SPRAGUE NATIONAL ISSUE LOG

Annual Report TO EMPLOYEES
SPRAGUE ELECTRIC COMPANY
Executive Offices
North Adams, Massachusetts

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3645 Stockholders
26 March 1962

To Our Employees:

1961 was your Company's 35th year of operations, and we are pleased to report that it was a very good year for Sprague, with sales and net earnings of the Company and its domestic and foreign subsidiaries attaining new highs for the third consecutive year. Total income increased to $77,650,168 from $66,029,241.

During the year we acquired a controlling interest in the Telegraph Condenser Company (Canada), Ltd. of Toronto, which had previously been a subsidiary of our British affiliated company, Telegraph Condenser Company, Ltd. The British company retains the minority interest in the Canadian concern, which is now known as Sprague-TCC (Canada), Ltd. This acquisition follows the acquisition of an interest in TCC of England last year, and furthers the close cooperation between the two companies. Sprague-TCC (Canada), Ltd. will continue to handle the sales of TCC electronic components manufactured in England, and will serve to broaden our marketing activities in the growing Canadian electronics industry by selling Sprague Electric products in the Dominion.

The high volume of sales and profits recorded in 1961 are a reflection of increased activity in most of our major markets, as well as the continued broadening of our product base through the introduction of new lines and extension of existing lines. Prospects appear good at this time for further gains in all major segments of the electronics industry in 1962. For the maker of components and subassemblies, the years just ahead will be challenging ones during which a rapid rate of obsolescence and changing trends in circuit technology will demand greater versatility and more careful research, development and market planning than ever before.

We look forward to a continuation of the growth that has characterized your Company's operations in its first 35 years, and we wish to express to our employees our appreciation for the vital part they have played in making this growth possible.

Robert Caffrey
Chairman of the Board and Chief Executive Officer

Ernest L. Ward
President
The increasing reliance of our defense programs on electronic science has been an important source of growth for the electronics industry in the past ten years, during which time the percentage of total National Security expenditures going for electronics has increased from 6% to 15%. In addition to the military procurement programs, current Federal budgets include substantial expenditures for non-military electronics by other agencies of the Government, such as the National Aeronautics and Space Administration, Federal Aviation Agency, etc. Taken together total Federal Government purchases in our industry are estimated to have approached $7 billion in 1961, and remain by far the largest market of all for electronics.

Shipments of equipment and components for military purposes in the past several years have shown relatively small year to year gains, reflecting chiefly the fact that total military spending was held at the $41 billion level for several years and increased only slightly to $43 billion in fiscal 1961. Presently, however, there is reason to look for significant increases in military spending for some time to come.

Military spending programs for the 1962 fiscal year have been revised upward no less than four times since January 1961, from $43.2 billion to $46.8 billion currently; this is a record peace-time level, being some $3 billion greater than the peak reached during the Korean War. Estimated expenditures for fiscal 1962 have been increased still further to $48.3 billion, and continuing increases thereafter are foreshadowed by the fact that estimated "direct obligations" (new procurement orders) exceed estimated expenditures by some $7 billion for the two fiscal years.

Expenditures by NASA are expected to increase from $1.3 billion in fiscal 1962 to $2.4 billion in 1963, and Federal spending for the promotion of aviation through the

Shown in this drawing are the major orbital and ground elements of the Tiros II television-infrared weather observation system, developed for the National Aeronautics and Space Administration. Tiros satellite in orbit receives instructions and transmits TV cloud pictures and infrared data to earth. Final step shown here indicates experimental and limited operational use for the first time of weather information gathered by Tiros II as it circles the earth.
FAA and other agencies has increased from $200 million to more than $700 million currently.

Several factors are contributing to the need for increased military spending in the years immediately ahead. One is that the technology of military science is continuing to advance with unprecedented rapidity, especially in the realm of guidance and control in which electronics plays a dominant role. Thus, development of a wide variety of complex defense systems continues at an accelerating pace. In addition, however, the events of the past year have brought increased awareness that limited warfare may occur at any place or time, and that the nation's arsenal therefore requires stepped-up procurement of already proven weapon systems concurrently with the development and testing of more advanced systems in the future.

