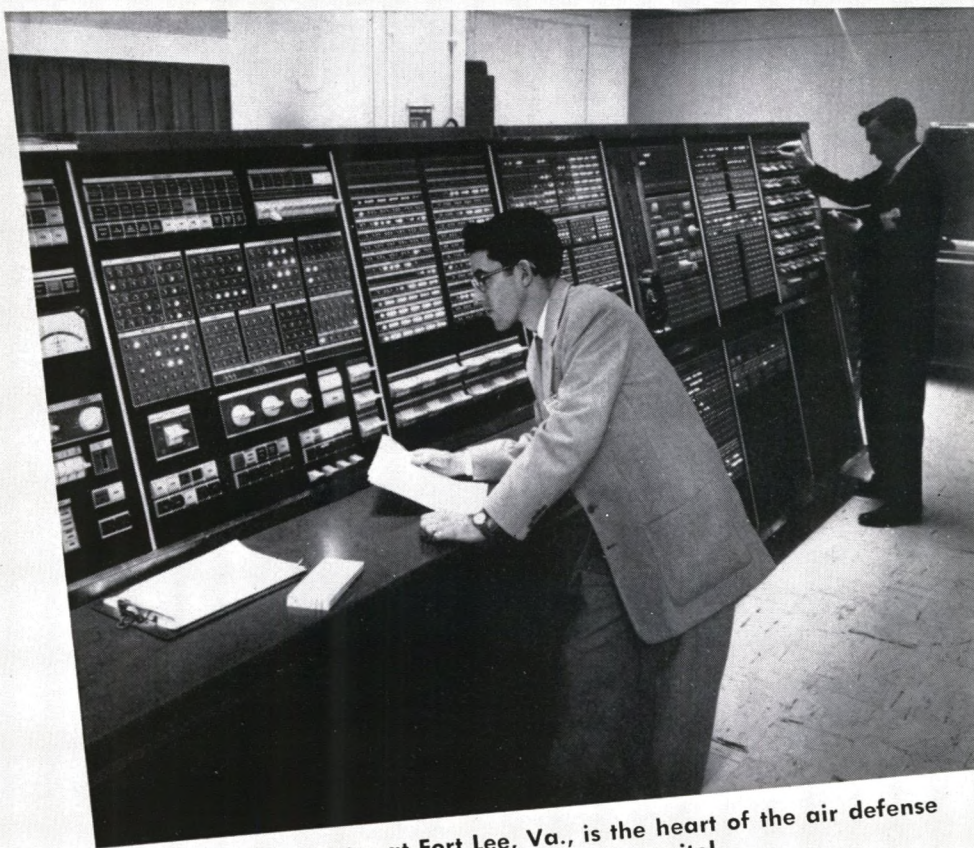


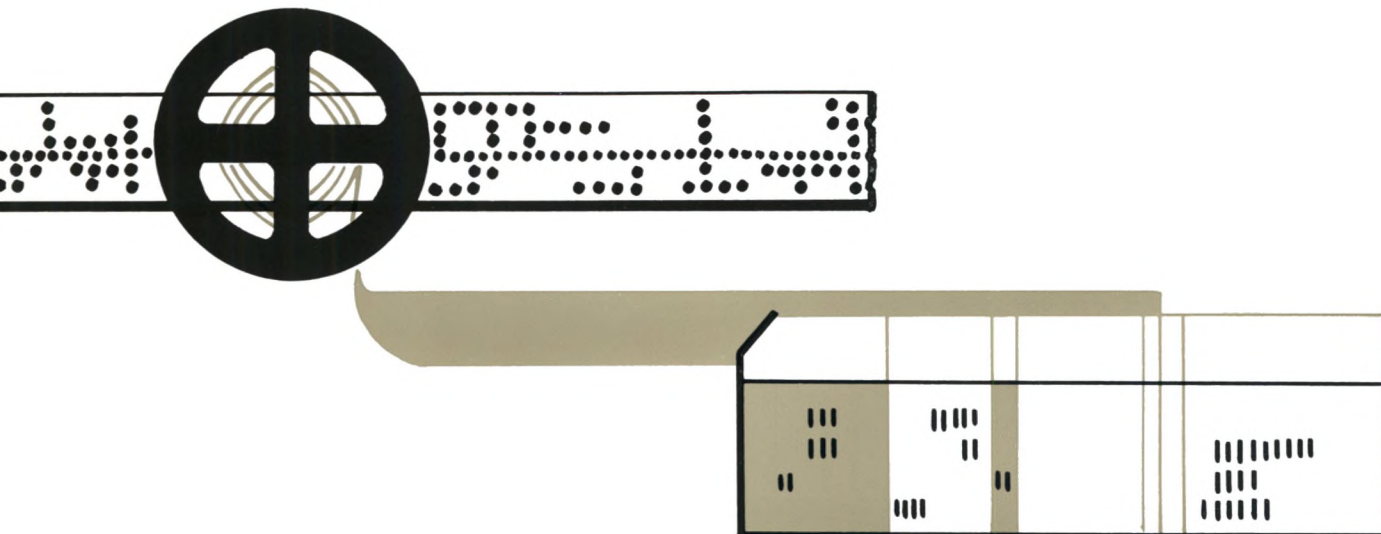
MONTHLY REVIEW



The SAGE computer at Fort Lee, Va., is the heart of the air defense system for the nation's capital.

FEDERAL RESERVE BANK OF RICHMOND

JUNE 1959



Paperwork Revolution by Electronics

The District is the scene of important progress in the electronic revolution against the tedium of routine paperwork. The number of electronic computers in the District is substantial—a conservative estimate is 200. Their area of operation is spread throughout the District—from Baltimore south to Charleston, South Carolina, and from Norfolk west to Huntington, West Virginia. The greatest concentration of computers in the District, and probably in the world, is in the Washington area. The applications of the many District computers are spectacular and varied—from tracking satellites to keeping track of leaf tobacco. Each computer, wherever its location, whatever its specific job, is a control over the vast amount of paperwork—record-keeping and computations—that accompanies modern industry and government.

Significantly, the paperwork revolution now in progress throughout the land had its beginnings in this District. The very first of the electronic computers—the Eniac—settled in Maryland as early as 1946 to solve ballistic problems for the Army. Also the first computer to make a living by processing business-type data migrated to the District: this computer was a Univac I, installed in the Bureau of the Census in 1951 to help the final stages of the 1950 census tabulation.

Industry quickly followed these government leads and jumped on the computer bandwagon. The machines aroused the tremendous enthusiasm of top management through their ability to figure in seconds the engineering and research problems that take weeks or months to solve with paper and pencil and their ability to do the centralized book-

keeping for a large, diversified firm with thousands of customers serviced by hundreds of branch offices. Not only had clerical cost risen, but key personnel were often bogged down by the great amount of paper crossing their desks. Thus the electronic computer—one of the most phenomenal scientific and technical breakthroughs of the mid-twentieth century—arrived on the business scene at a time ripe for a paperwork revolution.

