian Pacific. With the existing systems east of Montreal, the new system forms a transcontinental trunk route serving major centres across Canada. It is also the North American land link for the Commonwealth Telecommunications System between the United Kingdom and Canada, New Zealand and Australia. Initially, the Montreal-Vancouver microwave system will be capable of carrying 600 voice channels which
may be used for telephone, telegraph, facsimile and other types of transmission. It can be expanded readily to provide additional voice channels or television services.

The second microwave facility, a tropospheric scatter-wave radio system, reaches from Hay River, N.W.T., to Lady Franklin Point on Victoria Island in the Arctic, a distance of 554 miles. While constructed for defence purposes, the system will also enable CN Telecommunications to provide commercial communications to Coppermine and Cambridge Bay, N.W.T.

Other activities in Northern Canada included: a start on construction of a 1,020-mile pole-line system which, when completed in 1965, will provide communication services to a number of communities in the Mackenzie River Valley between Hay River and Inuvik, N.W.T.; initial work for the expansion, in 1964, of the capacity of the 1,200-mile microwave system between Grande Prairie, Alta., and the Yukon-Alaska border, and a start on the installation of new telephone, telegraph and radio systems for the communities in northern British Columbia, the Yukon and Northwest Territories.

In Newfoundland, a project to increase the capacity of the microwave link between St. John’s and Sydney, N.S., was begun. Also, construction of communications facilities to the North Coast and South Coast areas was undertaken, and dial telephone exchanges were installed in 18 communities in the province.

**Personnel and Labor Relations**

**Labor Relations** In November, new contract demands were received from unions representing more than 66,000 Canadian National employees. Involved are 15 unions, representing 57,500 non-operating employees, and the Brotherhood of Railroad Trainmen representing some 8,600 conductors, trainmen, and yard employees. Contracts with both groups expired on December 31, 1963, and in January 1964, a two-year agreement was reached with the Brotherhood of Railroad Trainmen involving an increase of 5 percent in wage rates. The non-operating unions negotiate jointly with Canadian National, Canadian Pacific and five other railroads. While a number of meetings was held between the railways and the unions’ joint negotiating committee, no progress was made, and in January the parties sought the conciliation services of the Department of Labor.

Under the terms of the previous agreement with the non-operating unions, dated November 2, 1962, a joint management-union committee was established to work out the specific provisions of a Work Security Plan, and to revise seniority and related rules. The railways advanced an overall proposal for this project to the committee in April, and while progress was made in developing a workable plan, there were, at year-end, points in dispute which had yet to be settled.

In the United States, the Arbitration Board, established to hear the work rules dispute between the railways and their operating employees, announced its findings on November 26, 1963. The award provides for gradual elimination of firemen and establishes guidelines for the parties.
to negotiate future changes in the make-up of train crews. Implementation of the award was delayed because the unions are contesting it before the courts.

During the year, eight contract settlements covering some 2,000 employees in seven hotels were achieved. In addition, five collective agreements were signed with other groups of employees including a five-year agreement for deck officers in the Newfoundland Steamship Services.

**Employee Relations**

Training continued to receive special attention during the year. A new training centre was established at Saskatoon, bringing training opportunities within more convenient range of the Company's many western employees.

In addition to established programs to keep employees informed of new developments and other matters of interest to them, a series of meetings was held in June during which the President and other senior officers discussed the 1962 Annual Report and future Company activities with the general chairmen of unions representing CN employees. The meetings were reported by both parties as a new and useful form of communication between management and labor.

Continuing attention was given to the development and implementation of measures that will gradually cause the System to reflect the bicultural character of Canada to a greater degree in its operations and personnel composition.

**Pensions and Welfare**

Total charges against CN earnings for pensions (excluding US Railroad Retirement taxes of $2.6 million) in 1963 compared with 1962 were as follows:

<table>
<thead>
<tr>
<th></th>
<th>1963 (Millions of Dollars)</th>
<th>1962 (Millions of Dollars)</th>
<th>Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935 and 1959 Pension Plans</td>
<td>$28.2</td>
<td>$26.3</td>
<td>$1.9</td>
</tr>
<tr>
<td>Pre-1935 Plans, etc. (including I.C. &amp; P.E.I. Railways Employees' Provident Fund)</td>
<td>7.0</td>
<td>7.1</td>
<td>(0.1)</td>
</tr>
<tr>
<td>Total</td>
<td>$35.2</td>
<td>$33.4</td>
<td>$1.8</td>
</tr>
</tbody>
</table>

Exclusive of payments made under the US Railroad Retirement Act, there was paid to pensioners and beneficiaries, under the various Canadian National pension arrangements, a total of $37.4 million in 1963, and 30,411 individuals were receiving such payments at the year end.

Charges against CN earnings for welfare plans providing hospital-surgical-medical benefits and life insurance were $6.4 million in 1963.

**Corporate Structure**

Under a continuing program to simplify the corporate structure of Canadian National Railway Company, six constituent companies were eliminated. They were Canadian National Hotels, Limited; The Central Counties Railway Company; The Montreal Stock Yards Company; The

**CN-CP Act** Areas where co-operative measures might be undertaken were explored in discussions with the Canadian Pacific Railway Company.


## The Outlook

In many respects, 1963 was an exceptional year for Canadian National Railways. A buoyant economy and an unusually high demand for transportation services put to a rigid test the overall efficiency of the new plan of organization introduced early in 1961. Considering the complexity and the far-reaching nature of the changes which had been made, the first since the formation of the System in 1923, it was considered that noteworthy progress had been achieved in a relatively short time. The entire work force proved effective in enlarging the railway's share of traffic in competition with other carriers, and the capacity of the plant fulfilled the demanding objectives. The result was that the System did more business than ever before with gross sales reaching $800 million, and had the second highest volume of revenue ton miles in any year of its history. It was significant that this volume of business was handled at an unparalleled level of efficiency. For example, the 40.2 billion revenue ton miles carried in 1963 was surpassed only by the 41.9 billion carried in 1956; the 1963 traffic, however, was handled with 13,000 fewer pieces of freight equipment than required in 1956, mainly because of improved car utilization and distribution techniques.

The 1963 performance illustrated, as well, the ability of the railway plant to absorb a large volume of additional business without greatly increasing its total expense. While the freight work load increased 10.3 percent over 1962, railway operating expenses rose only by 1.8 percent.

An important part of the achievement of 1963 was the contribution Canadian National made to the successful delivery of the large export grain orders. This immense task came upon the railway unexpectedly, and the Company responded in the national interest to meet the requirements of the Canadian Wheat Board efficiently and expeditiously. From the beginning of the 1963 crop year in August, the System transported 85,500 cars of grain, or 169 million bushels, and at year-end was more than 3,000 cars ahead of schedule in its deliveries. All of this additional work load was performed without disruption to regular services or other shipping needs.

The foregoing accomplishments, regarded as significant indicators of improved sales effort and operating efficiency, are not, however, apparent in the on-paper financial result. While gross sales were higher, the work load greater, and inventory and controllable expenses held firmly in line, the net income was insufficient to meet the interest burden which produced
a deficit of $43 million. Most of this debt can be identified as a legacy from the past through a
deficiency in depreciation practices which restricted the Company's ability to finance capital
expenditures from internal sources. The provisions of the Capital Revision Act of 1952 have
now run their normal term and, as was the understanding at that time, the effectiveness of the
measures is being re-examined in light of approximately ten years' experience. The basic prin-
ciple of the capital revision proposals which the Company has recommended to the Govern-
ment is that the railway be relieved of the crushing burden of debt charges which make the annual
profit and loss account such an inaccurate reflection of management and employee efficiency.
In the new competitive environment envisioned by the intended legislation based upon the Mac-
Pherson Royal Commission on Transportation, it is deemed essential that Canadian National
be placed in a position whereby it can be judged and held accountable on the same basis as its
competitors. The Board of Directors and Management consider that if the Company is destined
to chronic deficits, then this will not only be severely damaging to the morale of the personnel
but could, in fact, have a detrimental effect on the important private enterprise sector of the
transportation industry.

Canadian National is a valuable national asset and occupies a prime and unique role in the life
of Canada. Its objectives of providing an efficient and economic transportation system can be
fulfilled more satisfactorily if the accounts are placed on a basis that will reflect the true story
of current operations, so that the annual results do not need qualification and explanation in
respect of the past.

The Board of Directors once again takes pleasure in expressing its appreciation for the con-
tinued loyal services rendered by officers and employees throughout the System.

Signed on behalf of the Board of Directors. Montreal, March 16, 1964
Executive and General Officers

Donald Gordon, C.M.G., LL.D., D.C.L., President
N. J. MacMillan, Q.C., Executive Vice-President
S. F. Dingle, System Vice-President
R. H. Tarr, Vice-President and Executive Assistant
R. T. Vaughan, Secretary of the Company
K. E. Dowd, M.D., C.M., F.A.C.S., Chief Medical Officer
C. A. Harris, Director of Public Relations
E. A. Spearing, M.B.E., Director of Investigation
Accounting and Finance
J. L. Toole, Vice-President
L. J. Mills, O.B.E., Comptroller
E. J. Denyar, Treasurer
Highway Services
F. A. Gaffney, Vice-President
Law
H. C. Friel, Q.C., Vice-President
Lionel Côté, Q.C., General Counsel
Personnel and Labour Relations
W. T. Wilson, Vice-President
T. A. Johnstone, Assistant Vice-President, Labour Relations
George Lach, Assistant Vice-President, Personnel
Purchases and Stores
E. A. Bromley, Vice-President
T. M. Pye, General Purchasing Agent
Research and Development
Maurice Archer, Vice-President
D. F. Purves, Assistant Vice-President
J. P. Blanchet, General Manager, Real Estate
Freight Sales
A. H. Hart, Vice-President
E. A. Ryder, Deputy Vice-President
G. R. Johnston, General Sales Manager, Freight
Passenger Sales and Services
Pierre Delagrave, M.B.E., Vice-President
Transportation and Maintenance
J. W. Demcoe, Vice-President
D. M. Trotter, Assistant Vice-President
Atlantic Region
H. C. Grayston, Vice-President, Moncton
E. J. Cooke, General Manager
E. K. House, Manager, Newfoundland Area, St. John's
J. G. Davis, Manager, Maritime Area, Moncton
L. M. Poitevin, Manager, Chaleur Area, Campbellton
St. Lawrence Region
J. A. McDonald, Vice-President, Montreal
C. A. Bérubé, General Manager
A. A. Audet, Manager, Quebec Area, Quebec City
J. J. F. Roberts, Manager, Montreal Area, Montreal
R. J. Hansen, Assistant Manager, Montreal Area
J. H. Richer, Manager, Champlain Area, Montreal
K. E. Hunt, Manager, Rideau Area, Belleville
Great Lakes Region
D. V. Gonder, Vice-President, Toronto
Eric Wynne, Vice-President
E. P. Stephenson, General Manager
J. H. Spicer, Manager, Toronto Area, Toronto
R. H. Menary, Assistant Manager, Toronto Area
C. J. Morris, Manager, London Area, London
G. H. Bloomfield, Manager, Northern Ontario Area, Capreol
Prairie Region
W. C. Bowra, Vice-President, Winnipeg
A. Skinner, General Manager
C. T. Cameron, Manager, Lakehead Area, Port Arthur
L. H. B. Gooding, Manager, Winnipeg Area, Winnipeg
H. J. Fast, Manager, Assiniboine Area, Winnipeg
E. S. Barker, Manager, Hudson Bay Area, Dauphin
A. E. Street, Manager, Saskatchewan Area, Saskatoon
Mountain Region
G. R. Graham, Vice-President, Edmonton
W. D. McPherson, General Manager
W. B. Jackson, Manager, Edmonton Area, Edmonton
G. F. V. Middleton, Manager, Calgary Area, Calgary
J. A. Pollock, Manager, British Columbia Area, Vancouver
Grand Trunk Western Railroad
H. A. Sanders, Vice-President and General Manager, Detroit
Telecommunications
J. R. White, General Manager, Toronto
H. J. Clarke, Assistant General Manager
Hotels
S. S. Chambers, General Manager, Montreal
European Organization
J. C. Kenkel, General Manager, London, England
*Retired, January 1, 1964
Companies Included in the Canadian National System

Canadian National Railway Company
Canadian National Express Company
Canadian National Railways (France)
Canadian National Realities, Limited
Canadian National Steamship Company, Limited
Canadian National Telegraph Company
Canadian National Transfer Company
Canadian National Transportation, Limited
The Canadian National Railways Securities Trust
The Canadian Northern Quebec Railway Company
Eastern Transport Limited
East-West Transport Ltd.
Empire Freightways Limited
The Great North Western Telegraph Company of Canada
Hoar Transport Company Limited
Husband Transport Limited
Midland Superior Express Limited
The Minnesota and Manitoba Railroad Company
The Minnesota and Ontario Bridge Company
Montalta Holdings Limited
Montreal and Southern Counties Railway Company
Mount Royal Tunnel and Terminal Company, Limited
The Northern Consolidated Holding Company Limited
The Quebec and Lake St. John Railway Company
Sydney Transfer and Storage Limited
The Toronto-Peterborough Transport Company, Limited
Vancouver Hotel Company Limited
Wacos Holdings Limited
Central Vermont Railway, Inc.
Central Vermont Transportation Company
Duluth, Rainy Lake & Winnipeg Railway Company
Duluth, Winnipeg and Pacific Railroad Company
Duluth, Winnipeg and Pacific Railway Company
Grand Trunk-Milwaukee Car Ferry Company
Grand Trunk Western Railroad Company

In addition, the property of the Canadian Government Railways is entrusted to the Canadian National Railway Company as part of the system.
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## Consolidated Balance Sheet at December 31, 1963

### Assets

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Assets</strong></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>$32,707,012</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>87,811,533</td>
</tr>
<tr>
<td>Material and supplies</td>
<td>62,990,782</td>
</tr>
<tr>
<td>Other current assets</td>
<td>20,275,051</td>
</tr>
<tr>
<td>Government of Canada — Due on deficit account</td>
<td>8,513,517</td>
</tr>
<tr>
<td><strong>Total Current Assets</strong></td>
<td><strong>$212,297,895</strong></td>
</tr>
<tr>
<td><strong>Insurance Fund</strong></td>
<td><strong>17,500,000</strong></td>
</tr>
<tr>
<td>Investments in Affiliated Companies Not Consolidated</td>
<td></td>
</tr>
<tr>
<td>Trans-Canada Air Lines</td>
<td>242,471,000</td>
</tr>
<tr>
<td>Jointly operated rail and terminal facilities</td>
<td>48,539,703</td>
</tr>
<tr>
<td><strong>Total Investments in Affiliated Companies</strong></td>
<td><strong>291,010,703</strong></td>
</tr>
<tr>
<td>Property Investments</td>
<td></td>
</tr>
<tr>
<td>Road</td>
<td>2,515,851,946</td>
</tr>
<tr>
<td>Equipment</td>
<td>1,324,952,940</td>
</tr>
<tr>
<td>Other physical properties</td>
<td>123,694,663</td>
</tr>
<tr>
<td><strong>Less recorded depreciation</strong></td>
<td><strong>3,664,493,249</strong></td>
</tr>
<tr>
<td>Other Assets and Deferred Charges</td>
<td></td>
</tr>
<tr>
<td>Other investments</td>
<td>3,576,549</td>
</tr>
<tr>
<td>Prepayments</td>
<td>2,454,584</td>
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<tr>
<td>Unamortized discount on long term debt</td>
<td>19,489,453</td>
</tr>
<tr>
<td>Other assets</td>
<td>9,089,573</td>
</tr>
<tr>
<td>Deferred charges</td>
<td>10,578,349</td>
</tr>
<tr>
<td><strong>Total Other Assets</strong></td>
<td><strong>46,088,558</strong></td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td><strong>$3,730,356,480</strong></td>
</tr>
</tbody>
</table>

### Liabilities

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Liabilities</strong></td>
<td></td>
</tr>
<tr>
<td>Accounts payable</td>
<td>$64,815,458</td>
</tr>
<tr>
<td>Accrued charges</td>
<td>23,756,029</td>
</tr>
<tr>
<td>Other current liabilities</td>
<td>3,052,302</td>
</tr>
<tr>
<td><strong>Total Current Liabilities</strong></td>
<td><strong>$91,623,789</strong></td>
</tr>
<tr>
<td>Provision for Insurance</td>
<td>17,500,000</td>
</tr>
<tr>
<td>Other Liabilities and Deferred Credits</td>
<td>33,113,192</td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td><strong>$142,136,981</strong></td>
</tr>
<tr>
<td>Long Term Debt</td>
<td></td>
</tr>
<tr>
<td>Government of Canada loans and debentures</td>
<td>1,380,898,764</td>
</tr>
<tr>
<td><strong>Total Long Term Debt</strong></td>
<td><strong>1,380,898,764</strong></td>
</tr>
<tr>
<td><strong>Shareholders' Equity</strong></td>
<td></td>
</tr>
<tr>
<td>Government of Canada</td>
<td></td>
</tr>
<tr>
<td>6,000,000 shares of no par value capital stock of C/N Railway Company</td>
<td>359,963,017</td>
</tr>
<tr>
<td>901,504,556 shares of 4% preferred stock of C/N Railway Company</td>
<td>991,504,556</td>
</tr>
<tr>
<td>Capital investment of Government of Canada in the C/G Railways</td>
<td>440,912,615</td>
</tr>
<tr>
<td><strong>Total Government of Canada</strong></td>
<td><strong>1,792,380,188</strong></td>
</tr>
<tr>
<td>Capital Stock of Subsidiary Companies Owned by Public</td>
<td></td>
</tr>
<tr>
<td><strong>Total Shareholders' Equity</strong></td>
<td><strong>$3,730,356,480</strong></td>
</tr>
</tbody>
</table>

The notes on page 22 are an integral part of this Balance Sheet.

L. J. Mills, Comptroller.
Consolidated Income Statement

<table>
<thead>
<tr>
<th></th>
<th>1963</th>
<th>1962</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Operating Revenues</td>
<td>$725,181,334</td>
<td>$701,622,754</td>
</tr>
<tr>
<td>Railway Operating Expenses</td>
<td>770,189,669</td>
<td>707,442,091</td>
</tr>
<tr>
<td>Net Railway Operating Income or (Loss)</td>
<td>5,011,665</td>
<td>(5,819,337)</td>
</tr>
<tr>
<td>Net Income from:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecommunications department</td>
<td>5,367,458</td>
<td>5,619,686</td>
</tr>
<tr>
<td>Hotels</td>
<td>1,350,718</td>
<td>2,285,971</td>
</tr>
<tr>
<td>Separately operated trucking companies</td>
<td>1,283,213</td>
<td>875,975</td>
</tr>
<tr>
<td>Other Income</td>
<td>8,177,720</td>
<td>10,616,841</td>
</tr>
<tr>
<td></td>
<td>16,179,109</td>
<td>19,398,473</td>
</tr>
<tr>
<td>Net Income before Interest on Debt</td>
<td>21,150,774</td>
<td>13,579,136</td>
</tr>
<tr>
<td>Interest Charges:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total interest on debt</td>
<td>75,822,804</td>
<td>74,017,366</td>
</tr>
<tr>
<td>Less interest received on loans to Trans-Canada Air Lines</td>
<td>11,618,513</td>
<td>11,518,776</td>
</tr>
<tr>
<td>Net Interest on Debt</td>
<td>64,204,291</td>
<td>62,498,590</td>
</tr>
<tr>
<td>(Deficit)</td>
<td>$ (45,013,517)</td>
<td>$ (48,919,454)</td>
</tr>
</tbody>
</table>

Auditors' Report

To The Honourable The Minister of Transport,
Ottawa, Canada.

We have examined the consolidated balance sheet of the Canadian National Railway System at December 31, 1963 and the consolidated income statement for the year ended on that date. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances.

In our opinion, subject to the position with regard to depreciation accruing prior to the adoption of depreciation accounting as referred to in Note 1, the accompanying consolidated balance sheet and the related consolidated income statement are properly drawn up so as to give a true and fair view of the state of the affairs of the System at December 31, 1963 and of the results of its operations for the year ended on that date according to the best of our information and the explanations given to us and as shown by the books of the System, and in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

We further report that, in our opinion, proper books of account have been kept by the System and the transactions that have come under our notice have been within the powers of the System.

McDonald, Currie & Co.,
Chartered Accountants.

February 25, 1964
Notes to Consolidated Financial Statements at December 31, 1963

Note 1: Property Investment
Additions since January 1, 1923 have been recorded at cost and properties and equipment brought into the System at January 1, 1923 are included at the values appearing in the books of the several railways now comprising the System to the extent that these have not been retired or replaced.

Depreciation on Canadian Lines: Depreciation accounting as adopted for equipment in 1940, for hotel properties in 1954 and for track and road structures and all other physical properties except land in 1956 has been continued in 1963. The depreciation rates used are based on the estimated service life of the properties but do not provide for depreciation which was not recorded in prior years under the replacement and retirement accounting principles then in force, nor for extraordinary obsolescence resulting from the introduction of more efficient equipment.

Depreciation on U.S. Lines: Replacement accounting for track and depreciation accounting for equipment and other property except land has been continued in accordance with the regulations of the Interstate Commerce Commission.

Note 2: Material and Supplies
The inventory has been priced at laid down cost based on weighted average cost for ties, rails and fuel and latest invoice price for new materials in general stores, and at estimated utility or sales value for usable second hand, obsolete and scrap materials.

Note 3: Capital Stock
The capital stock of the Canadian National Railway Company (other than the four per cent preferred stock) and the capital investment of Her Majesty in the Canadian Government Railways are included in the net debt of Canada and disclosed in the historical record of government assistance to railways as shown in the Public Accounts of Canada.

Note 4: Major Commitments
(a) Pension Funds:
The Company has given a written acknowledgement to the Trustee of the Pension Funds for an amount not exceeding $395,000,000 for the outstanding liability in respect of prior service of active employees.

(b) Vacation Pay:
In accordance with past practice the Company has not recorded the liability for vacations earned in 1963 which will be paid in 1964.

(c) Chicago & Western Indiana Railroad Company:
The Grand Trunk Western Railroad Company is liable jointly and severally with four other proprietors as guarantor of principal and interest with respect to $10,997,000 First Collateral Trust Mortgage 4 3/4% Sinking Fund Bonds due May 1, 1982 of the Chicago & Western Indiana Railroad Company. In addition, the proprietors are obligated to make annual sinking fund payments sufficient to retire the bonds at maturity and to meet interest as it falls due; in the absence of default of any of the other proprietors, Grand Trunk Western's proportion of such annual payments is one-fifth.

(d) The Belt Railway Company of Chicago:
The Grand Trunk Western Railroad Company is liable jointly and severally with eleven other proprietors as guarantor of principal, interest and sinking fund payments with respect to $36,505,000 First Mortgage 4 3/4% Sinking Fund Bonds series "A", due August 15, 1987 of the Belt Railway Company of Chicago. Each proprietor is to make payments to the extent required in proportion to its usage of the Belt's facilities in the preceding three years. For the three years ended December 31, 1963 Grand Trunk Western Railroad's usage was approximately 2.1% of the total.