The Polaris and Minuteman missile programs continue to represent the backbone of the nation's strategic retaliatory forces for the mid-1960's and beyond, and currently receive the largest share of military funds. Also receiving greater attention in current budgets are tactical communications, guidance and fire-control systems, battlefield surveillance systems, and anti-submarine warfare. In particular, the availability of nuclear-powered submarines has led to growing interest in ASW sonar, including the provision of a network of long-range submarine detection stations through Project Artemis.

Your Company continues to develop and manufacture components for virtually all military and space electronics programs, including heavy participation in the Minuteman and Polaris guidance and control equipments. With the Federal Government expected to procure nearly $8 billion of electronics in 1962, we look for further increases in our military shipments volume in the coming year.

The Tiros II weather observation satellite is shown here atop the rocket launching vehicle before the installation of the nose firing. This was the second satellite launched by the National Aeronautics and Space Administration in its program of satellite weather observation and forecasting feasibility studies.

Tiros II payload in spin test with an unusual light technique.
TRENDS IN CIRCUIT TECHNOLOGY

Over the past several years the electronics industry has been concentrating on greater miniaturization of electronic circuits through the development of new component families which are small in size and specially adapted to the new techniques of assembling circuits.

Work in these areas has continued at an accelerating pace in the laboratories of our industry, and probably no subject as complex as this has received wider publicity in both the trade and the general press. Some of the reports of accomplishments in what has come to be called "micro-electronics" are quite accurate; some, unfortunately, are quite inaccurate. Because further developments in this field are bound to affect our Company as the largest producer of passive components, we believe it is important for our employes to understand these developments and to be acquainted with Sprague management's point of view with respect to them.

Some of the confusion that has surrounded this subject is the result of a lack of standard terminology to describe the various approaches being taken. To name a few, we read of microcircuits, integrated circuitry, solid-state circuits, thin-film circuits, and molecular circuitry or "moletronics", but none of these terms has as yet been generally accepted as fully descriptive of the wide range of possible approaches to the problem. We believe a more meaningful terminology results from looking at developments in miniaturization from the standpoint of the extent to which they depart from the conventional circuits of today, in which individual components are put together using either hook-up wire or printed wiring boards.

Much of the progress in miniaturization in the last ten years has come about through use of various component-oriented approaches, that is, tighter packaging techniques employing conventional components as well as improved methods of encapsulation and sealing, better interconnection methods, and so forth. Many good examples of these techniques are to be found in the miniaturized packaged assemblies that have been produced for several years by our Special Products Division for the data-processing field.

More recently, particularly in the last five years or so, a second approach, which may be called a circuit-oriented approach, has been made possible by the deposition of planar components on electrically active substrates using thin-film techniques. Many examples of this are to be found in
products in widespread use today, such as the ceramic-based printed circuits found in many radios and television sets, in which the ceramic plate serves as the dielectric of the capacitors and as the supporting base for printed resistors. To resistor-capacitor networks may be added active devices, such as the miniature glass tubes used in a printed circuit amplifier manufactured in quantity by Sprague in the mid-1950's.

Finally, in the more advanced devices in production today, single-crystal semiconductor materials are being substituted for the ceramic plate as a substrate, and some of the passive circuit elements are being fabricated on this crystal by highly complex procedures such as diffusion, alloying, plating, masking and thin-film deposition. And in the laboratory, simple circuits have been produced by highly selective crystal growing and diffusion techniques to produce so-called molecular functional blocks, in which the identity of the individual components is lost to the eye. This technique represents a third approach, and one which is completely function-oriented in that the theoretical size limitation of the resulting circuit depends only on the particular combination of circuit values desired, and not on the equivalent number of components that would be required to perform the same function in a conventionally assembled circuit. At the present time, such functional circuits can be produced only in the laboratory, and many additional inventions will be required before the ultimate extent of miniaturization they may make possible can be approached.

Promising as it is for the long-term future, the function-oriented approach presents a number of problems, both technical and economic. Parameter tolerances are difficult to control in the present state of the art and suitable values of certain parameters, such as large inductances and capacitances, are very difficult to obtain. Since molecular circuits are an all-semiconductor device, they are expected to be more temperature-sensitive than other types of circuits. Thus, the fact is that we are still far from possessing the functional capabilities required for the vast majority of complex equipment in either military or commercial use today.