WHAT IS A COMPUTER? The same fanfare that fired the imagination of top management caused a veil of mystery to surround this newest piece of office or laboratory equipment. A whole new language of computer equipment and computer technology sprang into existence.

Yet the basic principles of an electronic computer are the same as those for other data processing systems—from completely manual operations to the conventional punched card equipment. There are four essential functions operating under a focal control:

1. *Input* - information is fed into the machine.
 2. *Storage* - this information is memorized by the machine.
 3. *Processing* - the machine processes the data—adds, subtracts, multiplies or divides.
 4. *Output* - new information is produced.
- These functions are coordinated by a series of instructions, called a *program*, which tell the machine the exact order of operations to perform.

The electronic computer differs from conventional data processing machines in two basic characteristics. First, the electronic devices speed the

arithmetic operations to almost incredible rates: for example, some machines can perform 5,000 multiplications of ten-digit numbers in one second. But more importantly, the electronic components give the machine an immense memory capacity. By being able to store data and instructions and by being able to make simple yes-no decisions based on intermediate results, the machine automatically carries the problem through to completion. The “program” thus becomes extremely important: since the machine cannot grasp the entire problem, every individual step in the process and all conceivable possibilities must be carefully considered by the programmer. The machine must even be told when to stop.

THE PRESENT GENERATION Today’s computer comes in many sizes and shapes to fit every purpose and purse. Some computers require new buildings to take care of their unusual weight, power and space requirements; others may be plugged into an ordinary wall socket and take only as much space as a desk. The capacity of some machines may be souped-up as computer needs increase by adding accessory equipment and new circuits within a basic machine.