(e) Detroit & Toledo Shore Line Railroad Company:
The Grand Trunk Western Railroad Company is jointly and severally liable with one other proprietor as guarantor of principal, interest and sinking fund payments with respect to $2,708,000 First Mortgage 3 1/4% 30-year series "A" Bonds, due December 1, 1982 of the Detroit & Toledo Shore Line Railroad Company.
## Railway Operating Revenues

<table>
<thead>
<tr>
<th></th>
<th>1963</th>
<th>1962</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freight Services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$573,477,011</td>
<td>$547,799,257</td>
</tr>
<tr>
<td><strong>Passenger Services:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger</td>
<td>34,491,894</td>
<td>34,331,531</td>
</tr>
<tr>
<td>Sleeping, dining and parlour car, etc.</td>
<td>9,862,221</td>
<td>9,045,296</td>
</tr>
<tr>
<td></td>
<td>44,354,115</td>
<td>43,376,827</td>
</tr>
<tr>
<td><strong>Mail</strong></td>
<td>10,626,819</td>
<td>11,020,572</td>
</tr>
<tr>
<td><strong>Express</strong></td>
<td>45,602,316</td>
<td>46,963,146</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>22,064,172</td>
<td>21,650,472</td>
</tr>
<tr>
<td>Interim Payments — Royal Commission on Transportation</td>
<td>29,056,901</td>
<td>30,202,480</td>
</tr>
<tr>
<td></td>
<td><strong>$725,181,334</strong></td>
<td><strong>$701,622,754</strong></td>
</tr>
</tbody>
</table>

## Railway Operating Expenses

<table>
<thead>
<tr>
<th></th>
<th>1963</th>
<th>1962</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road Maintenance</strong></td>
<td>$143,181,049</td>
<td>$142,878,959</td>
</tr>
<tr>
<td><strong>Equipment Maintenance</strong></td>
<td>151,924,929</td>
<td>148,450,417</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>312,530,459</td>
<td>309,058,698</td>
</tr>
<tr>
<td><strong>Sales</strong></td>
<td>17,182,774</td>
<td>16,351,800</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td>6,956,866</td>
<td>6,152,519</td>
</tr>
<tr>
<td><strong>General</strong></td>
<td>61,725,269</td>
<td>58,704,428</td>
</tr>
<tr>
<td></td>
<td><strong>693,501,346</strong></td>
<td><strong>681,606,821</strong></td>
</tr>
<tr>
<td><strong>Railway Tax Accruals</strong></td>
<td>22,839,768</td>
<td>22,746,605</td>
</tr>
<tr>
<td><strong>Equipment and Joint Facility Rents</strong></td>
<td>3,826,555</td>
<td>3,088,665</td>
</tr>
<tr>
<td></td>
<td><strong>$720,169,869</strong></td>
<td><strong>$707,442,091</strong></td>
</tr>
</tbody>
</table>

## Other Income

<table>
<thead>
<tr>
<th></th>
<th>1963</th>
<th>1962</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rent Income</strong></td>
<td>$ 3,707,769</td>
<td>$ 3,443,272</td>
</tr>
<tr>
<td><strong>Interest Income</strong></td>
<td>2,160,206</td>
<td>1,976,129</td>
</tr>
<tr>
<td><strong>Dividend Income</strong></td>
<td>294,311</td>
<td>239,617</td>
</tr>
<tr>
<td>Amortization of premiums on shares purchased</td>
<td>(2,092,660)</td>
<td>—</td>
</tr>
<tr>
<td>Profit from sale of real property</td>
<td>4,548,963</td>
<td>2,435,994</td>
</tr>
<tr>
<td>Increased provision for insurance</td>
<td>(2,560,000)</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous (Net)</td>
<td>2,039,131</td>
<td>2,521,829</td>
</tr>
<tr>
<td></td>
<td><strong>$ 8,177,720</strong></td>
<td><strong>$10,616,841</strong></td>
</tr>
</tbody>
</table>
Property Investment Statement

Property Investment at December 31, 1962

Capital Expenditures in 1963
New lines and diversions $16,694,937
Roadway improvements 36,784,387
Large terminals 13,568,383
Yard tracks and sidings 1,933,865
Buildings 3,817,361
Highway crossing protection 249,235
Signals 3,384,432
Roadway and shop machinery 1,685,641
Other facilities 1,335,151

Total — Road Property 75,654,392
Branch lines 3,767,491
Equipment 14,027,119
Telecommunications 27,335,643
Hotels 2,765,537

Government of Canada net expenditure on Canadian Government Railways 1,645,579
Additions — U.S. Lines — in accordance with I.C.C. Order No. 32153 545,500

Additions to property in 1963 129,741,261
Deduction in respect of property retirements in 1963 55,651,273 73,589,988

Property Investment at December 31, 1963 $3,964,499,249

Recorded Depreciation Statement

Recorded Depreciation at December 31, 1962 $ 728,344,856

Add Provision for depreciation for the year
Road property $ 50,097,625
Equipment 45,058,777
Other Physical Properties 3,892,679 99,049,081

Increase in recorded depreciation — U.S. Lines — in accordance with I.C.C. Order No. 32153 545,500

Deduct Net Charges in respect of property retirements 99,594,581 62,705,069

Recorded Depreciation at December 31, 1963 $ 801,049,925
## Long Term Debt

<table>
<thead>
<tr>
<th>Rate</th>
<th>Maturity</th>
<th>Currency in which payable</th>
<th>Outstanding at Dec. 31, 1962</th>
<th>Transactions Year 1963</th>
<th>Increase or Decrease</th>
<th>Outstanding at Dec. 31, 1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 1/4</td>
<td>Feb. 1, 1963</td>
<td>Canadian National 8 Year 1 1/2 Month Bonds</td>
<td>Canadian $250,000,000</td>
<td>$250,000,000</td>
<td></td>
<td>$250,000,000</td>
</tr>
<tr>
<td>5 1/4</td>
<td>Dec. 15, 1964 a, g</td>
<td>Canadian National 5 Year Bonds</td>
<td>Canadian $198,711,000</td>
<td>$198,672,000</td>
<td>$639,000</td>
<td>$198,672,000</td>
</tr>
<tr>
<td>3</td>
<td>Jan. 3, 1965 b</td>
<td>Canadian National 17 Year Bonds</td>
<td>Canadian $35,000,000</td>
<td>$35,000,000</td>
<td>$3,000</td>
<td>$35,000,000</td>
</tr>
<tr>
<td>4 1/2</td>
<td>Jan. 2, 1967 b</td>
<td>Canadian National 20 Year Bonds</td>
<td>Canadian $50,000,000</td>
<td>$50,000,000</td>
<td>$0</td>
<td>$50,000,000</td>
</tr>
<tr>
<td>4 1/2</td>
<td>Apr. 1, 1967 g</td>
<td>Canadian National 6 1/2 Year Bonds</td>
<td>Canadian $72,300,000</td>
<td>$72,300,000</td>
<td>$0</td>
<td>$72,300,000</td>
</tr>
<tr>
<td>5</td>
<td>May 15, 1968 g</td>
<td>Canadian National 9 Year Bonds</td>
<td>Canadian $55,800,000</td>
<td>$55,800,000</td>
<td>$0</td>
<td>$55,800,000</td>
</tr>
<tr>
<td>2 1/4</td>
<td>Sept. 15, 1969 c</td>
<td>Canadian National 20 Year Bonds</td>
<td>Canadian $70,000,000</td>
<td>$70,000,000</td>
<td>$0</td>
<td>$70,000,000</td>
</tr>
<tr>
<td>2 1/2</td>
<td>Jan. 16, 1971 d</td>
<td>Canadian National 21 Year Bonds</td>
<td>Canadian $40,000,000</td>
<td>$40,000,000</td>
<td>$200,000</td>
<td>$40,000,000</td>
</tr>
<tr>
<td>5 1/4</td>
<td>Dec. 15, 1971 g, h</td>
<td>Canadian National 12 Year Bonds</td>
<td>Canadian $289,000</td>
<td>$289,000</td>
<td>$289,000</td>
<td>$289,000</td>
</tr>
<tr>
<td>3 1/4</td>
<td>Feb. 1, 1974 e</td>
<td>Canadian National 20 Year Bonds</td>
<td>Canadian $200,000,000</td>
<td>$200,000,000</td>
<td>$0</td>
<td>$200,000,000</td>
</tr>
<tr>
<td>2 1/2</td>
<td>June 15, 1975 f</td>
<td>Canadian National 25 Year Bonds</td>
<td>Canadian $6,000,000</td>
<td>$6,000,000</td>
<td>$0</td>
<td>$6,000,000</td>
</tr>
<tr>
<td>5</td>
<td>May 15, 1977 g</td>
<td>Canadian National 18 Year Bonds</td>
<td>Canadian $84,600,000</td>
<td>$84,600,000</td>
<td>$0</td>
<td>$84,600,000</td>
</tr>
<tr>
<td>4</td>
<td>Feb. 1, 1981</td>
<td>Canadian National 23 Year Bonds</td>
<td>Canadian $300,000,000</td>
<td>$300,000,000</td>
<td>$0</td>
<td>$300,000,000</td>
</tr>
<tr>
<td>5 1/4</td>
<td>Jan. 1, 1985 g</td>
<td>Canadian National 25 Year Bonds</td>
<td>Canadian $93,500,000</td>
<td>$93,500,000</td>
<td>$0</td>
<td>$93,500,000</td>
</tr>
<tr>
<td>5</td>
<td>Oct. 1, 1987 g</td>
<td>Canadian National 27 Year Bonds</td>
<td>Canadian $168,675,000</td>
<td>$168,675,000</td>
<td>$155,000</td>
<td>$168,825,000</td>
</tr>
<tr>
<td>4 1/2</td>
<td>Sept. 15, 1979 g</td>
<td>Grand Trunk Western Note</td>
<td>Canadian $400,000</td>
<td>$400,000</td>
<td>$99,500</td>
<td>$499,500</td>
</tr>
<tr>
<td>5 1/4</td>
<td>Perpetual</td>
<td>Buffalo and Lake Huron 1st Mortgage Bonds</td>
<td>Sterling $795,366</td>
<td>$795,366</td>
<td>$289,000</td>
<td>$1,084,400</td>
</tr>
<tr>
<td>5 1/4</td>
<td>Perpetual</td>
<td>Buffalo and Lake Huron 2nd Mortgage Bonds</td>
<td>Sterling $1,228,398</td>
<td>$1,228,398</td>
<td>$200,000</td>
<td>$1,428,398</td>
</tr>
<tr>
<td>5</td>
<td>Perpetual</td>
<td>Debenture Stock</td>
<td>Sterling $20,309</td>
<td>$20,309</td>
<td>$0</td>
<td>$20,309</td>
</tr>
</tbody>
</table>

**Total Bonds:** $1,633,319,073

**Government of Canada Loans and Debentures:**

<table>
<thead>
<tr>
<th>Capital Revision Act: Jan. 1, 1972 Debenture</th>
<th>Canadian $100,000,000</th>
<th>$100,000,000</th>
<th>$0</th>
<th>$100,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Government Railways: Advances for Working Capital</td>
<td>Canadian $16,583,762</td>
<td>$16,583,762</td>
<td>$0</td>
<td>$16,583,762</td>
</tr>
<tr>
<td>Financing and Guarantee Acts: Loans</td>
<td>Canadian $50,265,244</td>
<td>$50,265,244</td>
<td>$2,835,244</td>
<td>$53,100,488</td>
</tr>
<tr>
<td>Refunding Act, 1955: Loans for Debt Redemption</td>
<td>Canadian $30,856,767</td>
<td>$30,856,767</td>
<td>$204,163,213</td>
<td>$235,020,980</td>
</tr>
</tbody>
</table>

**Total Government of Canada Loans and Debentures:** $209,026,783

**Total Long Term Debt:** $1,842,346,866

**Note:**

- a Exchangeable on or before June 15, 1964 for 5 1/4% bonds due Dec. 15, 1971
- b Callable at par
- c Callable at par on or after Sept. 15, 1964
- d Callable at par on or after Jan. 16, 1966
- e Callable at par on or after Feb. 1, 1972
- f Callable June 14, 1962 to June 14, 1966 at 101 1/4%; thereafter to June 14, 1970 at 100 1/2%; thereafter at par.
- g Amounts of 1% or 1 1/2% of the original issues may be purchased quarterly through Purchase Funds operated under the conditions of each issue.
- h Issued in exchange for 5 1/4% bonds due December 15, 1964.

## Shareholders' Equity

<table>
<thead>
<tr>
<th>Government of Canada</th>
<th>No par value capital stock of Canadian National Railway Company</th>
<th>$359,963,017</th>
<th>$359,963,017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 1/4% Preferred stock of Canadian National Railway Company</td>
<td>$968,746,872</td>
<td>$91,504,556</td>
</tr>
<tr>
<td></td>
<td>Capital investment in Canadian Government Railways</td>
<td>$438,267,036</td>
<td>$1,645,579</td>
</tr>
</tbody>
</table>

**Total Government of Canada:** $1,767,976,925

**Capital Stock of Subsidiary Companies Owned by Public:**

| 4,499,261 | 13,476 | 4,485,785 |

**Total Shareholders' Equity:** $1,772,476,186

$24,389,787 $1,796,955,973
Investments in Jointly Operated Rail and Terminal Facilities

<table>
<thead>
<tr>
<th>Transactions Year 1963</th>
<th>Percentage Held</th>
<th>Investment at Dec. 31, 1962</th>
<th>Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Belt Railway Company of Chicago</td>
<td>Capital Stock</td>
<td>$240,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advances</td>
<td>8.33</td>
<td>$46,731</td>
</tr>
<tr>
<td>Chicago &amp; Western Indiana Railroad Company</td>
<td>Capital Stock</td>
<td>20</td>
<td>$1,000,000</td>
</tr>
<tr>
<td></td>
<td>Advances</td>
<td>7,113,869</td>
<td>27,132</td>
</tr>
<tr>
<td>The Detroit &amp; Toledo Shore Line Railroad Company</td>
<td>Capital Stock</td>
<td>50</td>
<td>$1,500,000</td>
</tr>
<tr>
<td>Detroit Terminal Railroad Company</td>
<td>Capital Stock</td>
<td>50</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Northern Alberta Railways Company</td>
<td>Capital Stock</td>
<td>50</td>
<td>$8,540,000</td>
</tr>
<tr>
<td></td>
<td>Bonds</td>
<td>16,902,500</td>
<td>16,902,500</td>
</tr>
<tr>
<td>The Public Markets, Limited Railway Express Agency, Inc.</td>
<td>Capital Stock</td>
<td>50</td>
<td>$575,000</td>
</tr>
<tr>
<td></td>
<td>Capital Stock</td>
<td>0.6</td>
<td>$600</td>
</tr>
<tr>
<td></td>
<td>Advances</td>
<td>173,493</td>
<td>173,493</td>
</tr>
<tr>
<td>The Shawinigan Falls Terminal Railway Company</td>
<td>Capital Stock</td>
<td>50</td>
<td>$62,500</td>
</tr>
<tr>
<td>The Toronto Terminals Railway Company</td>
<td>Capital Stock</td>
<td>50</td>
<td>$250,000</td>
</tr>
<tr>
<td></td>
<td>Bonds</td>
<td>12,102,200</td>
<td>12,102,200</td>
</tr>
<tr>
<td></td>
<td>Advances</td>
<td>200,000</td>
<td>200,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$48,616,893</td>
<td>$77,190</td>
</tr>
</tbody>
</table>

Source and Application of Funds for the Year 1963

| Working Capital January 1, 1963 | $129,532,936 |

<table>
<thead>
<tr>
<th>Source of Funds</th>
<th>Application of Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision for Depreciation</td>
<td>$99,049,021</td>
</tr>
<tr>
<td>Issue of 4% Preferred Stock</td>
<td>27,757,684</td>
</tr>
<tr>
<td>Government of Canada in respect of deficit for the year</td>
<td>43,013,517</td>
</tr>
<tr>
<td>Retained proceeds from Properties Retired</td>
<td>18,761,761</td>
</tr>
<tr>
<td>Victoria Bridge Track Diversion</td>
<td>13,569,627</td>
</tr>
<tr>
<td>Other (net)</td>
<td>173,493</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$213,277,209</strong></td>
</tr>
<tr>
<td>Additions to Property Investment</td>
<td>$127,050,182</td>
</tr>
<tr>
<td>Deficit for the Year</td>
<td>43,013,517</td>
</tr>
<tr>
<td>Decrease in Long Term Debt</td>
<td>51,092,340</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$221,156,039</strong></td>
</tr>
</tbody>
</table>

Net Decrease in Working Capital | 8,358,830 |
| Working Capital December 31, 1963 | $120,174,106 |
# Inventory of Railway Equipment

**On Hand Dec. 31, 1963**

<table>
<thead>
<tr>
<th>Motive Power Equipment</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel Electric Units</td>
<td>2,114</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Locomotives</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam Generator Units</td>
<td>108</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,249</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Freight Equipment</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box, Flat and Stock Cars</td>
<td>73,316</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerator Cars</td>
<td>4,919</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gondola and Hopper Cars</td>
<td>23,403</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caboose and Other Cars</td>
<td>2,043</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>103,881</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Passenger Equipment</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coach Cars</td>
<td>677</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeping, Dining, Parlour and Tourist</td>
<td>550</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baggage, Mail and Express</td>
<td>1,274</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Cars in Passenger Service</td>
<td>229</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,730</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Equipment</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units in work service</td>
<td>9,145</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Floating Equipment</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Ferries</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steamers</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barges, Tugs and Work</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

# Operated Mileage at December 31, 1963

<table>
<thead>
<tr>
<th>Operated Road Mileage — first main track</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic Region</td>
<td>3,859</td>
<td>1</td>
<td>83</td>
<td>3,943</td>
</tr>
<tr>
<td>St. Lawrence Region (including New England Lines)</td>
<td>3,903</td>
<td>7</td>
<td>16</td>
<td>3,926</td>
</tr>
<tr>
<td>Great Lakes Region</td>
<td>3,303</td>
<td>16</td>
<td></td>
<td>3,319</td>
</tr>
<tr>
<td>Prairie Region (including Duluth, Winnipeg and Pacific)</td>
<td>8,104</td>
<td>5</td>
<td></td>
<td>8,109</td>
</tr>
<tr>
<td>Mountain Region</td>
<td>4,066</td>
<td>35</td>
<td>85</td>
<td>4,186</td>
</tr>
<tr>
<td>Grand Trunk Western Lines</td>
<td>879</td>
<td>10</td>
<td>58</td>
<td>947</td>
</tr>
<tr>
<td>Central Vermont Lines</td>
<td>308</td>
<td>59</td>
<td></td>
<td>367</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24,422</td>
<td></td>
<td>322</td>
<td>24,747</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lines in Canada</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lines in United States</td>
<td>22,829</td>
<td></td>
<td>202</td>
<td>23,067</td>
</tr>
<tr>
<td></td>
<td>1,593</td>
<td>17</td>
<td>120</td>
<td>1,730</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operated Mileage — all tracks</th>
<th>Owned</th>
<th>Leased</th>
<th>Trackage Rights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>First main track</td>
<td>24,422</td>
<td></td>
<td>322</td>
<td>24,797</td>
</tr>
<tr>
<td>All other main lines</td>
<td>1,133</td>
<td>82</td>
<td></td>
<td>1,215</td>
</tr>
<tr>
<td>Spurs, sidings and yard tracks</td>
<td>7,073</td>
<td>16</td>
<td>1,552</td>
<td>8,741</td>
</tr>
<tr>
<td><strong>Total all tracks</strong></td>
<td>32,628</td>
<td>99</td>
<td>2,056</td>
<td>34,753</td>
</tr>
</tbody>
</table>
Pension Trust Funds Balance Sheet at December 31, 1963

### Assets

| Current Assets | Cash: in Banks — Current Accounts | $285,069 |
|               | — Time Deposits                   | 900,000  |
|               | Deposits with Trust Companies    | 1,787,392|
|               | Accrued interest on investments  | 2,972,461|
|               | Accounts receivable:             | 4,167,488|
|               | Canadian National Railways — current account | 1,659,936|
|               | Banks, Insurance and Trust Companies re Mortgages | 394,746|
|               | Other                            | 26,481   |
| Investments   | Stocks — at cost                 | (Market value $62,333,607) |
|               | Bonds — at amortized value       | (Market value $261,804,866) |
|               | Mortgages — at amortized value   | $143,065,760 |
|               | less holdbacks                   | 77,081   |
|               | Canadian National Railways       | $142,988,679 |
|               | Acknowledged liability in respect of past service of employees | 395,000,000 |

$885,600,914

### Liabilities

| Current Liabilities | Accounts Payable | $113,977 |
| Reserve for Pensions | In respect of pensions in force and pensions accruing to active employees under the 1935 and 1959 Pension Plans | 885,486,937 |

$885,600,914

**Note:** The Reserve for Pensions includes the accumulated contributions of certain employees in service, with interest thereon, which are held in trust under the rules of the 1935 Pension Plan as follows:

- Annuity Trust Fund: $12,945,901
- Supplemental Annuity Trust Fund: 2,419,642

$15,365,543

L. J. Mills, Comptroller
Pension Trust Funds Statement of Reserve at December 31, 1963

Reserve at December 31, 1962  $445,938,085

Addition to Reserve during the year:
Contributions from employees on account of:
  Current service  $18,408,485
  Prior years' deficiencies  4,642,264
Less refunds on termination of service, etc.  3,368,030  $19,682,719
Contributions by the Company  28,146,069
Net earnings on contributions made by the Company and employees  21,535,338  68,364,126

Deductions from Reserve during year:
Pensions paid  29,476,274

Reserve at December 31, 1963  $885,486,937

Auditors' Report

To the Trustee,
Canadian National Railways Pension Funds.

We have examined the balance sheet of the Pension Trust Funds of the 1935 and 1959 Pension Plans of Canadian National Railways at December 31, 1963 and the statement of reserve for pensions for the year ended on that date. Our examination included a general review of the accounting procedures and such tests of the accounting records and other supporting evidence as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet and related statement of reserve for pensions are properly drawn up so as to give a true and fair view of the state of the affairs of the Funds at December 31, 1963 and of the results of their operations for the year ended on that date according to the best of our information and the explanations given to us and as shown by the books of the Funds, and in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

We further report that, in our opinion, proper books of account have been kept by the Trustee and that the transactions that have come under our notice have been within the powers of the Trustee.

McDonald, Currie & Co.,
Chartered Accountants
February 25, 1964

Actuarial Certificate

This is to certify that the Reserve for Pensions shown in the Balance Sheet of the Pension Trust Funds of Canadian National Railways, amounting to $885,486,937 as at December 31, 1963, in my opinion, represented adequate provision for the accumulated liabilities of pensions then approved and in force, pensions awaiting approval and pensions accrued to the above date in respect of employees then in service under the 1935 and 1959 Plans, excluding pensions granted under prior Plans.

Denis R. J. George,
Fellow of the Institute of Actuaries.