From the standpoint of cost, it should be kept in mind that the number of rejects is a critical factor in any product which uses such complex processing techniques. Therefore, ability to produce functional circuits at a cost which is competitive with less advanced circuitry will depend upon the willingness of the circuit design engineer to standardize on a few basic circuits which can be manufactured in very large runs of identical devices.

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TOTAL INCOME

$ 77,650,168

Annual Report of SPRAUGE
The activities of Sprague Electric Company for 1961 are analyzed here to give each employe a clear picture of the results of the Company's operations.

Total income increased by $11,620,927 in 1961.

Net income for the year was $6,092,473 after deducting the minority interest in the income of a subsidiary amounting to $23,940.
Like so many harmless scarecrows, economic words tend to scare people away. Yet most economic terms stand for things that are quite simple and often familiar to all of us in our daily living. Some of the words on these pages are easily recognizable; others are not quite so common. Check them yourself, because they all have a great influence on our lives and our work. Perhaps you'll agree it isn't the word itself that's important, but the idea it stands for.

**Capitalism:** If your youngster sold lemonade in front of the house this summer, he was taking part in capitalism. By investing his money (or your money), his effort and initiative in the enterprise, he hoped to make a profit. The economic system called capitalism assures us all of the right to own property and to risk our savings in hopes of making a profit. Capitalism also breeds free competition, which provides vast benefits to the consumer. It was once thought that capitalism meant Big Business. Not so: of America's nearly 4.7 million businesses, 96% have fewer than 20 employees.

**Productivity:** Anyone with a large, robust and growing family is an expert on productivity, although perhaps not in the same sense that we use the word in business. Every business such as ours has certain resources: skilled men and women who know their jobs and do them well; machines and tools which help us produce much more than we could make with our own hands; materials, the raw stuff out of which our finished products are made. The word productivity means the efficiency with which these resources are employed to produce the goods we sell. Our productivity rises when we can turn out a greater amount of goods with the same effort or at the same cost. Rising living standards are the result.

**Capital investment:** It's a weighty term that sounds like it came right out of a textbook, but it refers to a very common practice: spending money for goods, tools, equipment, etc., in the hope of obtaining profitable returns. A woman may buy a sewing machine to save on clothing costs. Garden tools help bring to life a bountiful garden. The capital investments we make as individuals are multiplied thousands of times over by a corporation. Using money invested by stockholders or money which has been saved from profits and reinvested, the company buys the machinery, plants and other facilities it needs to keep operating. With no investment, we would have no tools for our jobs—we'd have no jobs at all.

**Obsolescence:** A leisurely search through your attic would probably uncover several classic examples of obsolescence. In business, the term refers to equipment which has become outdated though still not outworn. A new machine today may be rendered obsolete next year by another, better machine, even though the older model is still operating in perfect order. If a rival company gets the new machine, it gains a big competitive edge. Obsolescence, difficult to anticipate, is a chronic problem for all industrial firms.
cost reduction: There comes a time in everyone's life when the bills overtake the paycheck—sometimes it's more often than we like to think. If income can't be raised, the only answer is to cut down on the spending. Business is equally subject to this iron law of economics. In times of intense competition and low prices, which we have experienced, ways must be found to reduce costs without impairing quality or service, if we expect to stay in the competitive running.

buyer's market: Whenever the little woman goes shopping these days, she wields a power that is nothing short of awesome. Her buying decisions can make or break a product, sometimes an entire company. She is enjoying the fruits of a buyer's market, a situation where supply has equalled or exceeded demand. The customer is indeed king, and those companies which choose to ignore this reigning power today are practicing brinksmanship in the most disastrous way. This is why the customer must be catered to, in styling, quality, service, price.

depreciation: Oops! There goes another depreciated sock. Our hero's problem is similar to that of a company whose machinery, buildings, etc., simply wear out through use. And, as we're all resigned to getting holes in our socks, a company is resigned to depreciation of its capital investment. So the company sets some money aside each year to pay for new equipment when the old wears out. Present tax laws and continued inflation, however, make it difficult for the company to replace worn out equipment without drawing on additional funds—from retained profits or outside financing.