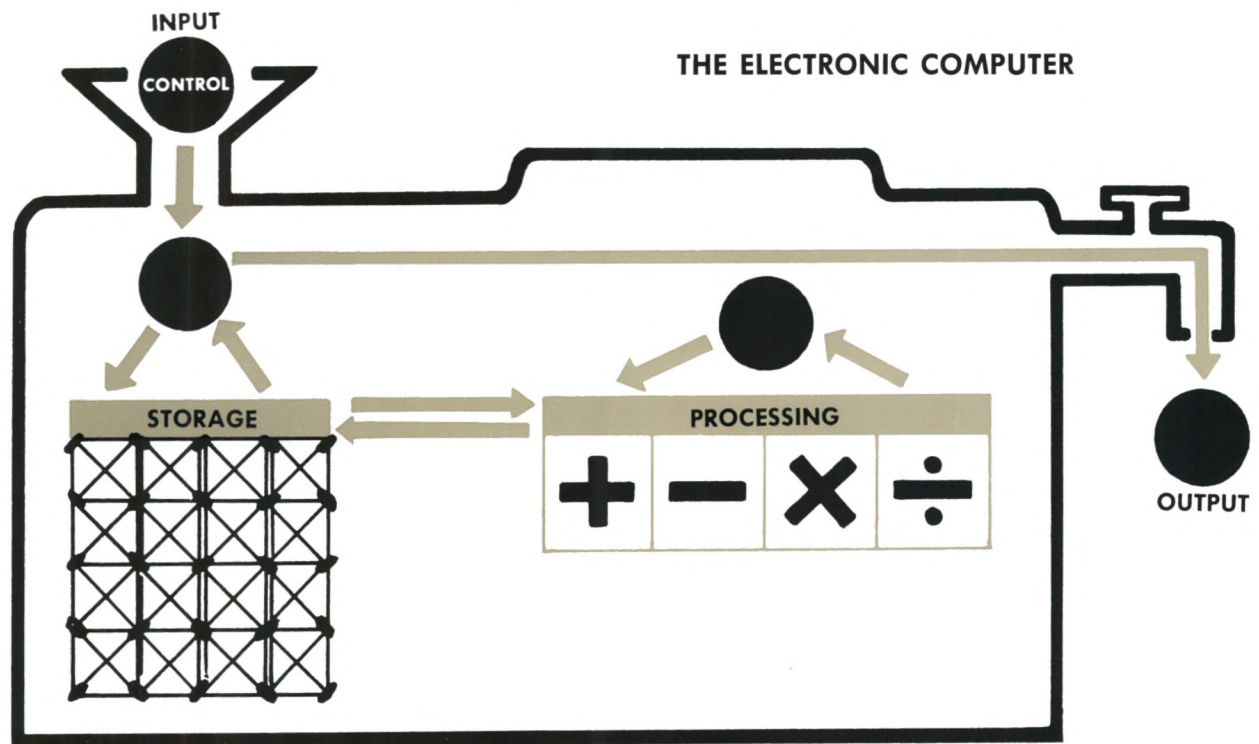
Computer models also vary widely by type of functional components—each having its own particular advantage in cost or function. The most popular media for input and output are punched cards, punched paper tape, and magnetic tape.

Often output is printed from an electric typewriter or high-speed printer, the latter operating at 1,000 lines each minute. The output of one machine may be the input of another machine located miles away—the data being transferred by electric impulses on telephone wires or radio circuits. Just as varied are the storage devices of these fantastic machines: most generally used are magnetic tapes, drums, cores, or disks. The most common components used in the computing circuits are electronic tubes, transistors, and diodes. The variety of basic computer components and their combinations into machine models reflect the varied uses of these wondrous machines.

THE DISTRICT BRANCH OF THE FAMILY From the two early pioneers—one for scientific computations and the other for data processing—the number of computers in Government and industrial offices and research labs throughout the District has increased at least a hundredfold.

The majority of these computers are in the medium-size class, defined rather arbitrarily as those costing from \$50,000 to \$500,000. The number drops sharply at the two extremes—the giant computer, costing over \$1 million, and the small desk-size computer, costing under \$50,000.

Classifying the computers by user shows that each of the District’s major employers is well represented. The Federal Government is by far the biggest single electronic computer user in the Dis-



trict. This is natural since the country's heaviest concentration of Government agencies is in the District of Columbia and its bordering states and since the Government is the country's biggest record-keeper and researcher. State and local governments in Maryland, Virginia, and West Virginia also have put the computer to work.

In manufacturing—the top employer in the District—the computer field is dominated by the textile industry in the Carolinas; over 15 mills have installed these electronic tools. Other manufacturing industries important to the District's economy are also well represented; these include manufacturers of chemicals, paper, tobacco, furniture, primary metals, fabricated metal products, transportation equipment, and electrical machinery.