February 21, 1964
# Statistics of Rail-Line Operations

<table>
<thead>
<tr>
<th></th>
<th>1963</th>
<th>1962</th>
<th>% Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Train Miles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight service</td>
<td>35,796,950</td>
<td>34,283,043</td>
<td>4.4</td>
</tr>
<tr>
<td>Passenger service</td>
<td>17,079,631</td>
<td>18,096,980</td>
<td>5.6</td>
</tr>
<tr>
<td>Work service</td>
<td>1,802,001</td>
<td>1,634,258</td>
<td>10.3</td>
</tr>
<tr>
<td><strong>Total train miles</strong></td>
<td>54,679,182</td>
<td>54,014,281</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Locomotive Miles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight service</td>
<td>36,116,058</td>
<td>34,545,768</td>
<td>4.5</td>
</tr>
<tr>
<td>Passenger service</td>
<td>15,131,531</td>
<td>16,072,350</td>
<td>5.9</td>
</tr>
<tr>
<td>Switching service</td>
<td>17,968,774</td>
<td>17,947,807</td>
<td>0.4</td>
</tr>
<tr>
<td>Work service</td>
<td>1,845,157</td>
<td>1,657,702</td>
<td>11.3</td>
</tr>
<tr>
<td><strong>Total locomotive miles</strong></td>
<td>70,961,520</td>
<td>70,223,624</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Car Miles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight Service:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loaded</td>
<td>1,180,853,158</td>
<td>1,110,109,898</td>
<td>6.4</td>
</tr>
<tr>
<td>Empty</td>
<td>746,696,479</td>
<td>680,423,883</td>
<td>9.7</td>
</tr>
<tr>
<td>Other</td>
<td>12,753,719</td>
<td>14,257,575</td>
<td>10.5</td>
</tr>
<tr>
<td>Caboose</td>
<td>36,667,660</td>
<td>35,075,508</td>
<td>4.5</td>
</tr>
<tr>
<td>Passenger - Coach and Combination</td>
<td>2,710,376</td>
<td>3,231,400</td>
<td>16.1</td>
</tr>
<tr>
<td><strong>1,976,681,392</strong></td>
<td><strong>1,843,098,264</strong></td>
<td><strong>10.3</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Passenger Service:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coach and Combination</td>
<td>38,557,750</td>
<td>32,788,731</td>
<td>1.8</td>
</tr>
<tr>
<td>Sleeping, Parlour and Observation</td>
<td>39,811,267</td>
<td>40,601,819</td>
<td>1.9</td>
</tr>
<tr>
<td>Dining</td>
<td>9,005,292</td>
<td>7,948,251</td>
<td>13.3</td>
</tr>
<tr>
<td>Motor Unit</td>
<td>3,876,828</td>
<td>3,805,194</td>
<td>1.9</td>
</tr>
<tr>
<td>Other (baggage and express, etc.)</td>
<td>70,663,805</td>
<td>79,132,838</td>
<td>10.7</td>
</tr>
<tr>
<td>Freight - loaded</td>
<td>1,100,731</td>
<td>1,423,952</td>
<td>22.7</td>
</tr>
<tr>
<td>Freight - empty</td>
<td>157,786</td>
<td>372,441</td>
<td>57.6</td>
</tr>
<tr>
<td><strong>185,173,499</strong></td>
<td><strong>172,564,216</strong></td>
<td><strong>7.4</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Work Service</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2,869,321</strong></td>
<td><strong>2,804,515</strong></td>
<td><strong>2.3</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total car miles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2,145,724,212</strong></td>
<td><strong>2,018,466,395</strong></td>
<td><strong>6.3</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Gross ton miles — all services</strong> (excluding passenger cars on passenger trains)</td>
<td>89,026,289,000</td>
<td>80,715,356,000</td>
<td>10.3</td>
</tr>
<tr>
<td><strong>Net ton miles — all services</strong></td>
<td>40,751,658,000</td>
<td>36,110,915,000</td>
<td>12.0</td>
</tr>
<tr>
<td><strong>Average Miles of Road Operated</strong></td>
<td>24,709.57</td>
<td>24,753.38</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Freight Traffic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tons carried — Revenue freight</td>
<td>$552,221,071</td>
<td>$529,307,712</td>
<td>4.3</td>
</tr>
<tr>
<td>Ton miles — Revenue freight</td>
<td>84,078,393</td>
<td>78,384,773</td>
<td>7.3</td>
</tr>
<tr>
<td><strong>40,171,133,489</strong></td>
<td><strong>35,595,425,349</strong></td>
<td><strong>12.9</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Train hours in freight road service</strong></td>
<td>1,573,046</td>
<td>1,548,194</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Averages Per Mile of Road:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight revenue</td>
<td>$22,348</td>
<td>$21,382</td>
<td>4.5</td>
</tr>
<tr>
<td>Train miles</td>
<td>1,449</td>
<td>1,385</td>
<td>4.6</td>
</tr>
<tr>
<td><strong>79,548</strong></td>
<td><strong>73,827</strong></td>
<td><strong>7.8</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total freight train car miles</strong></td>
<td>1,625,733</td>
<td>1,438,903</td>
<td>13.1</td>
</tr>
<tr>
<td><strong>1,649,225</strong></td>
<td><strong>1,458,828</strong></td>
<td><strong>13.1</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Averages Per Loaded Car Mile:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight revenue</td>
<td>$46.7</td>
<td>$47.6</td>
<td>1.9</td>
</tr>
<tr>
<td>Ton miles — All freight</td>
<td>34.5</td>
<td>32.5</td>
<td>6.2</td>
</tr>
</tbody>
</table>
## Statistics of Rail-Line Operations (continued)

### Freight Traffic (Continued)

<table>
<thead>
<tr>
<th>Class</th>
<th>1963</th>
<th>1962</th>
<th>% Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue per ton</td>
<td>$6,568</td>
<td>$6,753</td>
<td>2.7%</td>
</tr>
<tr>
<td>Revenue per ton mile</td>
<td>$1,379</td>
<td>$1,487</td>
<td>7.5%</td>
</tr>
<tr>
<td>Miles hauled per revenue ton</td>
<td>477.8</td>
<td>454.1</td>
<td>5.2%</td>
</tr>
<tr>
<td>Cars per train — loaded</td>
<td>33.0</td>
<td>32.4</td>
<td>1.9%</td>
</tr>
<tr>
<td>Cars per train — empty</td>
<td>20.9</td>
<td>19.8</td>
<td>5.6%</td>
</tr>
<tr>
<td>Gross load — Freight trains (tons)</td>
<td>2,485</td>
<td>2,362</td>
<td>5.7%</td>
</tr>
<tr>
<td>Net load — Freight trains (tons)</td>
<td>1,138</td>
<td>1,063</td>
<td>6.8%</td>
</tr>
<tr>
<td>Gross ton miles per freight train hour</td>
<td>56,561</td>
<td>52,045</td>
<td>8.8%</td>
</tr>
<tr>
<td>Train speed — Miles per hour</td>
<td>22.8</td>
<td>22.1</td>
<td>3.2%</td>
</tr>
<tr>
<td>Diesel unit miles per serviceable day (excluding stored)</td>
<td>234</td>
<td>217</td>
<td>7.8%</td>
</tr>
</tbody>
</table>

### Passenger Traffic

<table>
<thead>
<tr>
<th>Category</th>
<th>1963</th>
<th>1962</th>
<th>% Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue passengers carried</td>
<td>$34,491,894</td>
<td>$34,331,531</td>
<td>0.5%</td>
</tr>
<tr>
<td>Revenue passenger miles*</td>
<td>13,598,961</td>
<td>12,443,945</td>
<td>9.3%</td>
</tr>
<tr>
<td>Averages Per Mile of Road:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger revenue</td>
<td>$1,396</td>
<td>1,387</td>
<td>0.6%</td>
</tr>
<tr>
<td>Train miles</td>
<td>691</td>
<td>731</td>
<td>5.5%</td>
</tr>
<tr>
<td>Total passenger train car miles</td>
<td>7,173</td>
<td>7,503</td>
<td>5.7%</td>
</tr>
<tr>
<td>Revenue passenger miles*</td>
<td>48,121</td>
<td>42,184</td>
<td>14.1%</td>
</tr>
<tr>
<td>Averages Per Car Mile — Passenger:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger revenue</td>
<td>$41.3</td>
<td>40.2</td>
<td>2.7%</td>
</tr>
<tr>
<td>Revenue passenger miles*</td>
<td>12.2</td>
<td>12.2</td>
<td>16.4%</td>
</tr>
<tr>
<td>Revenue per passenger*</td>
<td>2.536</td>
<td>2.759</td>
<td>8.1%</td>
</tr>
<tr>
<td>Revenue per passenger mile*</td>
<td>2.901</td>
<td>3.358</td>
<td>11.8%</td>
</tr>
<tr>
<td>Average passenger journey (miles)*</td>
<td>87.4</td>
<td>83.9</td>
<td>4.2%</td>
</tr>
<tr>
<td>Percent on time arrival — selected principal trains</td>
<td>90.3</td>
<td>78.3</td>
<td>1.9%</td>
</tr>
<tr>
<td>Diesel unit miles per serviceable day (excluding stored)</td>
<td>385</td>
<td>379</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

### Operating Results

<table>
<thead>
<tr>
<th>Category</th>
<th>1963</th>
<th>1962</th>
<th>% Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total operating revenues per mile of road</td>
<td>$30,850</td>
<td>29,892</td>
<td>3.4%</td>
</tr>
<tr>
<td>Total operating expenses per mile of road</td>
<td>30,467</td>
<td>29,850</td>
<td>2.1%</td>
</tr>
<tr>
<td>Net railway operating income loss per mile of road</td>
<td>395</td>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

*Note:* In 1963 an improved method was used in compiling these statistics. For comparability the 1962 figures have been restated.

### Revenue Tonnage Carried (By classes of commodities)

<table>
<thead>
<tr>
<th>Class</th>
<th>1963</th>
<th>1962</th>
<th>% Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Products</td>
<td>15,953,322</td>
<td>13,484,634</td>
<td>18.5%</td>
</tr>
<tr>
<td>Animals and Animal Products</td>
<td>630,869</td>
<td>562,726</td>
<td>12.0%</td>
</tr>
<tr>
<td>Mine Products</td>
<td>28,015,448</td>
<td>27,188,716</td>
<td>3.3%</td>
</tr>
<tr>
<td>Manufactured and Miscellaneous</td>
<td>9,335,912</td>
<td>9,096,858</td>
<td>2.6%</td>
</tr>
<tr>
<td>Total Carload Freight</td>
<td>83,442,520</td>
<td>77,589,370</td>
<td>7.5%</td>
</tr>
<tr>
<td>All less than carload freight</td>
<td>635,873</td>
<td>795,403</td>
<td>20.1%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>84,078,393</td>
<td>78,384,773</td>
<td>7.3%</td>
</tr>
</tbody>
</table>
## A 25-Year Synoptical History of the Canadian National Railways

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross Revenues Millions</th>
<th>Railway Operating Revenues* Thousands</th>
<th>Net Railway Operating Profit or Loss* Thousands</th>
<th>Surplus or Deficit before Interest Charges Thousands</th>
<th>Interest on Debt Millions</th>
<th>Surplus or Deficit Millions</th>
<th>Freight Revenue per Ton Miles</th>
<th>Passenger Revenue per Passenger Mile</th>
<th>Average Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1939</td>
<td>$207.2</td>
<td>$199,517</td>
<td>$187,091</td>
<td>$12,426</td>
<td>$967</td>
<td>$13,393</td>
<td>$53,488</td>
<td>$40,095</td>
<td>17,084</td>
</tr>
<tr>
<td>1940</td>
<td>251.5</td>
<td>243,099</td>
<td>243,766</td>
<td>35,584</td>
<td>356</td>
<td>35,940</td>
<td>33,305</td>
<td>10,965</td>
<td>21,532</td>
</tr>
<tr>
<td>1941</td>
<td>308.8</td>
<td>309,230</td>
<td>39,464</td>
<td>1,714</td>
<td>57,178</td>
<td>53,162</td>
<td>4,016</td>
<td>27,200</td>
<td>1.88</td>
</tr>
<tr>
<td>1942</td>
<td>380.6</td>
<td>363,745</td>
<td>259,246</td>
<td>74,433</td>
<td>2,294</td>
<td>76,233</td>
<td>51,670</td>
<td>25,033</td>
<td>31,729</td>
</tr>
<tr>
<td>1943</td>
<td>446.0</td>
<td>433,527</td>
<td>253,158</td>
<td>80,369</td>
<td>7,460</td>
<td>87,929</td>
<td>52,190</td>
<td>35,639</td>
<td>36,327</td>
</tr>
<tr>
<td>1944</td>
<td>446.8</td>
<td>434,149</td>
<td>366,680</td>
<td>67,469</td>
<td>6,032</td>
<td>73,501</td>
<td>50,474</td>
<td>23,027</td>
<td>36,016</td>
</tr>
<tr>
<td>1945</td>
<td>439.7</td>
<td>426,233</td>
<td>258,972</td>
<td>67,261</td>
<td>6,005</td>
<td>73,766</td>
<td>49,010</td>
<td>24,756</td>
<td>34,600</td>
</tr>
<tr>
<td>1946</td>
<td>407.6</td>
<td>393,246</td>
<td>361,634</td>
<td>31,612</td>
<td>6,111</td>
<td>37,723</td>
<td>46,685</td>
<td>8,962</td>
<td>30,812</td>
</tr>
<tr>
<td>1947</td>
<td>446.4</td>
<td>430,512</td>
<td>406,335</td>
<td>24,177</td>
<td>5,664</td>
<td>30,041</td>
<td>45,926</td>
<td>15,885</td>
<td>32,945</td>
</tr>
<tr>
<td>1948</td>
<td>499.7</td>
<td>483,396</td>
<td>471,569</td>
<td>11,807</td>
<td>1,002</td>
<td>12,809</td>
<td>46,342</td>
<td>35,503</td>
<td>32,943</td>
</tr>
<tr>
<td>1949</td>
<td>509.4</td>
<td>491,478</td>
<td>484,728</td>
<td>6,750</td>
<td>161</td>
<td>6,589</td>
<td>48,632</td>
<td>42,043</td>
<td>30,522</td>
</tr>
<tr>
<td>1950</td>
<td>562.6</td>
<td>543,275</td>
<td>502,252</td>
<td>41,023</td>
<td>3,138</td>
<td>44,101</td>
<td>47,422</td>
<td>3,261</td>
<td>31,988</td>
</tr>
<tr>
<td>1951</td>
<td>634.1</td>
<td>612,902</td>
<td>585,615</td>
<td>27,187</td>
<td>5,958</td>
<td>33,145</td>
<td>48,177</td>
<td>15,032</td>
<td>36,435</td>
</tr>
<tr>
<td>1952</td>
<td>684.5</td>
<td>661,349</td>
<td>640,233</td>
<td>21,116</td>
<td>4,441</td>
<td>25,557</td>
<td>25,415</td>
<td>142</td>
<td>38,430</td>
</tr>
<tr>
<td>1953</td>
<td>707.7</td>
<td>680,669</td>
<td>660,248</td>
<td>20,421</td>
<td>9,199</td>
<td>29,620</td>
<td>29,376</td>
<td>244</td>
<td>36,678</td>
</tr>
<tr>
<td>1955</td>
<td>693.9</td>
<td>664,613</td>
<td>630,140</td>
<td>34,473</td>
<td>9,249</td>
<td>43,722</td>
<td>33,004</td>
<td>10,718</td>
<td>35,677</td>
</tr>
<tr>
<td>1956</td>
<td>785.7</td>
<td>754,931</td>
<td>710,977</td>
<td>43,954</td>
<td>13,006</td>
<td>57,860</td>
<td>31,783</td>
<td>26,077</td>
<td>41,935</td>
</tr>
<tr>
<td>1957</td>
<td>764.4</td>
<td>732,427</td>
<td>735,679</td>
<td>2,252</td>
<td>10,651</td>
<td>7,399</td>
<td>36,972</td>
<td>29,573</td>
<td>36,674</td>
</tr>
<tr>
<td>1958</td>
<td>716.3</td>
<td>680,993</td>
<td>698,327</td>
<td>17,334</td>
<td>12,264</td>
<td>5,070</td>
<td>46,521</td>
<td>51,591</td>
<td>35,077</td>
</tr>
<tr>
<td>1959</td>
<td>751.9</td>
<td>712,975</td>
<td>719,000</td>
<td>6,024</td>
<td>11,234</td>
<td>5,210</td>
<td>48,798</td>
<td>43,588</td>
<td>35,542</td>
</tr>
<tr>
<td>1960</td>
<td>723.4</td>
<td>663,214</td>
<td>681,692</td>
<td>18,478</td>
<td>12,004</td>
<td>6,474</td>
<td>61,023</td>
<td>67,497</td>
<td>34,011</td>
</tr>
<tr>
<td>1961</td>
<td>745.5</td>
<td>677,380</td>
<td>633,605</td>
<td>16,225</td>
<td>11,393</td>
<td>4,832</td>
<td>62,476</td>
<td>67,308</td>
<td>34,723</td>
</tr>
<tr>
<td>1963</td>
<td>800.0</td>
<td>725,181</td>
<td>720,170</td>
<td>5,011</td>
<td>16,179</td>
<td>21,190</td>
<td>64,204</td>
<td>43,014</td>
<td>40,171</td>
</tr>
</tbody>
</table>

* Restated to reflect inclusion of net income from Telecommunications Department in Other Income.
** Based on a new method of counting effective January 1, 1963. On former method of counting, the 1963 average was 95,906.
Your comfort is our concern
There is more to train travel than transportation. Comfort, convenience and economy are essential extras. These are the features you'll find in Canadian National's broad range of accommodations on all main-line trains:

**Coach**
Air-conditioned, roomy, with wide picture windows and deep foam reclining seats... CN coach travel is the answer for those who want good transportation at low cost. Best of all there is room to get up, stretch and take a walk. All the seats in the coach are equally comfortable but if you have a particular fancy, for a window seat perhaps, you may wish to take advantage of the reserved coach plan. On some trains, for a small extra charge, the seat you want will be reserved for you. For weekend and busy season travel, reservations should be made well in advance. There is porter service on reserved seat coaches.

**Parlor car**
If you want a separate chair of your own for a trip during daylight hours, you can reserve a seat on one of CN's parlor cars. Each of these spacious cars has upholstered seats with swivel action and reclining backs.

**Buffet lounge**
Truly a private club on wheels, the buffet lounge car is one of the "extras" offered on many Canadian National trains. You qualify for membership in this club whenever you occupy standard sleeping space whether it's an upper berth or a drawing room.

On many trains there are available lounge and/or beverage facilities for coach and tourist travellers.

**Dining car**
These cars reflect the high standards of comfort and style of Canadian National's dining car service, already famous for its fine food and gracious hospitality.

Every car is a luxurious restaurant on wheels, offering the cuisine and the elegance of a hotel dining room, plus a picture-window view of the ever-changing panorama passing your table.

**Dinette**
Designed for economy-minded travellers, the dinette car offers a wide range of good appetizing food at popular prices. The menu
runs from light snacks to full-course meals carefully prepared by expert chefs. An appetizing main course starts as low as $1.25.

Also widely used are the Coffee Shop and Cafeteria cars. Both types follow the same policy of first quality food at moderate prices.

section

Our section accommodation is inexpensive and flexible. You can obtain an upper berth or a lower, or have the whole section to yourself. In daytime, these quarters offer soft, deep-sprunged seats and wide scenic windows; at night, big comfortable beds with foam mattresses. There are mirrors, individual lights and ventilation, clothes hangers and luggage space. Extra pillows, blankets, hat bag, or card table may be obtained by ringing the porter.

Washrooms and dressing rooms are located at the end of each car.
The duplex roomette offers enclosed space for single occupancy, with every modern convenience at your fingertips.
You have your own toilet and wash basin, large lighted mirror with outlet for an electric shaver, individually controlled heat and air-conditioning, mechanically cooled drinking water, ample luggage space, picture window and a foam sofa seat—all arranged in a compact and attractive layout. At night, when you are ready to retire, you simply draw your bed out of the wall, or ring for the porter who will do it for you.
Canadian National's roomette offers all the advantages of the duplex roomette plus extra spaciousness.
There's plenty of living room, with ample luggage space. You can relax in deep-cushioned comfort in the daytime and enjoy a good night's sleep in a bed with a foam mattress that stretches a full six feet two inches in length. A new type of counterbalance permits the bed to be folded in and out of the wall effortlessly.
CN's attractive bedrooms have an upper and a lower bed, a wash basin that converts to a stylish dressing table and a private toilet enclosed in an annex. Both beds disappear from sight by day and two large, folding armchairs take their place.

Bedrooms are arranged in pairs, divided by a sliding panel which may be folded back if desired to permit the use of the two rooms as a single spacious suite, or as luxurious conference room. Each room has a wardrobe, mechanically cooled drinking water, foam mattresses, liberal luggage space and personal control of heat, light and air-conditioning.
Our compartments are skilfully designed to give you generous living space. There's a full-length sofa on which to lounge (or have a daytime nap) and a large armchair which folds up and tucks away when it's not needed. The sofa and chair provide ample room to seat four by day. When it's time to retire, the sofa becomes a bed and an upper berth swings out of its wall recess above. Both have deep foam mattresses. Private toilet facilities are included.
A Canadian National drawing room is rail travel at its luxurious best. There's sleeping space for a small family in two lower beds and one upper, all of which disappear from sight in the daytime. Toilet and washing facilities are completely enclosed in a separate room. There is ample dressing space, and clothes can be hung full-length in the large wardrobe locker. Each room has individual control of heat, light and air-conditioning. Side-panel heating provides an even flow of warm air and keeps windows frost-free.
Olivetti

a contemporary image of style and industry
The terms "corporate image" and "brand image" have come into use as attempts to define the characteristic picture of itself that a large firm projects on the contemporary scene. Today the industrial concern exerts an influence far beyond the sphere of economics: it transforms social modus vivendi, continually creates and satisfies new needs and tastes, and radically affects demographic distribution by creating new labour resources and new settlements. Its influence goes even further. It makes its mark on the psyche and mentality not only of those working in the factory, that is within the framework of a social body organized for specific purposes; but also on the outside world, which is made up of an ever-increasing mass of consumers who are confronted daily with tangible evidence of the firm's activity: its products, its advertising and its plants and showrooms.

For these reasons, the companies that are most aware of their own responsibilities and aims tend to direct their efforts, through a multiplicity of means, toward an ever clearer presentation of their own corporate images. Too frequently, however, these efforts are limited to standardized externals, eye-catching forms and expressions aimed at quick, easy and superficial appeal to mass psychology.

On the contrary, the corporate image is not made up merely of the form of the product, advertising, industrial architecture and of what is abstractly called "public relations". It should not be a distorting mirror or a come-on symbol, but the total expression of a complex reality. It should not be turned outward in one direction only, but should be perfectly clear, coherent and understandable not only to the eyes of a distracted and distant public but also in the minds of those whose life and work are bound up with the company. In short, the image we believe in is not merely visual and esthetic, but primarily social and ethical. In the light of these considerations, the conventional distinction between "public relations" and "internal relations" no longer holds. The distinction is tenable only if one accepts the hypothesis that it is legitimate to apply one set of standards where the "outside" public is concerned, and another "inside" the firm. Such a distinction implies that it makes sense to train part of the personnel specially for the unique purpose of putting across the firm to outsiders, which in effect implicitly authorizes the rest of the personnel to function as though there were no world existing beyond the walls of the factory.

As a fundamental concept and article of faith, we hold that there must be a unity of principle and behavior which co-ordinates in time and space and at every level of company responsibility all the activities initiated and developed by a firm.
The present booklet, which enlarges on this concept, has grown out of an invitation to our company from the Zurich Kunstgewerbemuseum (and later from museums in Germany and other countries in Europe) to put on an exhibition illustrating our own corporate image. The exhibition was entitled "Olivetti Style" and it aimed to give a rounded and organic picture of the company, from the perspective of its history and its present activities.

The kind of presentation permitted by an exhibition involved the risk of over-accentuating the strictly visual aspects of design, to the detriment of other factors and values which are obviously difficult to illustrate by means of the materials normally used in a traveling show, namely panels, photographs and models. The catalogue, here reprinted with a few modifications as a booklet, was therefore intended to complete whatever was lacking conceptually in our first attempt at an organic presentation of Olivetti's corporate image.

The booklet gives a summary of the firm's history and a brief review of the forms that express its personality and characterize its activity. In line with our interpretation of the meaning of corporate image, we have included not only industrial design, architecture and advertising but also the techniques of production and sales organization and social services. We have, in addition, attempted a very summary portrait of "People and Olivetti", but it is perhaps more a sketch than a portrait. More than fifty thousand people, all over the world, today work in the Olivetti organization. They represent many nationalities as well as all the varieties of specialization typical of modern industry, and naturally have widely differing duties and responsibilities toward the firm. But the "philosophy" that has shaped the corporate image well known to the public in the one hundred and thirty countries where Olivetti operates, is concerned first and foremost with these fifty thousand men and women. It is based on the principles outlined in the following pages and equally on the community of ideas established among the men and women who make up the firm today. Along with hard daily work, each one of these people has contributed his own experience and view of the world to create a constructive identity of aims.

Two fundamental ideas inspired the thought and action of Adriano Olivetti, political thinker, sociologist and industrialist. First, the conviction that industry, in view of its great influence in the contemporary world, ought to have a code of ethics and a system of objectives going beyond the purely economic sphere which, in any case, it has long overlapped. Second, the conviction that present-day mass civilization,
more dynamic and richer in technical and scientific resources than any period in the
past, should make every effort to achieve the "Kingdom of Vocations", a human
society organized so that every man may give the best in him by expressing himself
most fully and constructively.
The great ideas find concrete expression in commitments to daily work and the
solutions of an infinity of new problems. From the philosophy is derived the policy,
which serves as an instrument of action on a broad and unpredictable front. The
new tasks which come up every day call forth new forms of labor and new
applications of intelligence.
It is this convergence, which follows a dynamic rhythm of expansion, that determines
the day to day reality of the business concern and of the corporate image which is its
expression. To the heritage of ideas and achievements are added new, varied ex­
periences. With the acceleration of technical and economic development, distances
are reduced, cross-fertilization of ideas and methods is intensified and the world of
labor, which knows no frontiers, reinforces its unity through the participation of the
young builders of the future.
This publication does not aim to give a complete account of the Olivetti company's
history and experience over more than half a century of operation. It would be
impossible in a few pages to describe completely a reality in continuous movement
or to discuss thoroughly the technical aspects of three generations of work in the
most varied sectors of commercial, industrial and scientific activity. Swifter than
Chronos, the modern firm does not leave time for the contemplation of its offspring:
what is reported and published in any single field is apt to be out of date before
it is made known. However, we can refer those who might be interested in specific
problems to other sources of information. This booklet gathers together some
essential information — brought up to date as far as spring, 1962 — and
presents certain fundamental ideas. We hope it may arouse some interest among
the friends of Olivetti throughout the world and among the young people — in this
great world which has become so small — who are thinking of joining us in our work.