inventory: Midnight raiders and other eager eaters in the house heartily endorse the idea of inventory—refrigerator style. In industry, the term refers to stored quantities of raw materials, goods in process or finished goods. We keep an inventory of finished goods at all of our plants, to help fill orders with reasonable speed. The eternal question is, how much? A big inventory ties up great sums of money; a low inventory may slow shipments, lose customer orders. The right balance takes planning.

profit: A paycheck has the habit of splitting off in all directions, like ten pins on a strike ball. After paying the bills, keeping the peace with allowance money, etc., there's apt to be precious little left. What's left is something like a personal profit, for use in strengthening your home or family, to be saved for the future. Part of our company's profits is used much the same way for reinvestment in the business. But the analogy ends there. Our business, unlike the family, exists solely because thousands of people invested their money in it. Their dividends must also come out of the company's profits.
The past twenty-five years' growth of sales effort in the greater Boston area is synonymous with the phenomenal growth of electronics along Route 128, known as Electronic Alley, which circles Boston from the north to the west and south. To many people Boston means Faneuil Hall, baked beans, and Paul Revere, but today the area is the leading electronics research and development center of the east. Presently there are some 500 electronic research, development and manufacturing facilities located in this area. Much of its growth can be attributed to the proximity of MIT with its vast research facilities from which have come many new ideas and innovations. Many of the newer companies in the area are led or staffed by former researchers who have stayed in the area after leaving the academic world.

In the mid-thirties both the Sprague Electric Company and the Sprague Products Company were represented in the New England area by Reynolds and Harris Company. In 1946, through a reorganization they became known as the Harrison Reynolds Company, and it was at this time that Mr. William Arnold, Sr. joined the firm. With the retirement of Mr. Harrison Reynolds on December 31, 1955, the Sprague Electric Company and the Sprague Products Company established new district sales offices at 313 Washington Street, Newton, Massachusetts. Mr. Arnold was appointed District Sales Manager for Sprague Electric Company and Mr. O. Andrews Ferguson to the same position with Sprague Products Company. Mr. Arnold first joined Sprague Electric at its home plant in North Adams in May 1938. During World War II he served for 5 years with the Naval Aviation Service as a Commander.

Mr. Arnold presently supervises a staff of 2 sales engineers and four office personnel who serve 150 customers in an area including southern New Hampshire, eastern Massachusetts and Rhode Island. A veteran of 24 years service with Sprague Electric, Mr. Arnold is an MIT graduate and has three children and four grandchildren.

Sales Engineer James Flanagan has been with the Company for 5½ years and was a participant in the Company's Annual Field and Sales Engi-
neering Program in 1957. Mr. Flanagan, father of two daughters, was formerly an electronic components manufacturers representative. His Sprague customers range from Nashua, New Hampshire to most of Rhode Island.

Sales Engineer John Driscoll, former lieutenant in the Navy and graduate of Boston College, joined the Company a year ago. He is the father of one child and a participant in the Company's Annual Field and Sales Engineering Program in 1961.

This busy team covers customers from southern New Hampshire to Rhode Island, including the metropolitan areas of Boston. They presently do 5,000 times the billings in this area that were handled when their office was opened. Located in Newton, the geographic center of their territory, they are able to reach customers regularly, and in a hurry when needed.

The office personnel, who refer to the office in fun as the "Irish Embassy", consists of: Nancy McGoldrick, Mr. Arnold's secretary; Marilyn O'Leary; Elizabeth McLaughlin and Margaret MacDonald.

Sprague Products

Located in separate offices at 313 Washington Street, Newton, the Sprague Products group is responsible for Sprague Products' sales in the six New England states. A wholly-owned subsidiary of the Sprague Electric Company, Sprague Products maintains sales offices in 3 cities and sales representatives in another 20 locations. Working through 1250 distributors in over 680 cities, they are responsible for distribution of replacement parts to the radio, TV, air-conditioning and other electronic type organizations. In addition they have 105 industrial distributors who stock and service commercial and manufacturing accounts with Sprague components for small orders and fill requirements of research organizations for immediate delivery.

Mr. O. Andrews Ferguson, formerly engaged in field-sales promotional activities with the Sprague Products Company, took charge of its New England District Office when it was established in January 1956. The father of four children, and a World War II veteran, Mr. Ferguson received his BA degree from Middlebury College and an MBA from Stanford University. He joined the Company on May 12, 1952.