The wholesale and retail trade business, which accounts for a fifth of the District's employment, does not have the same proportion of computers, since the field is comprised mainly of relatively small businesses. Two large general merchandise stores, two retail grocery chains, and two wholesale drug firms, however, are among the District firms which have put their accounting operations on an electronic base. The computer is also moving into District financial circles: three of the larger banks have installed electronic data processors and six insurance companies are depending on computers to handle a share of their paperwork. Other major paperwork operations are being handled by computers for transportation companies and public utilities.

Universities are another primary user. The newly formed Research Triangle has a computer at each angle—a Univac Scientific recently installed at the University of North Carolina at Chapel Hill and an IBM 650 computer at Duke University and at North Carolina State College. Johns Hopkins University with two computers—a Univac Scientific and an IBM 650, Georgetown

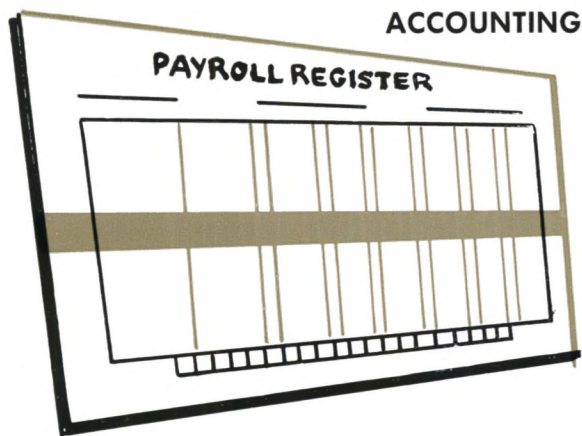
University with a Burroughs E-101 and Virginia Polytechnic Institute with a 650 complete the list.

Few organizations limit computer use to one application or even to one general type of application. These tools are expensive and most companies, after a brief initiation period, transfer task after task to the computer. In industry the most popular application and the one usually first programmed is the preparation of the payroll. Soon the computer is also aiding in billing operations, dividend computations, sales and cost analyses, inventory and production control. In contrast, universities focus their attention on scientific research but may have some accounting work programmed.

KEEPING TABS Electronic computers have the gigantic task of keeping track of the approximately 80 million active social security insurance accounts. Each year more than 250 million individual quarterly earnings items must be posted, 3 million new accounts established, and over 2½ million claims processed at the Baltimore office of the Bureau of Old Age and Survivors Insurance. In the ten months prior to the installation of the first large-scale computer used in this work, 18 man-years of programming were completed; 5,000 pages of programs and procedures were written; and a specially constructed area was prepared to house the machine. In less than three years after the initial installation, the expansion of applications necessitated a second large-scale computer. Plans are now being completed to replace these two with three somewhat more powerful machines.

A few of the other gigantic tasks of Government record-keeping turned over to electronic computers are the personnel accounting of the armed forces, up-dating the inventory records of the armed forces, editing and tabulation of income tax returns and compilation of the mass of business statistics published by the Bureau of the Census.

ECONOMIC RESEARCH The computers at the Census Bureau are also tackling economic research problems. Their computer method for the seasonal adjustment of statistical series is used universal-



OPERATIONS RESEARCH

$$\sum_{i=1}^m \sum_{j=1}^n p_i a_{ij} q_j$$

ly. The Board of Governors of the Federal Reserve System, with its need for up-to-the-minute statistics on the nation's economy, has utilized the rapid calculating ability of a computer to speed up its statistical processing.

A number of District industries are using computers in operations research: these machines are preparing sales analyses, market forecasts, labor force projections, cost analyses, and studies in optimum use of labor and materials. The Baltimore Transit Company, for example, is feeding passenger count data into a computer to reschedule its bus lines for the most efficient service at the least cost. The computer simulates a bus run under various schedules and picks the best.

Both industry and Government depend on private research organizations for the solution of many of their management problems. The Institute of Textile Technology in Charlottesville, Virginia, has a small computer to handle linear programming jobs for its member firms. The Corporation for Economic and Industrial Research in Arlington has just completed with its large-scale computers a statistical study of the impact of the Federal highway program on American business.

SCIENCE AND TECHNOLOGY The computer is also playing an integral part in the nation's scientific and technological development, and outstanding work in this field is being performed at installations in this District.