Riccardo Musatti, Director
Advertising and Press Department
Ing. C. Olivetti & C., S.p.A.
We have listed here a few of the most important articles which have appeared in recent years in the International Press concerning Olivetti and its activities. The choice has been limited only to writings of a complex and critical nature: we have therefore excluded news articles which have appeared in hundreds in the daily Press and in news weeklies, as well as articles serving as publicity. The list does not go beyond the writings dedicated to the person and works of Adriano Olivetti, considered from the political and ideological aspect. A collection of testimonies about the character of Adriano Olivetti — dictated by famous cultural and political personalities on the occasion of his death — is published in the book: "Ricordo di Adriano Olivetti" (Edizioni di Comunità, Milan, 1960).

There are two fundamental books, one is the biography of Camillo and Adriano Olivetti (Bruno Caizzi, Gli Olivetti, Torino 1962), the other is the story of technological development of the firm (Luciano Gallino, Progresso tecnologico ed evoluzione organizzativa negli stabilimenti Olivetti, Milano 1960).


Graphik, Stuttgart, No. 11, Januar 1952: "Die Olivetti Werbung".

Architectural Forum, No. 5, November 1952, pp. 116–122: "Olivetti — The name of this manufacturer in Italy spells 'modern design' to an ever-increasing audience".


Time, No. 6, 8 February 1954, p. 43: "Business abroad — Thinker from Ivrea".


L'Architecture d'Aujourd'hui, No. 82, Novembre 1955, pp. 88–91: "Usine Olivetti à Pozzuoli, près de Naples, Italie".

BAUEN UND WOHNEN, No. 3, August 1956, pp. 252-288: Full issue dedicated to Olivetti.


HOMMES ET TECHNIQUES, No. 159-161, Mars-Mai 1958, pp. 1-17: "Une politique italienne de relations publiques: l'expérience Olivetti", par A. Spreafico.


TECHNIQUES GRAPHIQUES, No. 25, Mai-Juin 1959, pp. 1-12: "Olivetti ou les vertus du graphisme".

FINISHING FACTS, No. 11, July 1959, pp. 2-4: "... both sober and elegant".

DESIGN, No. 131, November 1959, pp. 54-59: "European trade - office machinery" by Misha Black.


FORTUNE, January 1960, pp. 102-107: "Art in business years".


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The Olivetti typewriter factory, later incorporated as Ing. C. Olivetti & C., S.p.A., began operations in 1908 at Ivrea, a pleasant little town in Piedmont, at the foot of the Alps. The social climate in which the firm was born had scarcely felt the impact of the Industrial Revolution, but the idea of Progress and a general belief that hard work and practical enterprise would produce a radiant Future were in the air. In Italy, professional technicians were growing in number, and in public esteem were beginning to rank with philosophers, scientists and artists. Prominent among them were the new captains of industry. In this group, the name of Olivetti has a particular resonance, for Camillo Olivetti, the founder of the company, stood out among other industrial pioneers in background, original character and in the conscious ideals that gave his enterprise a special significance.

Camillo Olivetti did not exactly fit the old romantic stereotype of the self-made man who works his way up from the bottom. He came from a moderately prosperous small-town family. His father farmed and dealt in real estate in the Canavese district of northern Piedmont, which lies between the Valle d’Aosta and the Po river. Camillo took his degree in electrical engineering under the celebrated scientist, Galileo Ferraris, at the Turin Polytechnic, and then spent two years in California as assistant to Ferraris when he held the chair of electrical engineering at Stanford University. Subsequently Camillo established the first plant in Italy for electrical measurement instruments, the C.G.S. factory. When he was almost forty, he decided to leave C.G.S., which had been set up in Milan, to return to his native region.

By history and geography, the Canavese district has a distinct regional character. In 1907 its center, Ivrea, was like an overgrown village, living mainly by handicrafts and trade with the farmers of the fertile surrounding countryside. The sleepy small town, agreeably situated between the river Dora and the foothills, was dominated by its ancient past and its great four-towered medieval castle. Certainly it did not seem to be the most suitable setting for the revolutionary ventures of an engineer who had been living in the great world of the United States and Milan, and who now intended to start making a machine for which nobody appeared to feel the need.

While in other countries typewriters were already coming into general use, in Italy they were still regarded with distrust. Little had changed in the half century since
the Novara lawyer, Giuseppe Ravizza, invented the "clerk's clavichord". The first practical example of a device for mechanical writing, the invention met with a general indifference that embittered Ravizza's life. But Camillo Olivetti set about carrying out his own project in a spirit very different from that of Ravizza's visionary and essentially dilettante approach. His experience in the United States had shown him that it was inevitable for mass production to replace artisan ingenuity in the field he was entering.

In Turin, the nearest big city, the largest Italian automobile plant—Fiat—had been operating for ten years and employed fifty workers. Camillo Olivetti started industrial production of typewriters with some twenty men, headed by Domenico Burzio, a former blacksmith who had worked with him for many years. The factory was a plain red-brick building covering about 500 square yards. It still stands in Ivrea, dwarfed by the huge Olivetti plants that have since grown up beside it.

The modest factory, which housed the firm's first Browne and Sharpe automatic lathes and its first milling machines, also served as a school for the largely untrained staff. Two years went into training and experiment before the first typewriter, the model M1, could be put into production, and it was only in 1911 after being shown to the public at the Turin Exhibition, that the M1 started on its way to success. In the same year it received official sanction, winning the Ministry of the Navy's competition for an order of one hundred machines, and a little more than a year later another official order was received from the government postal system. "From that moment", Camillo Olivetti later wrote, "began the truly marvelous progress of our industry".

Between that moment and today, more than half a century after Olivetti started as an unlikely challenge to the giants of the industry established in America and abroad, the company has earned an international position of the first rank. Ivrea is still the headquarters and home of the company, but it would now be hard to find much trace of the old home's original handicraft atmosphere. The antiquated Piedmontese town has become part of the history of modern industry, and the Ivrea of today has grown along with the company, whose presence has influenced the environment materially and morally.

Camillo Olivetti's democratic ideals were dramatically put to the test right after the first World War when throughout Italy the relations between labor and capital were violently strained. To back up their demands the workers occupied the factories, and it was then that the unusual relations between management and labor that had
been established with the founding of the company proved to be based on farsighted moral views and not on mere paternalistic makeshifts. Camillo's evident good faith convinced the union leaders that the workers' interests would be met, without the need for agitation, by a man whose expressed ideal in operating the plant was "a state of things in which the greater share of the fruits of labor go to those who have labored usefully".

Camillo Olivetti owed his forcefulness as an industrialist to moral attitudes of this sort, which had a particular allure at a time when such views were considered highly unconventional. As an ethical capitalist, he felt it his duty to criticize the inadequacies that weakened the system. He never had any doubts about the worker's right to share in the profits, and it was on this basis that he understood cooperation between the classes, a conciliation whose ethical premise he found in religious inspiration. He wrote: "'Forgive us our debts as we forgive our debtors', goes an ancient prayer to which all believers can subscribe. We do not ask for total forgiveness, for this would require that all men have the Christian spirit one hundred percent — and this is too much to ask. But if men had fifty percent of this spirit, it might then be possible to insist that the interest rate on capital be low enough so that even the working man could develop his capacities. As is often the case, following moral law in this instance would also have an immediate practical value."

New Approaches to Techniques and Organization

For the Ivrea factory the period between the two World Wars marked the end of the handwork and pioneering phase. To survive in a market dominated by experienced foreign competitors, Olivetti had to face problems which more firmly established concerns in other fields had already solved. A new typewriter, the M20, was brought out in Italy in 1920 and immediately afterward was shown at the Brussels International Fair. In 1922 a new corporation, the Olivetti Foundry, was established; in 1924, the O.M.O. (Officina Meccanica Olivetti) machine-tools plant. In that year the company employed 400 workers and typewriter production reached the rate of 4000 a year. By 1926 the number of workers had risen to 500 and production to 8000. The rhythm of expansion, reflecting the inner dynamics of the firm, was intense and continuous. The growing number of employees made the old, almost patriarchal,
type of management obsolete. The first industrial revolution of the pioneers like Camillo Olivetti was about to be superseded by the second, that of the managers. In 1925 and 1926 Adriano Olivetti, at the request of his father Camillo, traveled in the United States to study American production methods. On his return to Ivrea he applied the ideas acquired on his visits to American factories to the reorganization of the Olivetti plants and the creation of new cadres of trained young personnel. Thanks to these systematic innovations, by 1929 production soared to 13,000 annually, without any increase in the labor force. The company was accordingly in a good position to face the great Depression of 1930 and 1931. The lowered costs of production made it possible to initiate a bold expansion campaign by building up the Italian sales organization, opening new branches in the main cities and staffing them with additional sales personnel. The first associated company abroad, the S.A. Hispano Olivetti was established at Barcelona in 1929, and the next year Olivetti Belge, the Belgian associate, was founded. A new product, the M40 typewriter, was brought out and subsequently held the market successfully for many years. Other products were planned, such as the Olivetti portable and the Synthesis horizontal card files. Along with production and sales, human relations within the company were transformed. Social insurance and assistance provisions were broadened; new work-time study methods were adopted; and new psychological and esthetic criteria were applied in advertising. Adriano's innovations added impetus to the heritage of Camillo's experience and moral force, and he was gradually given full responsibility for running the firm. By 1933, the year in which Adriano Olivetti became director general of the company, the battle to survive the world depression had been won. A specific meaning underlying the Olivetti story was becoming apparent. The replacement of manual by mechanical writing and calculating, and the creation of machines for rationalizing office work in business and industry were the motive force of an enterprise inspired by a responsible view of the economic, social and cultural implications of labor and industrial life. In this respect, the impress of Adriano Olivetti's personality was tangibly evident in the company's achievements, whether in organizing the social services, planning a new factory in terms of economic and social development, opening another line of production, studying the design of a new product, balancing form and function in an industrial building, or in drafting effective advertising copy.
When Olivetti celebrated its twenty-fifth anniversary, in 1933, the reorganization begun in 1927 had revamped every aspect of the company's life. Production amounted to 15,000 office machines and 9000 portables. The company employed 870 people. In Italy, the sales network included thirteen branches and seventy-nine concessionaries, and abroad Olivetti was actively represented in dozens of countries.

In succeeding years, the line of products was extended and elaborated. Studies for the construction of adding machines began in 1934. The semistandard Studio 44 was brought out in 1935. Plans for a teleprinter got under way in 1936 and the year following it went into production. The first planer milling machine, designed by Camillo Olivetti, was produced by the O.M.O. plant in 1938.

The years between 1938 and 1942 saw the construction of the group of buildings for the new I.C.O. plant, whose long façade in reinforced concrete and glass still stands out among successive enlargements as a bold and functional architectural solution.

At Massa, in Tuscany, the Olivetti Synthesis company began production of filing cabinets, card files and metal office furniture. The first permanent summer camp for employees' children was inaugurated at Champoluc, a mountain area near Ivrea.

In 1938 Adriano Olivetti succeeded his father as president of the company, a position he held, except for brief interruptions, until his death in 1960. For twenty-two years the history of the Ivrea plant and the biography of its president make a single story. Adriano Olivetti set a perhaps unique example of how full and coherent a part industry can play in the social and cultural life of the community.

A personal religious inclination, which he owed in part to his father's influence, was fused in him with a responsible sensitivity to contemporary values. Adriano Olivetti was aware of the spiritual impoverishment and the moral corruption that the superficial acquisition of the means of "civilization" visit on society and the standards proper to Western culture, but he considered them errors in the system which could be corrected. This was his outstanding trait as a modern industrialist, thinker and reformer. He considered material progress as an essential factor in human redemption. He did not view science as a destroyer of tradition, fundamental values and the feeling for the absolute that goes with religious morality. On the contrary, he identified the course of science with that of truth, its conquests with a continuous verging toward freedom from suffering. The background for his philosophy lies in various
sources, ranging from his personal interpretation of the contemporary French Catholic trend represented by Mounier, Weil and Maritain, to his familiarity with American developments in the social sciences. But they are united in a single theme running through everything he accomplished: the reconciliation of material and spiritual values. It is a motivating idea which he formulated in a book published just after the War, L'Ordine politico delle comunità ("The Political Order of the Communities"), and which recurs in his most disparate activities. Thus it underlies his work in industrial organization, town planning, social services, political campaigning, adult education, sociology, technical and scientific research, the visual arts, publishing and public administration. His interest was centered not so much on the industrial enterprise considered as an end in itself, as on the human and physical environment in which it operates. Even the most specifically technical and organizational problems were studied by him from this point of view. Whatever he gave his attention to achieved a firm balance between the growing industrial power of his company and the world around it. This approach led him to an intense interest in town planning, considered not merely as a means of pragmatic and esthetic improvement, but as a positive factor in group living and social progress. The idea of organically reconstructing city and territory by planning at local and regional levels was in his view of the world innate and necessary. He saw everything in terms of how best the individual could live with his neighbors in a given environment, and of democratic social organization "on the scale of man". His enthusiasm for town planning was an integral part of his interest in social assistance methods, the use of free time, and the administration of community life to permit the most effective individual expression.

The future historian of 20th-century Italian life will find that at the beginning of all the studies and work in town planning during the last several decades is Adriano Olivetti's master plan for the Valle d'Aosta, which was published in 1937. Going beyond municipal limits, it was the first attempt at regional planning. Moreover it was for the first time, at least in Italy, that a public leader considered town and regional planning an essential field of study in building a modern country. The creation of the social services and housing settlements in Ivrea and the model village of La Martella, near Matera, in one of the worst of southern Italy's depressed areas, are only two of the important examples of Adriano Olivetti's work as a social thinker and organizer. Town planning, understood as the science of community living, is
necessarily also concerned with architecture. Adriano's passion for industrial
architecture was closely connected with his philosophy, hence with the need he
acutely felt to improve living conditions by means of specific programs and actual
constructions. The form of a building interested him, but he was even more concerned
with its purpose. Radically different in approach from the pure esthete, he aimed to
promote the construction of buildings, whether for habitation, work, study, research
or recreation, that would correspond to people's needs, be satisfying esthetically
and above all embody the feeling of community life. This particular concept is one
of the most salient traits in his personality as a modern humanist. His outstanding
merit, as George Friedmann recently put it, is that of "having succeeded in bringing
together mechanized industry and the new form of beauty that has appeared on our
horizon—the beauty of technical civilization".

In his vision, factories built "on the scale of man" would produce a continual stream
of products designed for man. The desirability of devoting special attention to prod­
cut design had been emphasized by Camillo Olivetti from the very beginning of the
Ivrea factory. At that time he wrote, "A machine should not be a geegaw for the
living room, ornate and in questionble taste. It should have an appearance that is
serious and elegant at the same time".

His son echoed these words in more contemporary terms when he summed up the
principles of Olivetti design: "The design of every product stands out for its clarity,
unity and logic. The office machine designs are pleasing but not over-smooth,
rational but not inhuman, discreet but not banal".

With respect to Olivetti design, a few years ago an American writer quoted an ob­
servation by Schiller which might well apply to the achievements promoted by
Adriano Olivetti: "One of culture's most important tasks is that of subjecting man
to the influence of form even in his merely physical life, and to make his life esthetic
by introducing the norm of the beautiful wherever possible, for only from esthetic
conditions and not from physical conditions can moral life develop". If the "norm
of the beautiful" is an essential condition for a fuller life, this same norm is an in­
dispensable influence on man's will and psychology, making him aware of his
powers of mind, imagination and fantasy. In the light of this reasoning, advertising
must be seen as a means of stimulating and developing the moral and esthetic
values inherent in human nature. Believing this, Adriano Olivetti contributed to his
company's advertising the standards determined by his close involvement with
current cultural developments and his lively feeling for the forms of contemporary art. He had no faith in the hard sell. The company produced quality products and its advertising would have to meet the same high standards. Planned and maintained on the level of art, Olivetti advertising does not aim at quick impact, but at fresh and personal expression having a long-term effect in depth. These principles have themselves become “the company's true hallmark, standing for a firm founded on modern technology, efficiency, honesty, elegance and human welfare”.

The close bond between technology and the forms of publicity, and the influence of functional architecture and modern geometric design on the company's products, graphic work and printing, have created a unified image embracing numerous activities that complement each other. Each achievement is identifiable as expressing the company's “style”, in the broadest sense of the term.

Olivetti, a World Enterprise

This complex but unified corporate image is the creation of Adriano Olivetti and the many technicians, industrial designers, graphic artists, architects, painters, writers and social scientists he enlisted to work closely with him. The image took its present form mainly during the last several decades, in step with Olivetti's development on a world scale. Before the War the company had already begun to attract intellectuals and artists. The war years created a hiatus. Camillo Olivetti died toward the end of the sinister period when the triumph of extremist nationalism, racism and the forces of destruction saw the wreck of the values and ideals for which he had worked, and in which he believed religiously. Adriano Olivetti, obliged to go into exile in Switzerland, was able there to develop and then publish his political and social ideas, in his book “L'ordine politico delle comunità”, which served as a point of departure for his activities on his return to Italy after the Liberation. By 1945, the factory was employing more than 4000 people. Besides typewriters, the company was producing adding machines, calculators and teleprinters. A new plant was built in Turin to supplement the production capacity of those in Ivrea. The factory at Massa, which had been partially destroyed during the hostilities, was rebuilt. Between 1948 and 1954 the entire range of products was redesigned. Four new typewriter models and three calculators were produced. Increased production
called for the reorganization of the distribution network not only in Italy and the few countries where the company was represented before the War, but all over the world. The last ten years were marked by the unprecedented growth of what today is the largest manufacturer of office machines in Europe.

Adriano Olivetti's theories in politics, social service, town planning and esthetics presupposed a forward-looking policy of expansion in production and sales, for only the physical expansion of the enterprise could provide daily proof of the validity of his "revolutionary" approach.

In his personality, thinker and reformer, farsighted organizer and dynamic promoter complemented each other without conflict. Underlying his thought was the conviction that organized production is part and parcel of contemporary culture. He refused to follow what he called "the tragic march toward efficiency and profit", in the materialist sense, but was dominated by the idea of directing every effort toward ideal ends. In 1958 he wrote: "Labor has to participate in the aims of the factory, I realized when I started working. This realization implied the answer to some of the fundamental questions of my life, questions dramatically repeated in moments of doubt and uncertainty, questions profoundly decisive for the faith they presuppose and the obligations they denote: Can industry have aims? Are these aims simply to be found in the index of profits, or is there not also an ideal, a destiny and vocation in the life of the factory?"

The program of technical and organizational improvements initiated some thirty years ago in the Ivrea plants has been continuously carried forward, with the same objectives, up to the present day. At the end of 1951, after completion of the post-war reorganization, the labor force numbered 5000 and clerical and managerial personnel, 1000. By 1956 the total number of employees, including those in the Italian and foreign sales organizations, was 16,000. In 1959 there were 25,000 employees, while production reached 735,000 unit equivalents of a standard typewriter. The year following, production rose to 1,035,000, and in 1961 to 1,390,000 units. The number of Olivetti employees in 1961 was about 39,000. In the same year the Underwood Corporation (whose connections with Olivetti will be discussed below) had about 12,000 employees. New divisions have been added in recent years to the Ivrea plant constructed between 1938 and 1942. In line with the main building and connected with it by an overhead passage, a series of new plants houses various production facilities. Behind these, a large building for the company school and cafeteria has been erected.
Nearby, the Study and Experiment Center, inaugurated in 1955, is used by specialists engaged in designing new machines and working out new production methods. Opposite, on the same street, stand the social services and cultural center and the library, which are the concrete expression of the particular human climate that distinguishes the organization.

The development of the company and its increasingly broad economic influence on the region centering on Ivrea, suggested the desirability of a progressive decentralization program. Accordingly, a teleprinter plant was set up at San Lorenzo; the new machine-tools factory was constructed at S. Bernardo; and other small plants and workshops for the production of accessory equipment were similarly decentralized. Also in Piedmont, the Aglié plant was built in 1955 for the mass production of portables; and in Lombardy the more recent electronic research laboratory was constructed at Borgolombardo, near Milan. Finally, there is the Pozzuoli factory, near Naples, which not only raises Olivetti's production capacity, but also contributes to the needed industrialization of southern Italy and has helped to raise the living standard of a depressed area. Other factories were constructed abroad. Most extensive of the foreign plants is that of the Hispano Olivetti company, in Barcelona, where production and assembly shops are laid out around an office building, dining hall, sports fields and swimming pool. Also in operation abroad are the factories of British Olivetti in Glasgow, Olivetti Argentina in Buenos Aires, Olivetti Industrial in São Paulo, Brazil (the last two recently constructed), and of Olivetti Africa in Johannesburg.

The list of Olivetti products today ranges from typewriters to office furniture, from teleprinters to machine tools, from calculators to accounting machines, and from data processing equipment to electronic computers. Sales have been developed as dynamically as production. Thirty-nine branches and two hundred and fifty exclusive distributors comprise the commercial network in Italy. Abroad, a group of twenty-two companies associated with Olivetti have created their own sales organizations, either patterned on the Italian system or based, where more suitable, on local conditions. The Olivetti associated companies are located in Argentina, Australia, Austria, Belgium, Brazil, Canada, Colombia, Denmark, France, Germany, Great Britain, Japan, Mexico, Peru, Portugal, Spain, the United States, Sweden, Switzerland, South Africa and Venezuela.
The last years of Adriano Olivetti’s life saw the achievement of projects that had been on the company’s program for some time, as well as the opening of highly interesting new prospects. In 1958 when Olivetti celebrated its fiftieth anniversary, new products, new factories, new sales organizations were carrying the image of a vital contemporary enterprise all over the globe. Olivetti’s advanced level of technology and organization allowed it to compete successfully in all the main foreign markets, and production was now predominantly devoted to export. Consequently, every move to reduce tariff barriers and customs obstacles created new possibilities for Olivetti sales abroad. In fact, the measures already adopted toward trade liberalization and European economic integration have confirmed this by stepping up the rhythm of exports, and justify particularly favorable prospects for the future as the Common Market treaties are progressively implemented.

Another factor promising further notable development for Olivetti is the agreement, that was signed at the end of 1959 with Underwood, the famous American office machine company. Under the terms of this agreement for close cooperation, Olivetti became the majority shareholder in the American company. Mr. Ugo Galassi of Olivetti, still in charge of the Italian Sales Organisation, took over as President of the new American Allied Company. Underwood, operating an extensive sales network in the United States, needed other competitive products to offer along with models produced in its American factories. Following the merger, Underwood filled this need with machines constructed by Olivetti, especially in the calculator and accounting machine line. Similar relations were established between Olivetti and Underwood Ltd. of Toronto to cover distribution in Canada.

The Underwood deal was the last large-scale operation conceived and carried out by Adriano Olivetti. On February 27th, 1960, he died on a train traveling near Aigle. He was at the height of his dynamic career at the service of his company and the country, and the many-sided enterprise he summed up and represented was progressing as he had intended. A few months before his death he wrote: “Time is flying. Things are on the move. We cannot stop to rummage among the old formulas and institutions of the past. We now stand before the new. In easier times we may and should improve the social institutions of the past, but we would still be looking backward if these improvements were to be only technical. It is necessary to go beyond that, to see whether within the limits of a given economy and a chang-
ing society these forms and institutions can be modified or replaced by new solutions inspired by new principles."

The secret of the achievement connected with the name of Olivetti lies in this moral impetus which has vitalized the company from its pioneering period to the present day. The company's world importance was not achieved fortuitously. Besides the ability of its labor staff and management, it owes a great part of its success to the broad ideas of Adriano Olivetti, and of those who are continuing his work. In 1960, Giuseppe Pero, who entered the firm in 1920 as one of the first associates of Camillo Olivetti, became president of the company. In the present as in the past, his dedication to the company has been a central factor in its development.