Mr. Richard Keilty and Mr. Bernard Shine complete the field sales staff, covering the New England area and calling on approximately 100 customers. In addition to the three-man sales staff, Miss Anita Mongeon acts in the dual capacity of secretary to Mr. Ferguson and as telephone sales order specialist.
We believe such standardization will come only slowly, and that as molecular functional circuits become available, they will be used in conjunction with substantial numbers of individual parts in the foreseeable future.

Here at Sprague, we are carefully following developments in the entire field of miniaturization, and working actively on all three of the above approaches to it. The Special Products Division has become firmly established as a leading supplier of miniaturized packaged assemblies of the component-oriented type, and is working aggressively on still further improvements in packaging techniques to take advantage of the great flexibility which this approach offers the equipment designer. In the field of ceramic-based microcircuits, a highly qualified engineering and development group is working on the circuit-oriented approach using planar components. By incorporating uncased transistors, diodes and solid tantalum capacitors in the ceramic plate, they have achieved very high component densities equivalent to more than two million parts per cubic foot.

Although we believe the component-oriented and circuit-oriented approaches will remain the most practical circuit technologies for some years to come, your management recognizes the evident advantages for the future in the function-oriented approach in point of further miniaturization. Accordingly, our Research Laboratories are engaged in a variety of basic studies to provide Sprague with a thorough understanding of and competence in the advanced techniques that will be required by the producer of molecular functional circuits as they evolve from the simple devices that have been demonstrated to date.

In the area of semiconductor technology, studies of multiple-junction crystal growth and epitaxial growth processes are in progress, as are studies in the surface chemistry of various materials that hold promise in the field of microelectronics. Studies on improved electronic ceramic substrate materials and layer-built components are being accelerated, along with the whole field of thin-film deposition for resistive, capacitive and inductive elements. In addition, the matter of interconnection techniques in miniature circuitry is receiving close research and engineering attention, since this remains one of the large unsolved problems in combining the products of the new technologies to produce working equipments of a practical degree of complexity and acceptable reliability.

The future of circuit technology is assuredly a challenge to the manufacturer of electronic components, and your management is prepared to meet this challenge. We look forward to being in a position to utilize any of the various approaches that may become feasible as the future unfolds, but we believe that, as in the past, the very practical criteria of availability, reliability, and cost will be the dominant determining factors in the selection of circuit fabrication and assembly techniques.

Ampex Corporation's new scientific data recorder, the FR-600 has its oscilloscopes mounted in drawers termed "bays". There is a monitor for each track of recorded data providing for both input and output of up to seven channels, using separate miniature scopes. Here, the Scope Bay which utilizes Sprague Extended Life Electrolytic Capacitors, is shown.
You have already received copies of two of the three pamphlets shown above and Mr. Robert C. Sprague's letters which state his position very clearly. The problem of foreign imports has always been a controversial, and very often an emotional, one. Yet all too often its repercussions on the prosperity and life of a community go unnoticed by all except those directly involved.

Many industries and towns have been severely affected by past Trade Agreements, and many more will be hurt if new trade proposals are adopted without proper safeguards for United States industries. Meriden, Connecticut is one of these towns. Its total employment dropped 5,600 and total annual wages declined $11,500,000.00 as a direct result of foreign imports which affected the community's principal industry, International Silver Company.

Write your Congressman and Senators today asking them to carefully weigh all the alternatives before voting on any legislation affecting international trade.
Ask any employe what he thinks about job security and the reply may well be, "I'm all for it! Why not change company policy to give us more job security."

This statement probably mirrors the thoughts of employes in Sprague Electric and other industries across the nation. Unhappily they may not have recognized that job security cannot be written into company policy. Job security must be earned — and earned by each one of us.

The old fashioned virtues of perserverance and hard work have not changed, and the main ingredient in success continues to be pluck and not luck. Many thinking people in this country are becoming increasingly concerned about the prevalent attitude that "the world owes me a living".

Sprague Electric Company is very conscious of its responsibility to provide job security for its employes. By transferring employes in and between departments and with extensive training programs, we do our utmost to keep our people busy on a year round basis. All of these measures, however, can offer only limited help. Actually job security is based on the ability of the Company to remain successful and profitable by satisfying customers. Everyone — management, production and office employes — must work together to make our products competitive. It is this ability to compete which is the best gauge of our job security.