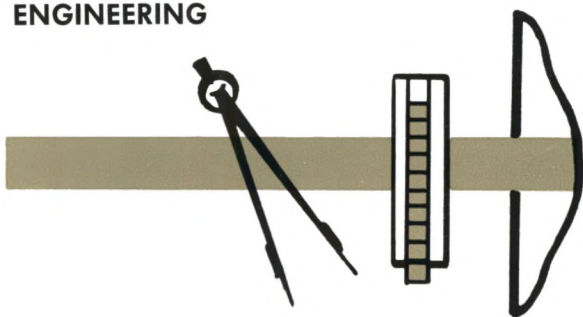
The Martin Company—a leader in space-age research and development—has at its Maryland plant a large-scale computer devoted exclusively to these problems. (Two medium-size computers in another division perform the data processing jobs needed by management.) The National Aeronautics and Space Administration has giant computers working on the conquest of space at Langley Field, Virginia, and the Navy has a powerful machine, NORC, at Dahlgren, Virginia. This latter computer is incredibly fast; it determined the altitude of the first moon shot with only

40 seconds of data from the rocket's transmitter. One of the most fabulous of the digital computers, however, is used in the SAGE air defense system. This computer takes information fed directly into it from outlying radars and combines it with information already in storage to determine the best defense measures and to guide interceptors to their targets; it requires an area the size of a basketball court in which to perform as many as 65,000 computations per second. The Fort Lee, Virginia, center, opened this year, is among the first in the nation's air warning network.

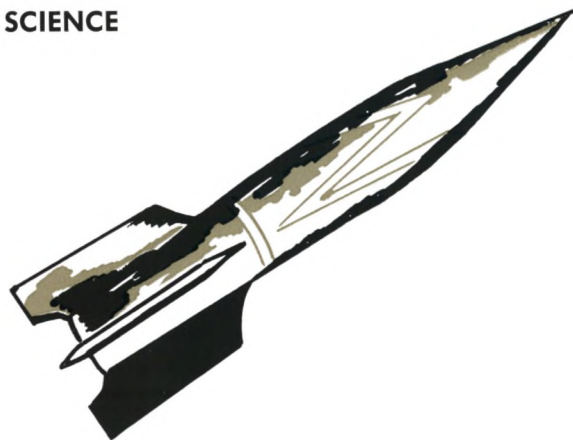
To speed the atomic navy, tens of thousands of computer hours have been used by the scientists and engineers at the Bureau of Ships. In solving the problems of using the nuclear reactors for shipboard power plants, the computers at the Newport News Shipbuilding and Dry Dock Company have proved invaluable. The computer at the Babcock and Wilcox Company in Lynchburg, Virginia, has also played a substantial role in the advancement of nuclear technology.

THE NEXT GENERATION Recent strides in technology of computer equipment and in methodology of computer use make the promise of the sixties indeed dazzling. The trend in computer models of increased capacity and speed and decreased space and power requirements will be accelerated by the use of smarter and smaller electronic components introduced just this spring. The proportion of smaller businesses with computers will undoubtedly increase appreciably; greater emphasis will be placed on the computer as a management tool going beyond basic accounting jobs. In problems where hundreds of variables could be used, the speed and capacity of the present-day machines have been limiting factors that will be pushed aside in the continuing surge of the paperwork revolution.

ENGINEERING



SCIENCE



MONTHLY REVIEW looks at
RICHMOND'S TOBACCO ROW





Overlooking the historic Kanawha Canal paralleling the James River is concentrated much of Richmond, Virginia's mighty tobacco industry. Throughout the city are located a total of 13 manufacturing plants and more than 100 warehouses, giving employment to just under 10,000 persons. Nearly one of every four cigarettes made in the United States is produced in Richmond, and the city lays claim to being the tobacco packaging center of the world.

Parks with trees and flowers will add to the beauty of open space between office buildings in Charles Center.



R_x for Heart Trouble

In 1904 a disastrous fire swept through Baltimore destroying much of the central business district. A Burnt District Commission was appointed to rebuild the damaged area. The commission ran into numerous obstacles and most of its plans were never put into effect. Much of the same site has now been chosen for another renewal plan—Charles Center, a forward-looking project for rebuilding the heart of downtown Baltimore. The citizens of Baltimore count on making this second plan a reality.