In little more than half a century the Italian, then the European public, and now the whole world have seen this company project a constantly varied but fundamentally unified series of ideas, forms and colors which make up its theme and visual image. If the result has been the creation of a distinctive style, a recognizable "face", it is thanks to what lies behind this face: a spirit whose aim is to unify this variety for a specific objective. And the objective has been to make a moral and cultural as well as a practical contribution to the life of our times.
Ivrea. The first plant (1908)

Women at work

Shipment of the first typewriters
Olivetti and Architecture

The visitor arriving in Ivrea sees the main Olivetti plant, with its three principal phases of construction, from the original red-brick factory to the glass-fronted successive additions. Opposite and around it he sees various buildings devoted to social services, cultural and recreational activities, and extending in two directions for several kilometers from the plant, housing developments of single-family row houses, detached private houses and multi-story dwellings. The overall impression is that of an industrial city which has grown up according to a definite plan, complete in plant, services and habitations, distinct in atmosphere and appearance. But this model industrial microcosm still does not give the whole picture of what architecture has contributed to the creation of the Olivetti style. In fact, in no other field more clearly than in this one has the company had a world impact. To understand architecture's role in Olivetti life and industry, it would be necessary to examine, from the point of view of their function and environment, dozens of buildings and constructions in Italy and abroad, ranging from factories to housing and from permanent showrooms to temporary displays at fairs and exhibitions. Olivetti architecture is not the work of a single personality. Many architects, engineers and artists have given their individual impress to the company's constructions. Although these cannot be ascribed to any given architectural "school", taken together even over the decades they recognizably have a strong family resemblance.

Olivetti's interest in architecture goes back to the 1930's when the firm was being reorganized and a new policy in production and general design was adopted. For some time previous, while focusing on the problem of regional planning, Adriano Olivetti had been cooperating closely with several groups of architects who were concerned with finding new expressions that would break out of the rut of the Italian academic tradition. Before the War, when it became necessary to enlarge the Olivetti plant, two young Milanese architects, Luigi Figini and Gino Pollini, who subscribed to functionalism, were asked to design new buildings. Its enormous glass façade, the first of its size in Italy, is a light and airy screen that has the opposite effect of the cold and inert fronts of old traditional factory buildings. The same architects were responsible for the kindergarten day center and many other more recent buildings in the main group of plants at Ivrea, such as the large calculator factory and the façade of the social services buildings. But Adriano Olivetti's faith in a particular group of artists was never allowed to become a habit that might lead to repetitive designs. Different architects with other views were called upon progressively, so long as they had strong creative personalities. The felicitous collaboration of the industrial designer Marcello Nizzoli and the archi-
tects Fiocchi and Bernasconi produced the various housing settlements at Ivrea and the Sales Management Building in Milan. Ignazio Gardella, whose background was in the Milanese functionalist group, designed the large cafeteria building. The new machine-tools plant at San Bernardo and the Study and Experiment Center at Ivrea were built by Eduardo Vittoria; the factories in São Paulo, Brazil, and in Buenos Aires, by Marco Zanuso. A number of Olivetti showrooms were designed by architects of great talent: in New York, by Belgiojoso, Peressutti and Rogers; in Venice, by Carlo Scarpa; in Paris, by Franco Albini; and in Düsseldorf, by Ignazio Gardella. Although conceived differently and freely varied in line, form and materials, these works make up a single vision of advanced industrial architecture. The contrasts in style and individual temperaments are resolved within an organic whole that embraces the separate expressions; each architect’s response to a general atmosphere resulted in a building having a fundamental kinship with all the others.

For more than twenty years it was Adriano Olivetti who decided on architectural commissions. The openness of his approach was particularly evident after the War when the battle between functionalist and organic architects was raging. As has been mentioned, he was among the first in Italy to believe in the International Style and to encourage functionalist expressions in architecture, industrial design and graphic art. Around 1950, when the problem of choosing architects for new factories and workers’ housing arose, he refused to make an arbitrary choice between functionalists and organicists. As in the past, he decided on the basis of individual merit, enlisting architects of either school whose work was coherent and esthetically satisfying.

The good results of this approach for the general aesthetic quality of Olivetti architecture are seen particularly in the Social Services Building in Ivrea and the factory at Pozzuoli, which was designed by Luigi Cosenza. The Pozzuoli factory, inaugurated in 1955 and the first Olivetti plant to be built in a typically southern landscape, is situated a few kilometers from Naples, facing one of the most beautiful bays in the world. Luigi Cosenza, an organic architect, worked out a solution that harmonizes the industrial building with the opulently colorful Mediterranean landscape. The lines of the structure make a lively visual link between the seascape and the steep hill behind the plant. The glassed-in open construction provides constant views of sea, land, sky and growing things, and the idea of expressing contact between the people working at the machines and nature was the architect’s guiding concept in creating his design.

This rapid bird’s-eye view of Olivetti architecture will perhaps suffice to emphasize the point that there is a unity of inspiration linking the great variety of functions and expressions. It may be called industrial architecture or, more simply, architecture; for it goes beyond the construction of production facilities to the problems of relating human life and work to the environment. Its constant aim is to help lessen labor’s burden of monotony and isolation.
Ivrea. Monument to Camillo Olivetti (E. Greco, 1957)

Ivrea. The north façade of the new factory (Figini and Pollini, 1938–42 and 1957)
Ivrea. The south façade of the main building.
San Bernardo (Ivrea). New wing and front view of factory for the production of machine tools (E. Vittoria, 1961 and 1954)
The plant at Pozzuoli, Naples (L. Cosenza, 1955)
Below left: the factory as seen from the air

Below right: the Synthesis factory, near Massa (Bottoni and Pucci, 1943-53)
Sao Paulo, Brazil. Front view of factory (M. Zanuso, 1959)
Below left: Glasgow. The "British Olivetti" plant (1947)
Below right: Barcelona. Front view of factory
Showrooms

Düsseldorf (I. Gardella, 1961)
Below: Milan, "Olivetti Spazio" (W. Ballmer, 1960)
Up: New York (Belgioioso, Peressutti, Rogers, 1954)
Center: San Francisco (Cavagneri and Lionni, 1953)
Below: Caracas (E. Bonfante, 1957)
Center: Paris (F. Albini, 1959)
Below: Venice (C. Scarpa, 1958)
For Olivetti the story of industrial design has the same points of departure and, at least in part, the same development as architecture. The problem of design also poses the problem of forms connected with the art movements and style of a given period. At the same time it is concerned with practical uses and the fusion of esthetics and function. Industrial design is however a fairly recent field which has grown up with the gradual lessening of the rigid old 19th- and early 20th-century habit of distinguishing between artists and technicians, architects and engineers, and men dedicated to esthetic pursuits and those devoted to practical affairs. The fundamental concept of industrial design is that "technique" is not extraneous to "form". They are not developed separately and then put together, but are interrelated aspects of the same creation.

Even if in the majority of cases the practical objectives of usefulness and technical function prevent or impede esthetic expression, ideally there is no reason why an object intended for practical or economic purposes should not be a vehicle or material for art.

Besides, the problem of the relations between useful object and esthetic form has existed from the earliest times, and has always found a contemporary solution. The triumph of the Machine Age and the somewhat misunderstood principle of functionalism led to the debasement of the esthetic value of tools and utensils, which at other times had been the objects of elaborate handwork. But this process also led to a close re-examination of the problem, which in some cases resulted in organic, rather than the old instinctive and spasmodic solutions. This is true especially for mechanical industry whose products must have a form that satisfactorily expresses their function for a given public.

In 1930 these considerations, which were soon assimilated by Adriano Olivetti as part of his general views on industrial esthetics, still smacked of futuristic theorizing, in Italy. At the same time there were no proper Italian industrial designers. When the company decided to produce a portable addition to its standard office typewriter, Aldo Magnelli, a member of the team working on the new machine who had a special interest in artistic and cultural developments, was assigned to design the body. The MP 1 remained for many years a model of clean-cut presentation in a mechanical object intended for business and private use, which would not be a discordant element in the home.

But the most advanced and esthetically satisfactory solutions in this field were provided years later by Marcello Nizzoli, a talented painter and advertising artist who was encouraged by Adriano Olivetti to become a product designer and then an architect. Today world famous as an industrial designer, Nizzoli was responsible for the body work of a whole series of Olivetti machines.
including the Lexikon 80, the Lettera 22, the Studio 44, the Lexikon Elettrica and the 82 Diaspron typewriters, as well as the Divisumma, Tetractys and Audit calculating and accounting machines. In fact a good part of the history of Olivetti design is bound up with Nizzoli's career. No one today can fail to recognize the contemporary note struck by the organic and balanced design of a machine like the Lexikon 80, or that of the Studio 44, with its ovoid form framing the keyboard and creating an inner margin of the body. The Lettera 22, with its invitingly simple yet subtle shape, was recently selected in a world poll of experts conducted by the Illinois Institute of Technology as first among the ten best examples of contemporary industrial design.

The shape of the 82 Diaspron is distinguished by a precise counterpoint of flat planes and wide angles, which are also adopted in the form of the Summa Prima adding machine. The calculators, however, on the whole presented different problems in design. While in a typewriter the body must allow the free movement of the key-linkage system, a calculator contains compact inner mechanisms from which only the paper tape emerges to carry the printed entries and results to the exterior. The Olivetti calculators designed by Marcello Nizzoli in the last twenty-two years, up to the Summa Prima 20, are all variations and modifications of his first creation, the Summa adding machine, produced in 1940. Yet every improvement, however apparently marginal, has involved the solution of complicated design problems. The basic shape is that of a six-sided solid parallelogram with rounded corners, truncated below and the front—bearing the keyboard—lowered and slightly inclined, like a sort of diminutive reading desk. The most obvious differences between one machine and another, apparent for instance between the Divisumma 24 and the Tetractys superautomatic calculators, lie in the keyboards. These, however, show a great variety of forms, and the different combinations of cylindrical, cubic and rectangular elements in contrasting or harmonizing colors have the value of abstract compositions. Nizzoli created substantially similar designs for another series of products, the Audit accounting machines. But here the abstract composition formed by the keyboard is accentuated because the greater complexity and size of the machines call for a larger keyboard with additional elements.

Other interesting examples include the recent creations of the architect Ettore Sottsass Jr., whose design for the Olivetti Elee 9003 computer won the international Rinascente prize—the Compasso d'Oro (Gold Compass)—in 1958. (The Olivetti company was awarded the Compasso d'Oro for the Lettera 22 in 1950, and in 1955 Adriano Olivetti received the same honor in recognition of his contribution to the development of industrial design.) Also outstanding in the design field are the Olivetti Spazio line of metal office furniture, created by the architectural firm of Belgiojoso, Peressutti and Rogers, and the body of the latest electric typewriter, the Olivetti 84, by Giovanni Pintori, the artist responsible for much of the best in Olivetti advertising. The various solutions were achieved case by case but always consistently following the fundamental concept of creating a harmony of form and function. The same criterion is applied by the company in designing such minor products as the accessories for the machines, packaging, souvenir gifts for clients and so on. The standard of taste is maintained even in small details.
Sketches for the body of typewriter “82 Diaspron” (M. Nizzoli)

Sketches for lever and body of the “Studio 44” (M. Nizzoli)
The "Lettera 22" portable typewriter (M. Nizzoli, 1950)
The "82 Diaspron" typewriter (M. Nizzoli, 1959)

The "Summa Prima 20" hand-operated adding machine (Marcello Nizzoli, 1960)
Olivetti Spazio metal furniture (Belgioioso, Peressutti, Rogers, 1960)
Cabinets for electronic computers "Elea"
(E. Sottsass jr.)
Keyboard of CBS/120 Converter (E. Sottsass jr., 1960)
Olivetti typewriters now in production include four models: the Diaspron, the Electric Olivetti, the semistandard Studio 44 and the portable Lettera 22. The Diaspron, a standard machine with new body design, replaces the preceding model, the Lexikon 80, which it excels in a number of technical features. The Electric 84 is adapted to high-speed accurate work in numerous copies. The lightness and compactness of the portable Lettera 22 make it especially suitable for travel and personal use. Intermediate between the portable and the big office machines, the semistandard Studio 44 is useful as a type-writer that can easily be moved about and performs a large volume of steady work.

The printing calculators for many years have accounted for a considerable share of Olivetti production and export. They fall into three groups. The first includes the adding machines: the manual Summa Prima 20, the electric Quanta, the electric adding-subtracting Elettrosomma 22 and the Multisumma 22. Outstanding in the group of calculators proper is the superautomatic Divisumma 24, which performs the four arithmetical operations at top speed, has one register and a memory device, permits automatic re-entry of the results and prints all the data horizontally. The Tetractys superautomatic printing calculator represents a great innovation in the calculator field. It has two independent registers, both of which give the credit balance, and a memory mechanism. It can switch from multiplication to division while retaining products or quotients for subsequent calculations, re-enter products automatically, change over from one register to the other and from either register to the "memory" and vice-versa. The third group consists of the Audit accounting machines, a series designed to satisfy every conceivable bookkeeping requirement of the modern firm. This group includes the latest machines for top-speed collection and processing of business data. These are the Audit 622, 623, 722, 723, 732, 733, 920 and 930 accounting machines which by means of a tape punch simultaneously and automatically provide a "memory" of the alphanumeric entries. The punched tape "memory" is transmitted to the data processing center where its information is automatically recoded for conversion to punched cards (by the CBS reader-converter) or to magnetic tapes (by the CBN reader-converter) used in the big electronic computers. Recent additions to the systems of integrated mechanization offered by the Audit series include the Mercator 5000 billing-accounting machine, which is a complete electronic data processing center in itself, equipped for programming with a memory and computing system, registers and tape punch. Another new data processing machine in this class is the RP, which was designed for use in industrial organizations. With the construction of the Elea 9003 in 1959, Olivetti extended
its product range to include the manufacture of electronic computers. The working cycle of the Elea 9003 is completely automatic, the operator’s role being limited to the feeding of the data and the collection of the processed results. The machine can be used, as required, for computing operations, classification, correlation and interpretation of data. Another computer in the Elea series is the Elea 6001, which is especially adapted to numerical computations required in scientific and technical research. The transistors that serve as the basic elements in the Elea computers are produced along with other semiconductors at Agrate (on the Milan-Bergamo highway) by the Società Generale Semiconduttori, a company in which Olivetti is a considerable shareholder.

Teleprinters and teleprinting equipment have long figured among Olivetti products. The company produces tape and page, sending and receiving models, tape perforators, relay stations and soundproof tables and hoods.

Olivetti’s business machine production is supplemented by Olivetti Synthesis office furniture, including filing cabinets, card files and cabinets. A recent addition to this field is the Spazio line of metal furniture: tables, desks and bookcases supplied in unit sections that can be combined or arranged in accordance with the space available. The Synthesis Division also produces various accessory supports, tables and chairs for use in conjunction with Olivetti machines or for general use in contemporary-styled offices.

Finally, the Sada, a company controlled by Olivetti, manufactures typewriter ribbons for the various models of typewriters and calculators, carbon paper and manual and electric duplicating machines. The only sector of Olivetti production not concerned with office equipment is represented by the Machine Tools Division. Its products range from sensitive and multi-spindle drills to grinding, planer- and rotary-type milling machines, operating units and transfer machines. The Olivetti Supplies Service supervises all aspects of the materials used in production from procurement to performance in the finished product. Cast iron and sheet steel, formerly the principal materials employed, have given way to the large-scale use of light alloys, special steels and plastics. The newer materials combine strength and greater lightness, and reduction of weight in the typewriters and calculators means easier and faster performance. The manufacture of high quality products depends on the use of select materials, but of course the design and execution are also fundamental. For research, study and the construction of working models, the designers of the machines must have laboratories, workshops and drafting rooms supplied with the latest instruments and equipment. To produce their projects successfully an efficient plant is required, which means having a skilled tech-
A checking and testing line for adding machines at the Pozzuoli factory.
Supply-conveyors linking the enameling section and the assembly division.
A modern industrial organization in which produc-
tion is considered only as a part of the life of
the community, a sector of a larger sphere that
embraces problems and pleasures close to the
heart of each individual, is the reality Adriano
Olivetti had in mind when he wrote: "The man
who spends long days in a factory does not shed
his humanity when he puts on his overalls". To
maintain this balanced community life when the
scale of an industrial enterprise becomes gigan-
tic requires an effort too ramified to be readily
summarized in a simple formula. The rela-
tions between the individual and his work vary from one
place to another, just as the climate, the land-
scape, the environment and people's faces
change. The general abstract picture of human
society breaks up into a series of particular
perspectives as one travels through the human
landscape, from Ivrea to Pozzuoli, or from
Barcelona to Johannesburg.

As attention shifts from organization to man, un-
expected aspects and details emerge from what at
first is seen only as a general totality. The life of
an industrial organization then comes into focus
as a microcosm reproducing all the nuances of
custom and mentality that are found in society at
large.

An old Piedmontese worker attached to his job
by faithful and equable habit... a Neapolitan girl
whose look is distracted and somewhat melancholy... a line of Negro workmen, steadfastly
punctilious... a twenty-year old taking a course
in salesmanship before throwing himself into the
commercial scrimmage...
Pozzuoli. A technical office
Ivrea. One of the stamping presses on the production line.
Ivrea. Technician attending courses given by the Customers Technical Assistance Service in Ivrea

Pozzuoli. Girl at work

Men and machines in Pozzuoli
The Olivetti school selects and trains promising students who wish to become skilled workers and technicians.
Villa Natalia, Florence. Training courses for sales personnel are held in historic Villa on the via Bolognese.
During the early years of relatively small-scale production of a single typewriter model, Olivetti did not place particular emphasis on advertising. With the reorganization of the factory around 1930, however, the need was felt for a comprehensive renewal of the company's publicity and the visual aspects of its activities. Functionalism, then becoming the major current of European taste, was bringing about a new unity of expression in the figurative and applied arts. Responding to this new cultural climate, Adriano Olivetti understood that a precision machine like the typewriter should appear before the public in distinctively contemporary, simple and functional form. The advent of mechanical writing after a millennial history of writing by hand would thus be signalized as a revolutionary advance toward rationalism in human communications.

To convey the idea of newness in a machine destined for large-scale daily use, Olivetti advertising adopted the most advanced expressions of contemporary art, which being functionalist were closely allied to current architecture, typography and decoration. For it was clear that no practical results could be achieved by employing the old illustrative artists who then dominated Italian advertising as well as painting.

On this policy of being in tune with the best of contemporary art, which it has followed consistently for more than thirty years, the Olivetti advertising department was established. The innovation it introduced in Italian advertising was based on the refusal to conform to so-called public taste. The refusal did not stem from the desire to be in the vanguard at any cost, but from the conviction that public taste does not exist like fashions it is not created by masses of people but by individual personalities whose example is accepted and then becomes general habit. To convey the idea of special quality requires stimulating the average taste by means of unconventional forms and language. In this connection Olivetti advertising put less emphasis on the product than on the service it offered and its message of modernity and progress. Contemporary art was an ideal means of succinctly expressing these concepts, and Olivetti tempered industrial severity with elements of cubism and surrealism in the '30's and '40's and of abstract art more recently.

The increasing number of products, the greater variety of customers and the world-wide extension of Olivetti advertising were accompanied by the problem of projecting the original ideas and intuitions of the company's publicity on a broad organizational level.

The Advertising and Press Department, headed by Riccardo Musatti, coordinates the company's advertising and publicity in Italy and abroad. It is directly responsible to the president of the company for its decisions and taste orientation. Directly concerned with commercial
policy, on the one hand it operates in close touch
with the sales departments, and on the other
maintains the public image of the firm's pre­
stige and progressive ro le in the community.
The department's main objective is, in fact, to
keep up a unity of visual and verbal expression
in Olivetti advertising all over the world. For this
reason the company has never employed ad­
vertising agencies for any of its graphic work
or original copy. The department's offices and
studios in Milan design and usually produce
almost all the firm's printed material, the major
part of its newspaper advertising and its dis­
plays and exhibits for shows and fairs.
Advertising agencies are engaged for publicity
outside Italy only for administrative purposes
and for re-editing copy for local circulation. Ex­
perience has shown the validity of centralizing the
creative work of the department. The same ad­
vertising messages and layouts have met the
same approval and practical results around the
world, especially when original graphics have
been emphasized. Instead of using different arti­
sts for different markets, the department special­
izes the work in terms of types of publicity and of
the different products offered by the company.
In line with this policy, four working teams have
been organized. The first, headed by Giovanni
Pintori, artist and foremost creator of Olivetti ad­
vertising, designs company ads for newspapers
all over the world and prepares the great number
of posters, leaflets and other printed matter in
many languages. The other three teams, led by
Egidio Bonfante, Franco Bassi and Walter Balt­
mer, are responsible for designing showrooms and
exhibits at fairs and shows, as well as the
graphic work concerning some of the specialized
divisions of the firm.
These main groups function independently and
are responsible only to the head of the depart­
ment. As in the past, however, outside artists
are occasionally commissioned for special pro­
jects. This collaboration also provides a useful
stimulus in creating new solutions, and helps
avoid falling into routine. A special office of
advertising research under the direction of
Gior­gio Soavi handles this kind of problems
in order to integrate the traditional activities of
the department. In all projects, from layouts to
art or industrial documentary films, the depart­
ment's staff men work closely with the artist
who has been called in.
Most publications concerned with architecture
and design have run articles and essays on Oli­
vetti graphic work and industrial design. In 1952,
the Museum of Modern Art of New York invited
the Olivetti company to exhibit its work in adver­
tising, industrial design and architecture. It was
the first such invitation to industry. Since then,
the company has shown at many exhibitions and
congresses in Italy and abroad, including the
International Graphic Art Exhibition in Berlin
(1954), the Louvre show (1955) where Giovanni
Pintori's graphic work was exhibited, and the
show held at the Institute of Contemporary Art
in London (1957). In Italy, the annual Palma d'Oro
(Gold Palm) award in advertising was given to the
Olivetti company in 1950, the year the prize was
established.
In the years 1961 and 1962 an exhibition "Stile
Olivetti" has visited the following Museums:
Kunstgewerbemuseum Zürich, Göppinger Galerie
Frankfurk, Die Neue Sammlung Munich, Landes­
gewerbeamt Baden-Württemberg Stuttgart, Mu­
seum für Kunst und Gewerbe Hamburg.
The name of a new product, the layout of a sales
letter, the plan for a pavilion at an industrial fair,
a color plate for a magazine, the text of a folde­
r, the selection of details from a fresco for the
annual art calendar—every aspect, in short, of
Olivetti's publicity is considered in terms of the
concept that advertising is a public service, and
that the choice of aesthetic and stylistic qualities
is not merely a means of persuasion but a public
responsibility.
This concept of responsibility underlies the nu­
merous cultural and civic activities undertaken
by the Olivetti company. Examples range from
the bi-monthly art review and digest, Sele-Arte,
edited by C.L. Ragghianti, which has a circula­tion
of fifty thousand, to many other instances of
community service, such as support for archi­
itectural studies and town planning.
A. Bresciani – M. Pirovano, 1923
Below: M. Dudovich, 1928

X. Schawinsky, 1935
olivetti
Olivetti art calendars

Covers for the house-organ "Notizie Olivetti" (E.Bonfante)
Below: cover and inside pages from the bi-monthly art review and digest "Sele Arte", sponsored by Olivetti
The Olivetti section at the "Mostra dell'Automazione", Milan 1960 (F. Bassi)
Below: Milan Fair 1960 (E. Bonfante)

Exhibition table which can be assembled and demounted (E. Bonfante, 1960)

Hannover Fair 1960 (E. Bonfante)
Advertising gifts
Paperknife (designer M. Nizzoli, 1959)
Below: writing desk set (B. Munari, 1960)

Pencil holder (G. Pintori, 1959)
Throughout its history, Olivetti has consistently anticipated the improvements in social assistance and working conditions that, in Italy at least, have been generally adopted only long afterwards. The company's program in this respect has developed simultaneously in two main directions: first, the progressive establishment of social and welfare benefits as clearly defined automatic rights; second, the maintenance of a high wage and low hours policy—an outstanding result of which, again for Italy, was the adoption of the five-day week. In short, the company has always gone well beyond the minimums set up under state law and cooperated with labor in guaranteeing generous work benefits.

In carrying out these objectives the workers participate directly in the creation and independent administration of the assistance organizations. At the same time, employees' benefits are extended wherever possible to all members of the community centering on the factories.

The social services thus represent a system of workers' normal rights and not a series of concessions and privileges unilaterally determined by management. To ensure this policy, all social service funds are controlled by the Management Council, a body jointly representing labor and management.

Olivetti social service provides assistance for every phase of individual and family life. Women workers have nine and a half months maternity leave at full pay. For employees' children between the ages of six months and six years a pediatric clinic and two kindergarten day centers are available in Ivrea. Holidays for older children are provided at seashore and mountain summer camps, while teenagers and young employees have a choice of the permanent camps, camping trips or tours to other countries. All employees are entitled to free health assistance. Medical care is given in the infirmary and at home by a large staff of physicians, specialists and consultants. Particular emphasis is placed on preventive medicine. Health facilities include a permanent convalescent home, situated in the hills a few miles from Ivrea, and when necessary employees are sent to health resorts for paid rest cures.

The company provides low-cost meals for employees at three main cafeterias operating at the O.M.O. plant in San Bernardo, at the Teletypewriter factory, and—the largest—in a separate building behind the main plant. An extensive network of bus lines is run for workers who commute to Ivrea from outlying districts.

Special types of assistance, going beyond the provisions of the national insurance programs, are financed by a factory community fund to which employees contribute 25% and management, 75%. Family allowances on a graduated scale are provided for employees with numerous dependents, and interest-free loans are available.

In individual cases concerning employees and...
their families that cannot be resolved under the company's regular assistance program, consultation and aid are provided by a special social-assistance office.

Particular attention is given to the improvement of young workers' skills and professional capacities. The Olivetti School offers a five-year course for students holding a high-school diploma or an elementary technical-training certificate. Selected on the basis of entrance examinations, the students receive a technical-training diploma on successful completion of the course, and are then eligible for admission to the Technical Institute, which is also free and has state accreditation. Through a system of scholarships outstanding students may continue their studies up to and including the Turin Polytechnic, where they may take a degree in engineering. The Olivetti School also offers advanced training and night-school courses for adults.

One of the most important problems dealt with by the social services is that of housing. With the rise in population accompanying the Ivrea plant's growth, the problem became urgent. The social services sponsored the construction of private houses and housing settlements, each designed in accordance with organic town-planning principles, and provided technical and architectural assistance. The first multiple dwelling was constructed in 1940 and 1941; since the War two entire residential neighborhoods of two-, three- and four-story houses, as well as single-family houses, have been constructed. Housing is assigned to applicants by a special committee. Employees may also obtain long-term building loans, and to date about two hundred and fifty private homes have been built under this plan. At Ivrea, though on a smaller scale, housing has been constructed at Pozzuoli as an organic complement to the industrial plant.

The social services extend beyond the immediate company sphere of employees and their families to the people of Ivrea and the entire Canavese district. The program outside the factories is directed by the Social Relations Center, which sponsors numerous assistance and social organizations operating throughout the region.

A broad program of cultural activities also forms part of the company's social service. The Olivetti Library has an up-to-date collection of more than 50,000 volumes, as well as periodicals, newspapers, records, art works, films, microfilms and slides. The adjoining Olivetti Cultural Center organizes discussion groups, lectures, debates, concerts, film showings, drama readings and various courses. The Center's activities, on which readers at the library are regularly polled, are administered by the Management Council.

The Sports and Recreation Group operates under very favorable conditions, having extensive sports fields, game rooms and an abundance of equipment for its activities. The group often sponsors events on the national and international levels.

It is a fundamental concept of the social services that industrial production must be considered as one part of the complex life of the human community, a sector of a vaster sphere. Production cannot be seen merely as a force that brings men and women to the machines and work benches in the morning and releases them at evening. In its highest terms, it is collective creation, and in its ever increasing importance for the economy it carries weighty moral and civic responsibilities for the community as a whole.
Ivrea. An 18-family apartment house for Olivetti employees (Nizzoli and Oliveri, 1957)
Ivrea. General view of employees' housing

Ivrea. 4-family houses (Nizzoli and Oliveri, 1952)
Ivrea. Front and partial view of the new cafeteria building
(I. Gardella, 1959)
Ivrea. The Social Services and Cultural Center building
(Figini and Pollini, 1957)
Ivrea. The kindergarten, where employees' children are looked after by trained personnel.
The mountain summer camp at Brusson (Conte and Fiori, 1961)
Ivrea. The kindergarten building (Figini and Pollini, 1940)
Pozzuoli, Borgo Olivetti: employees’ housing
(L. Cosenza, 1955)

Children playing in the factory's kindergarten
Children in the Barcelona kindergarten
Below: The seaside summer camp at Marina di Massa
(Fiocchi and Cascio, 1951)

Rest hour at the Pozzuoli kindergarten
seeing is believing
In a decade, Canadian National invested about two billion dollars in modernization... Diesels have replaced steam locomotives, new types of cars have been developed, new types of service, such as "Piggyback", have been instituted, terminal facilities have been brought up to date with electronic hump yards, centralized traffic control has been extended over more than 2300 miles of track, Telex has become a commonplace of business, the regions and departments of the CN system have been reorganized, credit cards, all-inclusive fares, group travel and other "package deals" have been introduced to promote passenger sales, integrated data processing has brought greater efficiency into office procedures as new machines and methods have improved the mechanical side of railroading and training programs have prepared employees for their part in the new world.

Our external appearances did not keep pace. Most of the innovations and improvements were behind the scenes. The railway has, in many respects, the same look it always had, apart from the disappearance of the steam locomotive.

Realizing that it had outgrown its clothes, Canadian National decided to do something about it. Seeing is believing. The visual redesign program was planned to bring corporate grooming into line with CN's character as a 20th Century enterprise. The first step was to seek the assistance of professional consultants. The firm headed by the brilliant young designer James Valkus was engaged and a study of the CN system was undertaken, to comprehend its character and to establish its corporate identity. A program was organized and a studio was set up in Montreal, with a staff of industrial, interior and graphics designers to implement it on a wide and diversified front.
The key to the program is Allan Fleming's CN symbol. Disappearance of the old maple leaf was regretted by some because of its sentimental associations, but the new mark has been widely acclaimed and the better it is known the better it is liked. As "an example of outstanding excellence in design", the Society of Typographical Designers of Canada gave it the Award of Distinctive Merit. The American Institute of Graphic Arts presented its Certificate of Excellence to Canadian National "in recognition of superior concept and craftsmanship". The designers have won many awards—for the railway's annual report, for covers of the employee magazine "Keeping Track", for telecommunications forms.

The CN, moving in a continuous line, suggests the movement of men, materials and messages. It symbolizes a forward-driving enterprise. The R was dropped because Canadian National is much more than a railway: it is a complex of services, including telecommunications, road transport, hotels, and marine services, and CN is bilingual while CNR is not.

Simple, drawn with exact geometrical calculation in a line of single thickness, the CN is one of the devices of 20th Century industry that share the qualities of timelessness, legibility and individuality with symbols that have been recognized throughout history. They all make an immediate impact. They are remembered.

The CN symbol may be reduced to 1/32nd of an inch, or blown up to 13 feet on the side of a box car or to 40 feet, like the sign on top of the company's headquarters building in Montreal. In motion, it is still recognizable; it may be applied to any surface without losing its identity.

As the program developed, the symbol was applied to equip-
ment, signs, stationery, tickets, labels and countless other forms, calling cards, soap wrappers, match books, telegram blanks, timetable folders. It will ultimately be placed on china, engraved on flatware, etched on glass, woven on linen and wool. A standard alphabet has been adopted to make for consistency wherever CN uses printing.

While the symbol is the key, it is by no means the whole of the visual redesign program. The appearance of locomotives, trains and trucks, stations, ticket offices and other buildings, inside and out, received consideration from the beginning.

In studying railway cars, the designers took samples of dirt gathered in actual service to determine the effect on various colors, studied the weathering of pigments, as well as the psychological implications of related colors, and costs.

Many combinations were worked out and discussed with railway officers and some of them tested before decisions were reached. Some are still pending. Visual redesign is not a crash program. The policy is, for example, to apply the new colors to trains and stations only when they are due for repainting. Simplification has resulted in savings for the company.

Prefabricated stations are a matter for future consideration. Meanwhile, older buildings are spruced up, the traditional drab dress discarded in favor of fresh, new colors.

The designers are working on uniforms for train crews, marine officers, railway police, hotel personnel, telegraph and express messengers and others.

Redesign is a continuing program. Already the response has been good and the new image is giving a new sense of pride to employees and enhancing CN's reputation as a company intent on providing first class service to meet the needs of today.
voir, c'est croire
En l'espace de dix ans, le Canadien National a affecté à sa modernisation environ deux milliards de dollars. Les diesels ont remplacé les locomotives à vapeur; des voitures d'un nouveau modèle ont été mises en service; de nouveaux services ont été institués, tels que le «Piggyback»; les terminus ont été dotés de triages à buttes à commande électronique; la Commande Centralisée de la Circulation a été installée sur plus de 2,300 milles de voie; l'usage du Télex s'est généralisé; il y a eu réorganisation des régions et des divers services du Réseau CN; par les cartes de crédit, les tarifs «tout compris», les tarifs de groupe et les voyages organisés, on a stimulé les ventes voyageurs; la gestion électronique a amélioré le rendement dans nos bureaux, tout comme les nouvelles machines et les nouvelles méthodes ont amélioré le côté mécanique du chemin de fer; des cours de perfectionnement ont préparé les employés à leurs nouvelles fonctions.

Cependant, aux yeux du public, le CN n'avait guère changé. La plupart de nos innovations et de nos améliorations s'effectuaient dans les coulisses. Le Canadien National, à bien des égards, si l'on excepte la disparition des locomotives à vapeur, avait gardé le même aspect.

La Compagnie, consciente de ce décalage, entreprit d'y remédier. Voir, c'est croire. Un programme de rénovation visuelle fut conçu pour faire ressortir le caractère dynamique du Canadien National, vraie entreprise du XXe siècle.

Il s'est d'abord agi de s'assurer les services de spécialistes en esthétique industrielle. James Valkus, jeune et talentueux designer, et ses collaborateurs furent choisis. Ils firent aussitôt une étude du Réseau pour en découvrir les traits essentiels et trouver le symbole qui les traduisit le mieux. Ils ouvrirent un
studio à Montréal, auquel furent adjoints des designers, des dessinateurs et des décorateurs nécessités par le vaste programme à réaliser.

Le sigle CN, dessiné par Allan Fleming, est la clé de ce programme. La disparition de la feuille d'érable fut regrettée par quelques personnes, mais le nouveau symbole a enlevé tous les suffrages : il est même de plus en plus populaire. Comme exemple de dessin excellent, il a gagné le prix Award of Distinctive Merit, décerné par la Society of Typographical Designers.

Il a valu au Canadien National un certificat d'excellence de la part de l'Institut américain des Arts Graphiques. James Valkus et ses associés ont gagné plusieurs autres prix, notamment par le rapport annuel de la Compagnie, les couvertures d'« Au fil du rail » et les formules des Télécommunications.

Le sigle CN, dessiné d'un seul trait, suggère le flot incessant des voyageurs, des marchandises et des messages. C'est le symbole d'un dynamisme à toute épreuve. Le « R » de CNR a été supprimé, le Canadien National étant non seulement un chemin de fer (railway), mais un ensemble de services comprenant, entre autres, télécommunications, transport routier, hôtels et services maritimes ; du reste, CN est bilingue, contrairement à CNR.

Par ses lignes simples et parfaitement balancées, CN est un emblème durable, lisible et facilement reconnaissable de l'industrie du XXe siècle ; il a les deux principales qualités des emblèmes les plus célèbres ; il frappe l'imagination et s'imprime dans la mémoire.

CN peut se réduire à 1/32⁸ de pouce ou s'agrandir jusqu'à 40 pieds. Il tranche sur toute surface. On le reconnaît tout de suite. Le nouvel emblème est déjà porté par les wagons, les ensei-
erges, la papeterie, les billets, les étiquettes et par nombre d'autres formules, cartes de visite, enveloppes de savon, livrets d'allumettes, formules de télégrammes, indicateurs. Il sera imprimé sur la vaisselle, gravé sur l'argenterie et la verriére, et brodé sur la lingerie.

Dès le début, la décoration des trains, des camions, des gares, des bureaux de billets et des autres immeubles, était à l'étude.

Pour rénover les wagons, on a prélevé des échantillons de poussière sur le matériel roulant en service afin de déterminer son effet sur diverses couleurs; on a aussi étudié l'effet de l'air sur les pigments, l'influence psychologique de couleurs apparentées, le coût. La stylisation, la simplification des lignes et des couleurs a fait réaliser une économie appréciable à la compagnie.

La rénovation visuelle n'est pas un projet-éclair. Dans le cas des trains et des gares, entre autres, il a été décidé de ne changer les couleurs que lorsque le temps serait venu de les repeindre.

La question des gares préfabriquées ne se pose pas encore. Pour l'instant, on remet à neuf les édifices, dont les couleurs ternes sont remplacées par des tons plus clairs.

Les dessinateurs sont en train de créer de nouveaux uniformes destinés au personnel des trains, aux officiers de marine, aux agents de police du chemin de fer, au personnel des hôtels, et aux messagers du télégraphe et des messageries; et cela n'est qu'une partie du programme.

En fait, la rénovation visuelle n'a pas de fin. Déjà elle suscite partout l'intérêt. Le nouvel aspect du CN enorgueillit les employés et contribue à la bonne renommée de la Compagnie, qu'il montre soucieuse d'offrir un service de première qualité et à la page.
Perspective

This is the story of 105,000 persons, working together in over 170 locations—of men and women carefully chosen, provided with superb facilities, and given scope for imaginative and daring concepts / It is about great products—but more so of the philosophies, the capabilities, and the techniques that made the great products possible / It tells of four new ages of man—the space age, the jet age, the nuclear age and the undersea age—and of a company that served as a catalyst for all of them / It is the story of a creed: scientific excellence—with a sense of mission / It is the story of General Dynamics Corporation
Polaris-firing submarine USS Patrick Henry, second of her class, goes on station.
Change comes quickly nowadays. From the Wright Brothers' first flight, at 30 miles per hour, to the transonic speed of postwar military planes took 50 years. To double that speed took four years. From the first war rockets used in China to the German V-2 of World War II took 500 years—between the slow, erratic V-2 and mighty rockets capable of taking a man into space only 15 years passed. The first practical submersible was able to stay under the surface for 10 minutes; 50 years later the submarine could still run submerged for only a few hours. The leap to giant nuclear submarines capable of remaining submerged almost indefinitely at high speed took four years.

To be successful in such a world requires three abilities:
- To adapt to change as it occurs;
- To anticipate change and be ready before it occurs;
- And to create the change, to pull the future into today.

In all of these, General Dynamics excels. In one decade General Dynamics has grown from a small submarine-building yard in Connecticut to a vast and unique industrial complex. It is still a submarine builder. It is also an aircraft company; an electronics company; a research company; a space company; a nuclear company. It is a coal miner, a machinery maker, a producer of gases and building materials.

Its laboratories and plants have paced the scientific explosion. Almost 90% of the current products of General Dynamics Corporation literally did not exist one decade ago.

Its products today range from supersonic bombers to anesthetics for surgery; from vehicles to carry man into space to coal for use of industry; from jet passenger planes to concrete for roads and buildings; from ballistic missile-firing, nuclear-powered submarines to electronic telephone equipment. Its spectrum includes nuclear reactors, extracts and flavors for soda fountains, machine tools, high-fidelity stereophonic equipment, electric motors, and intercommunication systems.

Its interests range from rocketry to chemistry, meteorology to fusion, metallurgy to biology, electronics to human engineering.

To look at the capabilities that made this growth possible, let's start with the nuclear submarine.

Until the mid-1950's submarines were still not true undersea vehicles. They remained essentially surface vessels with the ability to submerge periodically.

Nuclear power for propulsion made the submarine potentially capable of sustained operations anywhere under the ocean's surface, with virtually unlimited range and high undersea speed.

To transmute the potential into reality, the United States Navy turned to Electric Boat Division of General Dynamics. Electric Boat built the Navy's first submarine in 1900, and much of its undersea fleet since. It has been the designer and builder for almost all the prototype nuclear submarines of the United States Navy. The breakthroughs have stacked up cumulatively since 1955: the Nautilus, the first nuclear-powered vehicle of any kind; the Skipjack, whose shark-shaped hull represented the marriage of a true hydrodynamic design with nuclear power and provided high speed and improved maneuverability for submarines; the missile-firing George Washington and Patrick Henry, which converted the submarine from its role as a limited tactical weapon to one of a strategic deterrent.

But first answers had to be found. The nuclear submarine is literally a city under the sea. In a length often not exceeding 100 yards, it must be a place in which 100 men can live and work, cut off from contact with the rest of the world for months at a time, yet it must also be a weapon with which to fight.

The ship must carry full provisions for more than 90 days. It must contain engines to propel it and a nuclear reactor, with its shielding, to power it. It must carry sonar and radar to find the enemy and a weapon system with which to attack and to defend itself.

A submarine has just one-third as much room in which to put things as a surface ship of equal length—and no deck space. Yet into this cramped area must also go facil-
The gallery of missile tubes in a Polaris-firing submarine, known to the crew as Sherwood Forest, houses 16 ballistic missiles.
Section 1  CAPABILITY FOR DEFENSE

Ities for cooking and feeding and sleeping; for light, heat and air-conditioning; for washing machines and motion pictures; for elaborate interior and exterior communications systems; for massive electronic computer systems for control and navigation; for oxygen production and water desalination. Each component and the entire complex must operate with absolute reliability.

With the Nautilus and the nuclear ships that followed her down Electric Boatways, this set of problems was solved.

For the speed and maneuverability of a Skipjack, designers looked to the natural shapes of the sea. Every protuberance that could interfere with her true hydrodynamic form was smoothed off. Even her anchor was designed in a mushroom shape to cleave to the hull, presenting an unbroken streamline to the sea.

For the metals that can withstand the stresses of high speeds at great depths, new techniques of metalworking were needed. Metallurgists worked out ways to make "impossible" clean welds on stainless steel piping for nuclear systems. New electrode-flux combinations were developed to create a sound bond with no weld cracks for high-strength hull steels.

For the livability needed in ships submerged for months at a time, engineers achieved feats of compression. Bunks were designed with individual lighting and music outlets, more space for personal gear. Equipment was installed to provide unlimited fresh water for drinking and bathing, to keep air fresh and temperature constant.

Capacity for frozen food supply was increased.

The mating of the nuclear submarine with the ballistic missile created the need for still greater technological achievement. The newest missile-firing submarine must have all the capabilities of its predecessors—and must, in addition, be able to carry, service, guide and fire sixteen nuclear-tipped missiles.

Keeping a submarine properly trimmed is always a problem. For its missile submarines, the Navy added a further requirement—the ship must be able to fire its full complement of missiles at intervals of only one minute each and maintain stability under gale force turbulence.

At the moment the missile leaves the tube, an equivalent volume of water, which weighs considerably more, rushes in. Giant pumps in the hull simultaneously expel an amount of water equal to the difference in weight. Tons of water leave or enter the ship in a matter of seconds. Yet the ship never loses her stability; she is ready to fire again within the specified limit of one minute.

Nothing like a ballistic missile submarine had ever been built before, but the urgency was great. General Dynamics built the George Washington, from contract award to commissioning, in just 24 months.

At its yards in Groton, Connecticut, General Dynamics has not only designed and built these nuclear ships but also has been responsible for the installation and testing of their integral parts. In the process, it has pioneered in areas normally unrelated to traditional shipbuilding skills: sound and vibration control; electronic navigation; biology for life-support systems; human engineering to make it possible for men to work, live and fight under conditions of strain for long periods.

Atlas is the first of the free world’s intercontinental ballistic missiles. General Dynamics, through its Convair Division, fabricates the airframe, assembles and tests the missile.

Already operational at two bases, Atlas by the end of 1962 will be standing ready at 129 launch sites at 11 Air Force bases.

Eighty-two feet tall, weighing 130 tons, Atlas is capable of hurling a hydrogen warhead more than 9,000 miles with devastating accuracy. Designed, tested, produced with unprecedented urgency, Atlas reached operational status in just four and a half years as a major deterrent weapon in the arsenal of the United States.

The Atlas is fired from the ground and, in a brief powered flight of less than five minutes, is accelerated to about 17,000 miles an hour. Then its engines shut off. From there on, the missile is in a ballistic trajectory, hurtling toward its
Atlas missile 44-D, similar to missiles now in operational readiness with the Air Force, starts on a successful flight.
Construction workers at Schilling Air Force Base position reinforcements for concrete Atlas silo; an early step in a complex task.
objective thousands of miles away. It will hit a target well within two miles of its point zero.

In the research program that led to Atlas, three key innovations were developed which have since become universally accepted as part of the art of rocketry:

1. The first swiveling engines for directional control;
2. The first integral tanks, with the skin of the missile serving as the wall of the propellant tanks;
3. The first separable nose cone.

The only previous long-range rocket, the 200-mile German V-2, had been controlled by graphite rudder-like vanes in the exhaust. The technique was clumsy and cut engine efficiency. Convair engineers, designing the MX-774 research rocket, hit on the idea of swiveling the rocket engines themselves to gain directional control, and proved it out on early test rockets. On the Atlas, the technique was further refined to allow the engines to gimbal.

The eventual Atlas airframe, a monocoque of tough steel—thinner than a dime but with a tensile strength of 200,000 pounds to the square inch—represented a further design breakthrough.

Engineers had already shown that the wing of an airplane could be filled with fuel. They applied to the Atlas a similar integral fuel tank technique. The airframe of the missile itself became the wall of the propellant tanks, effecting a substantial saving in weight. When empty of fuel, the skin could be kept inflated like a giant metal balloon with small amounts of gas.

The third innovation was the separable nose cone. Earlier rockets and missiles had been forced to carry the tanks and engines that got them started all the way to target. But the sole purpose of Atlas as a weapon is to thrust a warhead to a predetermined point in the sky. It then breaks free, sending the nose cone, the warhead, to streak alone to the enemy target.

These design breakthroughs were just the beginning. The Atlas as a missile is an infinitely complex total of some 100,000 parts. Moreover, by itself Atlas is just one part of a total weapon system. It must be serviced, fueled, fed target information and launched. In many respects, the missile is like a bullet—useless unless fired by a weapon.

As systems integrator for Project Atlas, General Dynamics, from its Convair/Astronautics plant outside of San Diego, California, builds the airframe, the autopilot system and various components; assembles and checks out the missiles; conducts both captive and flight tests; activates new Atlas bases, and trains Air Force personnel who will man the operational bases, which are under the Strategic Air Command.

In normal development of a weapon system, the steps of design, system testing, flight testing, final design changes and production follow in sequence. But the normal development of such a system in the past has averaged seven years or more. For Atlas, that time was cut by more than a third through a requirement for "currency." All the steps were overlapped to save time. Production facilities were ordered before the first missile had been built; design of the operational bases was started before the first test flight; production was increased early in the flight test program, and operational bases were under construction midway in the research and development program.

The first full-range flight went more than 6,000 statute miles on November 28, 1958. By 1960, the standard Atlas D was being successfully fired 9,000 miles on target. During a 20-month research and development program sponsored by the United States Air Force to prove out the missile as a weapon system and space booster, 51 Atlas D missiles were fired. Only seven were unsuccessful. Currently a new and more advanced model, the Atlas E, is beginning its testing.

Building the total ground support system, of which the launch complexes are only a part, is nearly as big and as difficult an undertaking as designing and testing the missiles.

Missile bases, for instance, have created fantastic new requirements for construction standards. Building foundations must be aligned to the precision tolerances of fine machinery. Electricians must install miles of wiring with the knowledge that one faulty circuit will knock a missile out of action. Fuel storage tanks and loading lines must be assembled to hospital sanitary standards.

In early "soft sites," some of which are now operational, the structure for one emplacement contains 129,000 tons of steel and con-
Advanced Terrier surface-to-air missiles, anti-aircraft protection for the fleet, stand at the ready on the USS Preble.
crete; its control center has nearly 4,000 miles of electrical circuitry, enough to provide a telephone exchange for a city the size of Cheyenne, Wyoming. Newer "hardened" complexes, called silos, call for building into soil and rock a 175-foot-deep cavern to house the missile, its fuels and other service requirements, the blockhouse to control its flight, and facilities to keep the missile prepared to fire on a few minutes notice, today or a year from now.

But the ICBM, with its thermonuclear warhead, is an instrument of total war. Equally vital to the safety of this nation are weapons to support a tactical defense in the event of "small wars." At Convair/Pomona, General Dynamics operates the nation's leading research, development and production facility for such tactical guided missile systems as Advanced Terrier, Tartar, Redeye and Mauler.

All air-defense missile systems have at least one thing in common: they must be capable of fast reaction. An attacking vehicle has all the advantages of surprise and maneuverability. The defending missile must be able to intercept swiftly and surely. It must take to the air the moment the enemy is detected; and to catch and kill it must fly faster and maneuver more adroitly. It must counter, in flight, every evasive trick that the attacking vehicle will attempt.

As a class, the newer generations of defensive missiles are highly sophisticated devices. Powerful rocket engines with high thrusts are required to accelerate them; pounds of electronic gear give them the necessary "intelligence." Yet these missiles must be both small and light, and rugged enough to be fired by personnel with limited technical training.

An example is Advanced Terrier, a supersonic surface-to-air guided missile which is now the Navy's principal fleet weapon for anti-aircraft protection.

Guidance commands come from an electronic brain packed within the missile. A computer on the surface tracks the target, instructs the radar transmitter where to direct its signal. The weapon's "brain" directs the missile along the pencil-thin radar beam until Advanced Terrier has met and destroyed the target.

Tartar has a similar mission, but is smaller and designed specifically for shipboard use on destroyers and other vessels where space is a problem. Tartar, however, has a homing-guidance system which permits the missile to "follow its nose" rather than a ground-based radar beam.

Both of these, however, are sizable. Advanced Terrier, including its booster, is 27 feet long. Tartar is 15 feet long. But the foot soldier also needs protection from enemy aircraft. Redeye is the infantryman's own private anti-aircraft missile. It is about 3½ feet long and 2¼ inches in diameter, and weighs 16½ pounds. He can carry it into battle under his arm and fire it from his shoulder.

Redeye searches out its target by following the heat rays given off by any fuel-burning aircraft. An electronic circuit directs a set of steering fins to keep the missile on an intercept course.

Redeye has a dual-thrust solid propellant engine with provisions for protecting the gunner from its blast.

In a less advanced state of development is Mauler, a highly mobile battlefield air defense system designed to knock down enemy close-support tactical missiles as well as jet aircraft. As an all-weather, completely integrated weapon system, it can be mounted in a military tracked vehicle, and be able to deliver highly accurate fire even while on the move itself; or it can be dropped by parachute or helicopter into field position.

Each Mauler unit is to be able to fire and move with complete independence. Each will contain its own power supply, target detection and electronic fire control equipment, as well as its own battery of missiles.

On August 1, 1960 a revolutionary aircraft became operational as part of the deterrent force of the Strategic Air Command. Six weeks later, it won first place for radar bombing in SAC's annual combat competition. Five months later, it broke six world's speed records - five of them formerly held by...
The Air Force B-58 Hustler supersonic bomber became operational during 1960; a few months later it broke six world's speed records.
Russian planes — by flying 1,284 mph over 1,000 kilometers and 1,061 mph over 2,000 kilometers. The plane is the supersonic Air Force B-58 Hustler, produced by the Convair Division at Fort Worth, Texas. The B-58 is the free world’s newest, swiftest and most versatile long-range bomber. Built to deliver nuclear bombs at intercontinental distances with pinpoint precision, it can penetrate to targets from above 60,000 feet, hurtling at double the speed of sound, more than twice as fast as any other bomber in America. Alternatively, it can hug the ground at 500 feet, going faster than a .45 bullet, to duck under an enemy radar net.

The Hustler is the latest of a long series of military aircraft with which Convair Division has served the United States. The earlier names have long been famous: The Catalina Flying Boats, the B-24 (Liberator) of World War II, the ten-engined B-36, the F-102 all-weather supersonic interceptor, and its advanced brother, the F-106, which holds the 15-to-25-kilometer speed record of 1,525 miles per hour.

To meet the Air Force requirements in the early Fifties for its first supersonic bomber, Convair Division proposed an unconventional plane: a relatively small aircraft for a bomber, with a delta (after the triangular shape of the Greek letter Delta) wing and a disposable under-fuselage pod to carry the payload. The proposal was accepted by the Air Force, which also designated Convair as weapon system manager.

As weapon system manager, Convair was directed not only to design, build and assemble the new airframe—but was also given responsibility for overseeing development and procurement of all major sub-systems, except the government-supplied jet engines. The complete weapon system included, as well as the vehicle, the ground equipment and logistic support needed to keep it ready for combat.

Early in the development of the B-58, the National Advisory Committee for Aeronautics discovered the area rule, a method of overcoming the considerable rise in drag at the speed of sound. Convair engineers first applied it to the F-102 all-weather jet interceptor, later to the F-106 and the B-58 Hustler.

On all three aircraft, the area rule application is most apparent in the wasp-waisting of the fuselage. On the F-106 and B-58, the effect is to increase the range of the two planes by reducing the amount of power (and fuel) required to overcome the drag rise near the speed of sound. The area rule has a lesser but still significant benefit in reducing drag on both planes at speeds as high as Mach 2.

Design of the B-58 structure itself required new concepts. One of these was the use of large sandwich panels for the primary structure. The "sandwich" consists of a cellular honeycomb core, bonded between two thin, tough skins. The core may be glass fiber or metal; the skins, aluminum or stainless steel. The bonding process may employ either organic adhesives or brazing.

Sandwich material is structurally efficient, has a high strength-to-weight ratio, provides aerodynamic smoothness, and is resistant to sonic fatigue failure. Its use helped hold the B-58’s structural weight to only 13.8 per cent of maximum gross weight (compared with a low of 19.8 per cent among previous operational bombers). As a result, nearly two-thirds of the B-58’s maximum takeoff weight is fuel.

Sandwich panels comprise some 90 per cent of the Hustler’s wing surface. Stainless steel is used in areas subject to severe loading and heating (such as the elevons). Since the entire wing is used as a fuel tank, glass fiber honeycomb is the core material used most extensively; being a poor thermal conductor, it insulates the fuel from external heat.

The Convair-pioneered delta wing added further to the aircraft’s performance flexibility. The large triangular shape provides both the wing thinness and sweep-back required for supersonic speed at high levels without sacrificing the wing volume needed to carry large quantities of fuel. At the same time, the wing affords exceptional structural rigidity and stability when the plane is flying low-level missions in the turbulent air only 500 feet above the ground.

Until the B-58, bombers were designed on the same principle as boxcars—a body large enough to surround the cargo. The B-58 broke with that tradition; the fuselage was made only large enough to house the crew (three men) and the essential flight systems. The entire "bomb bay"—in the form of an external disposable pod—can
Air Force's SAGE air defense system makes use of CHARACTRON shaped beam tube in electronic consoles to display areas situation.
be dropped, letting the Hustler fly home lean and fast.

Today, the B-58 is probably the most flexible military aircraft in the world. As a rocket-launching platform, it achieved the first supersonic air launch of a ballistic missile. In another approach it has shown its feasibility as a launcher for a satellite-inspection vehicle. In spite of the availability of missiles—and in some ways because of the very frightening power of the ballistic missile with a thermonuclear warhead—the manned bomber now is more important than ever. A missile cannot be recalled once it is launched. Bombers can take to the air at the report of danger, but can be called back if the report proves false, avoiding war by accident. Today, the strategic doctrine of the Air Force is that a mixed force of bombers and missiles will be needed indefinitely.

When strategic decisions must be made in minutes, tactical decisions in seconds—and equipment must function reliably in terms of millionths of a second—electronics becomes an integral part of every decision and every weapon. As part of its over-all status as a weapons producer, General Dynamics has built a tremendous capability in a field that barely existed one generation ago, when electronics still meant largely radio.

Electronic equipment guides a missile to its destination, controls its operation, tracks its flight, transmits its test data to ground stations, and reduces that data to meaningful use. Human reaction times, too slow to cope unaided with the incredible speeds of modern aircraft, are aided by electronic devices. Ground and sea warfare depend on electronics for communication and reconnaissance.

In one decade, modern weaponry and modern electronics—two sides of the same coin—have developed together. The weapons producer has perforce become an electronics producer.

The list of military electronic products made by General Dynamics is already an impressive one, ranging from airborne computers to control aircraft in flight through an assortment of communication and surveillance equipment, automatic testing equipment, missile tracking systems, radar of all kinds, and anti-submarine warfare equipment.

The interrelation between electronics and a weapon can be seen with the Atlas. Its original design was worked out with the aid of giant computers. In the course of its construction and testing, its sub-systems are checked and rechecked with electronic test equipment. During shipment of the missile from San Diego, where it is built, to the base where it is to be flown, electronic sensors keep a constant check on the internal gas pressure that keeps the missile's skin rigid. In preparation for test flight, an electronic countdown quickly checks all of the missile's guidance, communication, telemetering, and emergency destruct systems. From the first second of flight, electronic components guide the missile to its destination, control its fuel flow, tell the nose cone when to part company with the rest of the missile, and radio back data from instrumented points in the missile. The data, recorded on some 10 miles of magnetic tape, include temperatures, vibration, valve position, acceleration, fuel flow.

When the first Astronaut goes into space as part of Project Mercury, scientists on the ground in the General Dynamics-designed-and-built control room at Cape Canaveral will receive, on giant visual display panels, immediate information about the second-by-second progress of the space vehicle and the physiological reactions of a man in space.

On the ground, new theories of warfare are based on broad dispersal of military units—which increases the need for effective communications to coordinate actions. General Dynamics supplies the Army with light, flexible and reliable electronic communication systems, both telephonic and radio. With its BASIC battlefield information system, tactical ground operations can be revised. Forward scouts carry tiny data transmitters; button-punched information on enemy dispositions and movements can be sent in a millisecond "burst". This field in-
Test equipment checks a tactical missile. Reliability requirements of modern weapons make rigid quality control necessary.
Intelligence will appear visually on a rear area receiver similar to a television set to give command personnel timely and accurate information about a tactical situation on which to make decisions.

One factor common to all General Dynamics systems lies in an article of faith—reliability.

A major military weapon must work. If it is ever needed, there will be no time to correct failures after they occur. Reliability is planned into a product from its very conception.

The 100,000 parts of the Atlas come from 3,500 different suppliers. Failure of an eight-cent cotter pin can destroy a missile—and its mission—as effectively as a breakdown in one of its giant motors. The B-58 contains over 6,000 tubes, diodes and transistors; one defective electrical circuit can stop a supersonic plane, racing a mile every 3 seconds, as effectively as anti-aircraft fire. A nuclear submarine carries the lives of 100 men with it the very first time it submerges.

A weapon system is only as good as its reliability—its ability to work perfectly in every particular, whenever it may be needed.

General Dynamics builds this sort of reliability into every one of its systems. The very fact that supersonic aircraft, intercontinental missiles and nuclear submarines—all tremendously complex systems—could be brought into being successfully at one time, along with a host of other concurrent production and research activities, is clear indication of sound engineering and management.

For General Dynamics, reliability is a management function. At its divisions, responsibility for reliability starts not with an inspector or an engineer but with the division president. Reliability begins with goals—the mission requirements, operational objectives. Imaginative concepts are matched against sound engineering principles. Every component and sub-system is pre-checked through intensive computer programs, as individual items and in relation to mathematical models of the total system.

Preliminary studies for one aircraft involved over 1,300 hours of computer time—the solution of more than a billion arithmetic problems, equivalent to almost 20 million man hours of figuring. Parts are redesigned whenever necessary until predictions agree with the requirements of the system. Only then are components specified for production.

Subcontractors and suppliers are selected with extreme care. Selection depends on proven technical and management abilities, past performance in quality work, and financial stability.

Whether purchased or directly produced, components are subjected to exhaustive tests. Among these tests: X-ray, ultra-sonic probe, vibration and fatigue, tensile strength and hydraulic pressure, reaction to environmental conditions of extreme heat, extreme cold, and the high vacuum of space.

During fabrication, a quality control program as meticulously worked out as the weapon design itself is employed to weed out probability of error. Parts are inspected and tested individually. As parts are combined into subsystems, these are tested under operating conditions, as are larger systems and then the final weapon itself. Special automatic testing equipment checks vital systems, and is in turn constantly checked itself for possible malfunction.

As one indication of the rigor of this program: at Convair/Astronautics, which assembles and flight-tests the Atlas, over one third of all employees of the division are involved in testing procedures at some level.

The potential for error can never be entirely removed—but as far as possible, General Dynamics tries to do just that. General Dynamics never considers that "it is just selling a product." As a philosophy, it feels that it is producing, in partnership with the Government, the vital items that may save lives and perhaps the very existence of the free world. Reliability, from top management to production-line, is a crusade.

Does it work? One evidence comes in a statement from the Navy: "Terrier is so reliable that if we have a failure on a missile test, we check the test equipment to see that it is working properly before we start checking the missile."
Section 2

CAPABILITY FOR INDUSTRY

The Convair 990, world's fastest passenger aircraft, is readied for flight.
Discoveries and techniques that make possible great weapon systems often have ultimate application to industrial and consumer needs.

Aerodynamic research for military planes has resulted in new high-speed jet liners for passenger travel. The development of the electronic computer for Government uses has brought about a complete revolution in the processing of information. The Manhattan Project opened the way to atomic power for peaceful uses.

General Dynamics serves industry as well as defense in its habit of research. It is as important to think in terms of the needs decades hence for industry and the consumer as it is for military requirements.

As General Dynamics has met, and will continue to meet, the need for new and more effective weapons to safeguard civilization, so also it meets the call for new and better products with which to enhance that civilization.

The Convair 880 cruises at 615 miles an hour. The present southern transcontinental speed record was set when Delta Air Lines took delivery of its first 880 in February, 1960. The plane raced from ocean to ocean—from San Diego to Miami, a distance of 2,267 miles—in 3 hours, 31 minutes and 54 seconds.

Since the end of World War II, Convair Liners have earned an enviable reputation for dependability, ruggedness and economy. Over a thousand of the Convair 240/340/440 series of twin-engine propeller planes were made, and most are still in use.

General Dynamics’ commercial planes have staked out a particular market—the medium-range flight which represents the bulk of all air traffic. When the jet age came in sight, General Dynamics planned its jets for that market.

For its new planes, it set these specifications: the aircraft had to be fast, fly so close to the speed of sound that they could not be obsoleted short of the arrival of true supersonic commercial transport. They had to be comfortable for passengers. They had to serve the medium-range market, operate out of most commercial airports that now handle four-engine piston planes. They had to be rugged; the stresses from the frequent take-offs and landings of medium-range traffic are more punishing than those of actual flight.

To build speed into the plane, designers picked a new jet engine, a commercial version of the engine that powers the supersonic B-58. For the plane itself, they created the thinnest of all jet airliner wings, with an unusually large surface.

Into the wing, they built extra strength through a system of three main spars interconnected by bulkheads and trusses, thus distributing the structural load. The large wing supplies another bonus: fuel capacity for operation on long-range non-stop flights, and fewer servicing requirements for the aircraft in several-stop, medium-range service.

For comfort, they built in the quietest passenger ride of any four-engine jet by using extensive glass fiber padding, sound-damping tape, and heavy-gauge aluminum alloy in the fuselage.

Toughness was verified with one of the most punishing test programs ever devised. An entire fuselage was hung by stub wings in a giant water tank. Hydraulic rams pushed the airframe up and down 62,000 times to simulate landing and take-off stresses, equivalent to the effect of more than 20 years of airline service.

Though the 990 strongly resembles the 880, it is larger, has a longer range—and will be even faster. The extra speed comes from the combination of more powerful aft fan engines, and from a visible feature that distinguishes the 990 from all other aircraft—its speed capsules. These capsules—“aerodynamic anti-shock bodies”—roughly resemble overturned canoes placed on the wings. When a plane flies close to the speed of sound, air passing over the curved upper surface of the wing reaches supersonic speed and develops shock waves that increase drag. The capsules smooth...
The swing tail of the Canadair Forty Four permits straight-in loading, cuts handling time and cost for commercial air cargo.
the airflow to lessen the shock wave.

Although General Dynamics' jet transports can serve route segments varying in length from 300 to 4,300 miles, there still remains a need for shorter-range aircraft to equip "feeder" airlines serving smaller communities. The turboprop-powered twin-engine Canadair 540 fills this role. It combines high speed with passenger comfort and the convenience of integral loading ramps.

By air, transcontinental freight shipments can be made in one day, compared to an average shipping time of three weeks by other means of transport. Yet although "time is money," for many years air freight, which can save both, has been more discussed than used. Planes and flight schedules have been designed for people. Cargo has been, at best, an incidental.

Over-all volume of air freight has increased steadily, but it still represents less than 1% of all the freight moved in the United States last year. Air freight remained small because the right planes were not available; the right planes were not built because volume was low.

Beginning with 1961, that picture could change significantly. The Canadair Forty Four, the first plane specifically designed for commercial air freight, will go into service with three United States all-cargo air lines.

General Dynamics decided to break the cycle because it was convinced that air cargo—as with passenger traffic back in 1932—needed only the proper plane. The swing-tailed turboprop Forty Four is 135 feet long, and capable of lifting more than 30 tons. It flies at better than 400 miles per hour, with a range up to 6,000 miles.

The entire tail section swings open more than 100 degrees. Cargo can be run in fast in straight-line motion. With an integrated ground loading system and full palletization, the plane can be unloaded, reloaded, and off the ground in one hour—compared with six hours for passenger planes converted to cargo work. Ease of loading, combined with low direct operating costs—estimated at 4-5 cents per ton mile—will cut the expense of carrying freight sharply. Customer airlines which have ordered the Forty Four have already applied for rate reductions, cutting as deeply as 70% below former levels.

These new rates in themselves will be competitive with many ground transportation tariffs. But air freight promises economies far beyond changes in current rate structures.

If a manufacturer can be assured of regular, on-time, one-day delivery of his product to any point in the country, the need for warehousing and distribution centers drops sharply. Production can be keyed closely to orders, inventory and interest costs reduced, and redundant handling charges eliminated. With these additional factors considered, true cost of air freight should drop far below that of any other means of transport.

Accelerating population growth plus increased per capita use of electricity means that power will ultimately be required from every source through which it can be developed—including nuclear power plants. The Sixties is the decade of decision on which types of atomic power plants will be capable of generating electricity at costs equal to, or even less than, plants based on fossil fuels. As the most direct route to economic atomic power, General Dynamics, through its General Atomic Division, is developing high-temperature, gas-cooled nuclear power reactors both for central station power and propulsion.

Modern thermal power plants burn coal, oil or gas to produce the high-pressure and high-temperature steam required by modern high-efficiency turbo-generators. In an atomic plant, nuclear reaction rather than burning fossil fuels supplies the heat.
Simulated fuel elements are loaded inside coolant flow test installation for high-temperature gas-cooled reactor.
Efficient use of nuclear fuel for power generation also requires that this energy be extracted at high temperature and transferred to another medium which will either heat water into steam or directly drive a turbine. General Atomic scientists and engineers chose helium gas as the most effective medium to transfer the high nuclear heat.

In the General Dynamics HTGR system for large-scale electricity production, helium gas passes through the core, absorbing the heat from the atomic reaction. The gas leaves the reactor at 1,380 degrees F, then passes to a boiler where it converts water to 1,000-degrees steam at pressures of 1,450 pounds per square inch for the turbines. This high-temperature, high-pressure steam fits the requirements of modern generating equipment and can be used with existing electricity-generating technology.

Another part of the economic prospect of HTGR lies in its efficient fuel use. Generally, reactor fuel life is limited by the burning out of uranium atoms, which makes the fuel fall apart. Fuel lifetimes over two years are considered very long. In the HTGR, the fuel is mixed into a carbon matrix and does not crumble even when a great part is burned out. As a result, the fuel in the HTGR will last from three to seven years.

The first HTGR power station, a 40,000 kilowatt prototype designed to point the way to economic nuclear power, will be built at Peach Bottom, Pennsylvania. Beyond this prototype, the HTGR concept has been selected for a large-scale development program directed toward construction in New York State of a 300,000- to 500,000-kilowatt capacity nuclear plant that would be competitive in cost with fossil fuels.

Smaller nuclear power plants, in the 25,000- to 100,000-kilowatt class, will be needed both for land-based power generation and for ship propulsion. For this purpose, General Dynamics is perfecting another high-temperature, gas-cooled system, moderated by beryllium oxide rather than carbon. The Atomic Energy Commission has awarded General Atomic Division a contract to develop and test-operate the first beryllium oxide reactor to be built for civilian power purposes.

The beryllium oxide system, because it allows fewer neutrons (neutral particles, created by the fission process, which in turn hit other atoms and cause them to fission) to escape, provides high fuel economy. In this type, the hot helium leaves the reactor at nearly 1,500 degrees and goes directly into a gas turbine, eliminating intermediate boiler systems. In a merchant vessel, the turbine can be coupled to the propeller shaft to drive the ship; in a land-based system, the closed-cycle gas turbine drives a generator to produce electricity.

The sources and forms of energy are almost limitless, and General Dynamics is pursuing many combinations of them. It has joined forces with a large segment of the investor-owned utility industry to push ahead in nuclear power production, in the study of energy from the fusion of hydrogen atoms, and in the direct conversion of heat to electricity. Additional programs for the United States Government range widely from power reactors to development of thermoelectric devices to harness solar energy for auxiliary space power, to special TRIGA research and test reactors.

More than 20 TRIGA research reactors are already in use or being installed on five continents. The latest addition to this family of reactors is the Mark F "pulsing" TRIGA, which opens new research and testing opportunities whenever short, high-intensity pulses of nuclear radiation are required. TRIGA's today are being used for a wide variety of research and biomedical applications; in a number of cases they form the core of nuclear training centers set up by foreign governments.

American universities which have selected TRIGA's for operation on their campuses include Columbia, Cornell, Illinois, Kansas State and Arizona. Abroad, they have been chosen by the University of Mainz in Germany, two universities in Japan, the University of Minas Gerais in Brazil, and Lovanium University in the Congo.

General Dynamics has long produced fine radios and high fidelity
Complex engineering drawings are produced on microfilm in less than one-half second directly from computer data by the SC-4020.
Advanced manufacturing techniques and electronic testing cut electric motor vibration, reducing noise and improving performance.
and stereophonic music systems under the famous Stromberg-Carlson label. But the key to modern electronics is communications and information handling—and in precisely these areas lie General Dynamics' greatest strengths.

Growing masses of data call for an equally rapid growth in the use of electronic information processing systems for control. But information processing requires more than a central computing "brain." Equally essential is finding manageable ways of receiving, and using, the results.

General Dynamics makes special-purpose computers for aircraft and missile control. But emphasis is more on devices for transmission and end use of data—the peripheral equipment that makes it possible to translate the fast output of high-speed computers into a form that can be absorbed by the human eye and mind.

Its electronic printers supply data from a central computer at up to 100,000 words or figure combinations per minute, to print mailing labels for mass circulation magazines, or utility bills, or information sent from a space satellite. A high-speed transceiver transmits electronic impulses over commercial telephone lines or microwave systems to allow data to be transferred from one location to another, or to permit computers to "talk" to each other.

Another system translates computer data directly into the charts and graphs that supply an immediate picture the researcher may be seeking. General Dynamics' SC-4020, a computer readout microfilm printer, will record data on microfilm at 15,000 characters per second, plot permanently recorded graphs at 15,000 points per second, and eliminate the time lag and the potential error involved in plotting graphs by hand from printed computer output. Other adaptations will produce complete engineering drawings within one-half second.

Information handling has older meanings, however—the direct transmission of the spoken and written word. A high-speed facsimile transmission system can transmit a letter, a drawing, or a printed page from coast to coast in four seconds at little more cost than a first-class letter.

In the field of controls and instrumentation, General Dynamics has developed advanced systems for nuclear power reactors. Solid-state circuitry is employed in both nuclear and process control systems, assuring reliability and compactness.

Telephony is expanding its boundaries. New DYNALOGIC electronic switching systems will provide better telephone services at greater speed. Calls can be transferred to other phones by coded dialing; conference calls of several parties can be arranged; waiting time after dialing will be reduced to microseconds. For telephone companies, the new system solves the problem of proliferating space requirements. A 600-line DYNALOGIC system needs only eight square feet of floor space compared to 625 square feet with present electro-mechanical systems.

Faster information handling also means greater safety control where human lives are at stake. Within the New York metropolitan area alone, with its eight airports, a total of 3,200 flights a day arrive and depart. In spite of that traffic, safety records are amazingly good—due largely to a wide range of air-to-air and ground-to-air electronic devices that make it possible to control this churning of high-speed motion.

General Dynamics, through its long association with aircraft, has been deeply concerned with aircraft safety. Electronic products designed around this one purpose include: automatic air-traffic control systems, aircraft data-link systems, both airborne and ground radar, beacon monitoring and control systems, and mobile radio transmitters and receivers.

Industry moves on thousands of unseen items. One of these is the electric motor—without it, very few wheels would turn at all.

General Dynamics, through its Electro Dynamic Division, has made electric motors for 80 years. As an essential part of machinery, the motor is generally taken for granted. But motors vibrate—and vibration creates noise.

In submarine warfare, water-borne sound which can reveal your pres-
Compressed gases are playing a growing role in manufacturing. Carbon dioxide, which this plant produces, is used in over 120 industries.
ence is a hazard—the submarine particularly requires stealth, the absence of noise, to complete its mission.

To meet Navy requirements, General Dynamics builds motors that are almost vibration-free. Key parts are tested and balanced under stroboscopic light and sound analyzers. The completed motor is so well balanced that, externally, neither sound, sight nor touch will indicate whether the motor is on or off.

Dynamics has reduced motor shaft vibration to as low as 10 millionths of an inch, a tiny fraction of the 10 thousandths of an inch standard for general non-precision applications.

For industry, lack of vibration in a motor means new standards can be applied to production machinery where extremely close tolerances are required. Low vibration means not only greater precision but less wear and a longer economic life for motors and the equipment they power. It can mean quieter factories, and a more comfortable climate for plant workers.

In another attack on mechanical noise, General Dynamics engineers at its Electric Boat Division found a way to quiet the widely-used ventilating fan.

Slotted blades in the fan make it possible for the vanes of the fan to pass through the air without creating turbulence while still moving large volumes of air. Result: a noise level only a small fraction of that created by standard fans. These "vaneaxial" fans have application wherever the requirement exists for efficient movement of air with minimal noise and vibration.

But some problems of modern manufacturing are not solved merely by improvements to relatively standard equipment. For example, nothing was available to measure precisely the effects of acceleration and deceleration on missile parts. So General Dynamics created its own new testing equipment—and in the process, a new line of machine tools.

Dynamics engineers developed a unique pneumatic actuator they called HyGe. HyGe generates a repeatable and precisely-controlled high-energy thrust through differential gas pressure acting on two faces of a thrust piston in a closed cylinder.

This principle has been applied to a whole family of HyGe simulation and testing machines and Dynapak high-energy-rate metal forming machines. These are capable of applying millions of pounds of pressure in a fraction of a second, making solid metal "flow" and even changing the characteristics of its grain.

 Dynapak forming removes old restrictions and opens new design possibilities for even such high-temperature metals as molybdenum and tungsten. Tungsten melts at 6,170 degrees F. It will retain its strength long after steel has melted and evaporated. For that very reason, it has been difficult to work. Under high-strain rates created by Dynapak, molybdenum may be formed in conventional tooling, and tungsten has been extruded into shapes never achieved before. Dynapak has even created a new class of metal parts—forged castings. Parts are cast slightly oversize, then sized in a Dynapak die to obtain the greater strength of a forging at little more than the price of a casting.

General Dynamics, through its Liquid Carbonic Division, is the world's largest producer of carbon dioxide. In addition, it manufactures oxygen, hydrogen, nitrogen, acetylene, argon, nitrous oxide and other industrial and medical gases. These products, taken from the atmosphere or broken out of fossil fuels, are literally invisible and omnipresent.

Carbon dioxide once was identified mainly as the " fizz" in soda pop or the chunk of " dry ice" that kept ice cream frozen. Working closely with other industries, Liquid Carbonic has developed innumerable other uses. Both fresh meats and such prepared foods as instant coffee or cake mixes use CO₂ in their processing. In golf balls, the liquid center is frozen with carbon dioxide before being wound in latex. Rubber for tires and paint for houses are both improved by use of carbon dioxide.

Other gases also are playing an increasingly large role in industrial production. Oxygen-lancing
Building materials produced by the Corporation are playing a major role in the building boom that is changing the face of Chicago.
is growing in importance as a steel-making technique. Electronic components are produced under an atmosphere of nitrogen or argon. Hydrogen is a key agent in the fusing of glass and the refining of rare metals.

Perishable goods are better preserved because gases pre-cool the vehicles in which they travel. Foundry operations are revamped because carbon dioxide makes possible core and mold hardening in a fraction of the time required by former methods.

Industrial gases have already helped create a revolution in the eating habits of the United States by making possible the development of frozen foods. They are the keystones for a still newer form of food preservation—freeze drying (rapid freezing followed by removal of liquids in crystal form in a vacuum) which promises long preservation of even cooked foods without refrigeration.

Fifteen years ago, General Dynamics' Liquid Carbonic Division served about 20 different industrial categories; today it serves more than 150 different categories.

The basic principles of construction were laid down millennia ago. But in recent years, even some of the principles have changed. Mushrooming population and greater intensity of land use demand more concentrated construction, at reasonable cost.

In southwest Chicago a huge addition to Evergreen Shopping Plaza, a 900,000 square foot shopping center, will utilize a technique to cut the total material weight of construction by almost 50% under any comparable method. The key: a unique engineering design making extensive use of Dynacore prestressed hollow-core slab, designed and produced by the Material Service Division of General Dynamics.

The prestressed cored slabs offer both strength and light weight; the hollow cores provide built-in insulation and conduits for pipes, cables and utilities; with a variety of surfaces, the slabs can be used either as floors or as walls. The technique makes possible single concrete slabs 8 feet wide, 3 feet deep, and 100 feet long which can be manufactured on an assembly line basis in advance and lifted into place quickly and easily at the construction site.

The Material Service Division is one of the largest producers of ready-mixed concrete, concrete products, sand, gravel and crushed stone. It has pioneered in new applications for reinforced and prestressed concrete and new lightweight concretes with great strength. These permit the architect far more freedom in design than ever before, without sacrificing economy.

For massive construction—dams, for instance—concrete has long been a staple. It has been the underpinning of transportation, particularly for heavy-traffic highways and airports. Today, concrete is making inroads on areas formerly reserved for other structural materials—largely because of the comparatively new technique of prestressing. By eliminating otherwise undesirable strains, prestressing makes possible enormous savings in the amount of steel and concrete required to support a given load; by reducing other materials needed, the light, strong and flexible prestressed members offer economic advantages over competitive materials. Material Service prestressed beams, for instance, now support numerous bridges on the network of new highways speeding traffic in the Chicago area.

In the Chicago metropolitan area Material Service pioneered in the use of Redi-Mix—a system of premixing concrete at a central point and in transit for immediate pouring at the construction site. That operation today has been automated extensively—electronic control systems measure out precise amounts and types of cement, aggregate, and water to create a concrete custom-designed for any specific building application.

These automated techniques, combined with new lightweight concrete aggregates developed by Material Service, produce concretes that are lighter, stronger, less brittle, and more uniform in grain. These have made possible such projects as Marina City, being built on the Chicago River at the edge of the Loop, whose twin 60-story towers will make it the tallest reinforced concrete structure in the world.
Section 3

CAPABILITY FOR THE FUTURE
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Quickly as change has come in the past generation—it will come even more quickly in the next. Few organizations have been able to meet the change so well as General Dynamics. Few are so ready for an accelerated rate.

General Dynamics today is a versatile complex of many specialized units, whose total is greater than the sum of its parts. In creating its great products, it has accumulated a deep reservoir of men, talents, machines—and ideas. Out of that reservoir will come the great products of the future.

Its binding spirit is a sense of dedication to the national interest. Its denominator is its people: their freedom to inquire; their direct responsibility for developing new and better products and processes; their cross-fertilization of ideas and sharing of knowledge.

What kind of people make up General Dynamics? Ordinary people, except that the products they make require an unusually high standard of competence, whether the individual is a production worker, a clerical specialist, a technician, or a manager. The advanced nature of many production and research programs calls for a high ratio of technically trained persons. At General Dynamics Electronics, one out of every seven employees is technically trained. For the tactical missile operation at Convair/Pomona, there is one engineer for every three other employees. At General Atomic Division, there is one scientist, engineer or other technically trained person for every non-technical employee.

General Dynamics lives on the frontiers of science. Its studies range from some of the oldest disciplines such as biology or metallurgy to such new ones as plasma physics and astrophysics. When necessary, the entire background of experience and knowledge from all the Corporation’s technical resources can be focused to attack a single problem.

Effective anti-submarine warfare is one such problem. Militarily, the seas represent the greatest of all hiding places. The Arctic Ocean alone covers an area twice as large as the United States. As the existence of a missile-firing submarine is an immeasurable aid to the defense of this country, so the possession of similar weapons by potential enemies is a threat. To help find a counter to this threat, General Dynamics can, and does, marshal the competence of its several divisions: from Electric Boat Division, knowledge of submarine construction and warfare; from Convair and Canadair, Ltd., aerodynamic skills for air search and hydrofoils; from General Dynamics Electronics, advanced techniques in sonar and hydroacoustic reconnaissance.

But the ideas of men must be backed by the means with which to execute them. To provide these means, General Dynamics has invested in research and production facilities employing the most advanced equipment. A few examples for space research alone are illustrative.

High-vacuum test chambers 12 feet in diameter and 20 feet long simulate environmental extremes found in space 100 miles from the earth’s surface. A working mock-up of a three-man space station duplicates all space conditions but absence of gravity to help develop such life-support systems as waste disposal and water regeneration. Materials and components are subjected to extreme vibration and acceleration forces, at temperatures varying from 300 degrees below zero to 750 degrees above, in an ultra-high vacuum chamber capable of duplicating conditions at altitudes up to 250 miles. For space vehicle instrumentation studies, a dynamiton accelerator bombards test specimens with charged particles accelerated with energies up to three million electron volts. A hypersonic, shock-driven wind tunnel helps scientists determine heat-transfer characteristics under velocities up to 14 times the speed of sound and aerodynamic characteristics up to Mach 17. A molecular beam generator has been devised which is testing the impact effect of high-velocity molecules and ions on various target samples that represent possible space vehicle materials.

In space technology, General Dynamics already has an impressive list of accomplishments. It built this nation’s first intercontinental ballistic missile. Its experience
includes both liquid and solid propellants. It is building this country's first space vehicle to use liquid hydrogen as a propellant. It is building upper stages for multi-stage rockets and payloads for them. And it is studying the propulsion systems that will replace the present chemical fuels for some missions.

The Atlas currently is the backbone of this nation's space effort. Designed as a military weapon, it was drafted for early ventures into space because it was the most powerful booster available. It won the right to spearhead the nation's space efforts because of its accuracy and reliability. Atlas is a key part of the Midas and Samos satellite programs, and of the Mercury man-in-space program, in which the first American astronaut will be propelled into an orbit around the earth.

More ambitious programs for orbital flights, lunar examination and inter-planetary missions will depend upon Atlas coupled with Centaur, a high-energy upper stage vehicle. Centaur is designed to send payloads of nearly 9,000 pounds into an orbit 300 miles above the earth, or soft-land a 1,000-pound package on the moon. It will loft large communications satellites and research satellites into orbits 22,000 miles above the earth, and send instrumented probes to other planets of the inner solar system.

Meanwhile, General Dynamics engineers and scientists are at work on other satellites, space ships and propulsion systems for the future. Code names assigned to three of these projects are ARENTS, Apollo and Orion.

Apollo is a manned spacecraft planned to carry three men for orbital flights around the earth and for reconnaissance flights to the vicinity of the moon.

General Dynamics is cooperating in preliminary design study of the vehicle for the National Aeronautics and Space Administration. In addition to the preliminary design, the study will include requirements for construction and for propulsion, for crew protection, re-entry problems, the life-support system and guidance.

ARENTS calls for construction of three experimental satellite payloads to be launched into orbits 22,000 miles above the earth starting in 1962. They are designed to determine the effect of exposure to very high altitudes for long periods on materials, components and subsystems planned for future space programs.

A longer-range program, Project Orion, is a plan to use small, carefully controlled nuclear pulses for rocket propulsion. Still another approach involves a nuclear heat exchanger rocket, in which an enclosed nuclear reactor acts as the heat source for a propulsive gas, with nuclear energy producing high-temperature ion plasma for a propulsion drive where high acceleration is not required.

In support of these sweeping major programs, General Dynamics also is carefully going over some of the ground work that these systems will require, including the possibility of developing very small jets for controlling satellites and methods of sensing deviation from orbital path.

The transition from piston to turbine-powered aircraft will be completed by the major scheduled airlines within the next few years. After that, probably by the early Seventies, will come the next major advancement in commercial airliners—the supersonic jet transport.

General Dynamics' studies, designed to keep the company abreast of transport development, indicate that the supersonic jet passenger aircraft is technically feasible.

But it cannot be built by private capital. The magnitude of expected development costs dictates financing on a scale far beyond the capacity of any single aircraft manufacturer, or even any grouping of the major airframe manufacturers.

Studies at Convair Division indicate that the supersonic jet transport of the 1970's will be more than 200 feet long—nearly twice the length of today's jet airliners—but the span of its delta wing will be less than 100 feet, slightly under that of today's jets. It will carry about 130 passengers at cruising speeds of more than 2,000 miles an hour, yet it will be able to operate from existing major
airports. Los Angeles will be only an hour and a half from New York; Paris less than two hours.

It will be most useful on very long-range routes, such as transcontinental or trans-oceanic flights, since it rapidly loses its speed advantage over shorter distances. Even availability of supersonic transports, therefore, will leave major markets for subsonic medium- and short-range jet transports.

When the supersonic passenger airplane arrives, General Dynamics will have had an important part in its development. No other jet transport producer in the world has amassed as much experience in the design, production and flight-testing of supersonic multi-engine aircraft, or added as much to the knowledge of the art, as has General Dynamics with its 1,300-mile-an-hour B-58 Hustler bomber.

Few segments of the economy are more deeply influenced by work in the laboratories than electronics.

Both military and civilian needs call for an accelerating degree of complexity. And every increase in complexity increases the problem of reliability.

The development of the transistor and other semi-conductor devices has provided new dimensions for building complex devices in small size with reasonable reliability. Dynamics' engineers have already set high standards for miniaturization. A missile guidance system which originally took up 1,050 cubic inches and weighed 31 pounds can be brought down to a volume of 105 cubic inches and a weight of only 4.8 pounds. A video amplifier can be reduced from 50 cubic inches and 2 pounds to less than 4 cubic inches and ounces, through block packaging techniques. All components needed for one complete circuit are encapsulated into a one- or two-inch cube of plastic, to provide optimum resistance against shock, vibration and moisture.

But the demand for still higher performance requires more and more interconnected components, still smaller sizes, even greater reliability and lower costs. Scientists today are working to develop single circuit blocks which will be the equivalent of anywhere from a hundred to a thousand separate components and circuits. Units will be combined to form larger and larger combinations so that the present effectiveness of electronic equipment will be increased a thousand-fold, with reliability increased at the same time.

In the search for further improvement in block circuitry, General Dynamics is putting increased emphasis on solid-state physics. One approach is the study of thin films. In this concept, all circuits will eventually end up as very stable micro-thin elements deposited on surfaces mainly by the process of evaporation in high vacuum. Having virtually no thickness, such circuits can be assembled very compactly.

An equally radical approach involves the study of a phenomenon called "whisker growth," whiskers being minute bits of matter which are nearly perfect crystals. Rather than attempt to make a micro-sized device by the process of reducing the size of conventionally grown crystals, the concept here involves the use of a crystal which is micro-sized from the beginning to create fantastically small solid-state devices.

In any system, the human component is a necessary, if sometimes weak, link. General Dynamics scientists are devoting attention to the interface between human and electronic systems through biological studies, particularly on neurological systems and their basic means of communication.

Studies in communication theory have led to new insights on the problem of increasing traffic congestion on radio voice channels. For example, 18 channels of tele-type material can be carried in the bandwidth required for one channel of human voice. If the bandwidth needed for speech can be compressed to an equal degree, far more voice traffic can be carried. Physicists, engineers, linguists and psychologists have pooled their efforts to find new systems of speech synthesis. By eliminating redundant sounds and transmitting, in the form of coded signals, only those needed for intelligible speech, the possibilities have been opened for new communication systems which permit a greater rate of information flow with lower error rates.
Size of electronic equipment is reduced and reliability increased by 3-dimensional block packaging techniques as in this amplifier circuit.
Beyond the reactors and associated nuclear devices and techniques already developed, General Dynamics scientists are looking deep into tomorrow. If man can learn how to convert it to power, ordinary sea water contains enough energy to do most of his work for him.

The harnessing of this power may result from an understanding of controlled thermonuclear (fusion) reactions. Since 1957 a research program has been carried on by General Atomic Division aimed at unlocking the secret of this energy-generating process of the sun and stars.

In a fusion power system, energy would be released by the combining of two particles of heavy hydrogen under tremendously high temperatures — as much as 100 million to one billion degrees and attainable normally only in a nuclear explosion. Powerful magnetic fields appear to be a possible means of containing a plasma heated to such temperature extremes. The appealing aspect of fusion is the plentiful source of heavy hydrogen fuel (called deuterium) in nature: deuterium is present in all water. Researchers at General Dynamics are concerned not only with the generation of heat from nuclear and thermonuclear fuels but also with a number of advanced means of converting heat into electricity.

Scientists at General Dynamics' General Atomic Division already have turned up some clues that may have far-reaching significance in the conversion of heat directly into kilowatts, without the use of conventional rotating machinery.

Since 1957, General Dynamics' broad program of direct conversion methods has explored the use of unconventional (high temperature) semi-conductors capable of operating at more than 2,000°F, as well as other new methods of direct conversion, including the thermionic cell.

The thermionic cell consists of two plates with the inter-space containing a small amount of metal vapor, typically cesium. When made white hot by a heat source, such as that produced in a nuclear reactor, the hot plate emits electrons. These are collected on the adjacent cold plate and are tapped off as electricity. The cesium vapor is used to provide a plasma through which the current may pass more readily.

Thermionic cell converter systems appear to have great advantages for application to space vehicle power plants because of their compactness and light weight; power levels up to thousands of kilowatts may be feasible. A cesium cell thermionic converter has already produced appreciable amounts of electricity directly from the heat of a TRIGA reactor. Ultimately, direct conversion by thermionic cells may be practical for marine power, and possibly for central station power in the more distant future.

General Dynamics' scientists and engineers are looking into other kinds of nuclear power applications. Among these are the use of small reactors as a remote, unattended power source, and a new concept for a nuclear-powered "ground effects" machine capable of hovering or cruising over land, sea or ice on a cushion of air.

Nuclear energy will play an important future role in the space sciences also, since it provides more power for a given weight than any other energy source known to man. Vast amounts of energy are required to propel space vehicles; the ultimate future of manned space exploration will depend on the successful development of nuclear energy as the propulsion source.

A great historian has suggested that history may not remember this century primarily for its wars, or its medical miracles, or even for the discovery of nuclear energy, but rather as that century when, for the first time, the benefits of civilization became available to all mankind.

To the achievement of that concept, General Dynamics has dedicated itself.
Atomic beam research and study of characteristics of atomic collisions is part of a broad program of nuclear energy experimental work.
Image by Design is the name which identifies the new Westinghouse design program. It will be a continuing study of the visual impression Westinghouse is making on the public. The first broad area selected for concentrated study is that of graphic design. Among many other items, the trademark and logotype illustrated in this folder, are the first new designs to help put a bright new face on all visual material representing the Westinghouse Electric Corporation. The new Circle W and logotype were created by Paul Rand, noted graphic designer and consultant.

The new Circle W and logotype will become Westinghouse trademarks through consistent use in advertisements and other printed material, in packaging, products, buildings, and motor vehicles.

1. The Circle W trademark and the logotype should appear in every advertisement and television commercial.
2. Wherever possible, these devices should be used as companion pieces, as shown by some of the variations here. However, the overall design is ultimately the determining factor.
3. The Circle W should be used boldly; generally in a larger size than the logotype.
4. The Circle W may be used in positive or reverse; in black and white or in color.
5. When the Circle W is used three dimensionally, the discs on top of the W should be flat, like a checker, and never concave or convex.
6. The new logotype has been designed in both light and heavy versions and, like the Circle W trademark, may be used in positive or reverse, in black and white or in color. The light face will be particularly useful when a more delicate effect is desirable.
7. The Circle W and logotype should be kept clean and distinctive by avoiding the use of additional division symbols or insignia, tune-in plugs, industry slogans or insignia, etc. If an occasion arises when it is absolutely necessary to consider using an extra element, such use must be cleared through the office of the Director of Advertising.
8. The selling statement, “You can be sure...if it's Westinghouse”, has shown, after careful study, that its continued use is desirable.
9. The selling statement should appear in every advertisement. It may be isolated in a given place, or preferably used as the last line of body copy.
10. When the selling statement is used as the last line of body copy, the type-face should match the body type, in italic or bold face of the same type face.
11. When the selling statement is isolated in a given place, as in a signature, the word “Westinghouse” should appear in the new logotype form. The type-face selected for the remaining words in the selling statement should be in contrast with the logotype or exactly in the same face as the logotype. See examples on last page of this folder.
12. A new type face for use in selling statement, headlines, and captions is now available in regular and light face. Its design is the same style as the logotype and is called Westinghouse Gothic. It may be obtained from Photo-Lettering in New York. It is also available on Prototype.
13. The old hand lettered style of type for the selling statement should never again be used.
14. Use of the new Circle W trademark with the selling statement is optional. Good design should be the determining factor.
15. Use of the selling statement in areas other than advertising is not mandatory; in packaging, stationery, signs, etc.

The purpose of this folder is not to hamper but to encourage individual initiative. The few limitations set forth, namely: diligent and thoughtful adherence to the basic design of logotype and trademark, and proper use of the selling statement are merely tools for creating a cohesive corporate image.

Questions concerning proper use of the items discussed should be referred to Gateway: Corporate Design Department, or Gateway: Exhibit Properties and Identification, General Advertising.

Reproduction proofs and-or electrotype are available from Westinghouse Electric Corporation Printing and Nameplate Department, Trafford, Pa.

Heavy logotype: 7½” to 5” form no. B-7971
Heavy logotype: 4½” to 3¾” form no. B-7972
Light logotype: 7½” to 5” form no. B-7973
Light logotype: 4½” to 3¾” form no. B-7974
Positive Circle W: 2” to 3½” form no. B-7975
Reverse Circle W in circle: 2” to 3½” form no. B-7976
Reverse Circle W in square: 2” to 3½” form no. B-7977
In an advertisement the selling statement may be isolated in a given space or used in the last line of body copy, provided it is set in italics or bold face, e.g., You can be sure... if it's Westinghouse.

The logotype may also be used as part of the selling statement in the last line of body copy if it is not repeated elsewhere on the page, e.g.,

You can be sure... if it's Westinghouse
### CN Telecommunications

<table>
<thead>
<tr>
<th>check</th>
<th>full rate</th>
<th>day letter</th>
<th>night letter</th>
<th>tolls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>company or individual</th>
<th>charge acct. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>address and telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>time and date</th>
<th>local time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>heure locale</td>
</tr>
</tbody>
</table>

**Canadian National**  
**Department of**  
**Public Relations**

**Canadien National**  
**Service des**  
**Relations Extérieures**

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J. R. White, general manager· directeur général, Toronto  
6121b

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