DOWNTOWN DECLINE Baltimore, like other large cities, has experienced a population trek to the suburbs and the growth of regional shopping centers and office buildings far from the downtown area. The Baltimore metropolitan area, in fact, is one of the fastest growing of the major metropolitan areas in the country. From 1930 to 1958 the Baltimore metropolitan area ranked sixth in population increase among the eighteen largest metropolitan areas in the country. But although the metropolitan area has been expanding, downtown Baltimore has failed to keep pace.

An estimated 94,000 people are employed in the central business district. This is about the same number as was employed there twenty years ago. The amount of vacant loft and warehouse space in the downtown area has become a serious problem. About 6% of all floor space in the area is now vacant and in some blocks the rate is 25%.

The business of downtown department stores has also been adversely affected. Sales at these stores have declined in almost every year since 1952. Although the assessed value of all real

property in the city has shown regular increases since 1952, assessments in the central business district reached a peak in 1952 and have declined steadily since then. Along with these problems, downtown Baltimore is harassed and hamstrung by heavy traffic, narrow streets, and inadequate off-street parking facilities.

This situation does not face Baltimore alone but is repeated in metropolitan areas throughout the country. Downtown is declining in other cities too, and they must decide what they can and will do to stop deterioration at the core of the urban center. Baltimore believes that it must come up with a dramatic plan to build a new downtown. Charles Center is the first step.

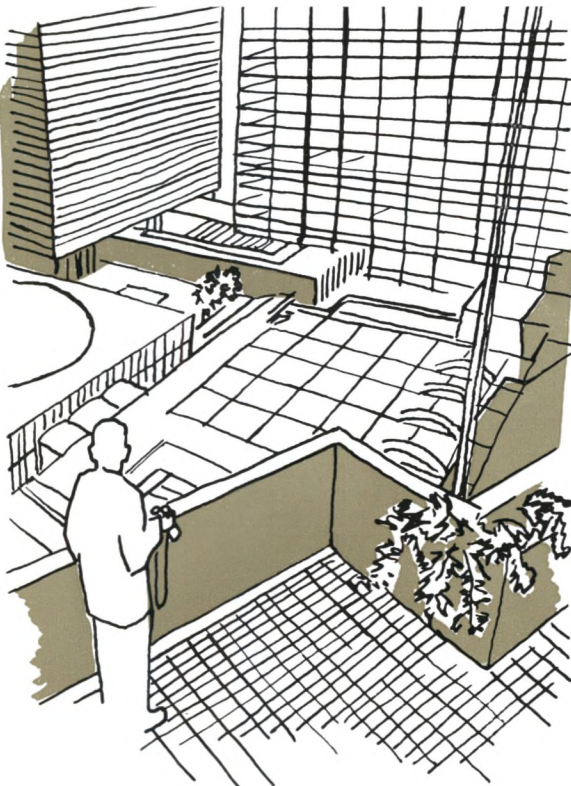
PARTNERSHIP PLANNING The plans for Charles Center have been made through the cooperation of private organizations and the city government. In 1957 an organization of businessmen known as the Committee for Downtown, Inc. commissioned The Planning Council of the Greater Baltimore Committee, Inc. to prepare a master plan for the renewal of the downtown district. The Planning Council is a private, non-profit organization. Charles Center emerged as part of the master plan and was announced first because it was felt that it was the best possible site for the initial onslaught against serious economic deterioration.

The Planning Council has worked closely with city officials and with the Baltimore Urban Renewal and Housing Agency in planning Charles Center. The responsibility for actually carrying out the plan, however, rests with the latter organization. It has the authority to acquire the prop-

erty in the area from the present owners either through purchase or condemnation proceedings. The Agency will also have the imposing problems of relocating the occupants, demolishing existing buildings, and selling the cleared sites to private redevelopers. The Urban Renewal and Housing Agency will, of course, place certain restrictions on the size and design of the buildings in keeping with the Charles Center plan. Some of the cleared land, three acres to be specific, will be retained by the city for development as public parks.

NEW FOCUS FOR DOWNTOWN Charles Center is planned to include about 22 acres of downtown Baltimore. At present, 371 business firms with about 5,600 employees are located within its bounds. These establishments are quartered in some 250 buildings, many of which are worn out or obsolete. Five of the buildings now in this area will be allowed to stand: three office buildings, a hotel, and a parking garage. The plans call for construction of eight office buildings, a hotel, a TV theater center, a municipally-owned transportation terminal, an underground parking garage, retail space with pedestrian malls, and three public parks.

A future guest at the new hotel looks out from a balcony toward the proposed TV theater center and two office buildings.



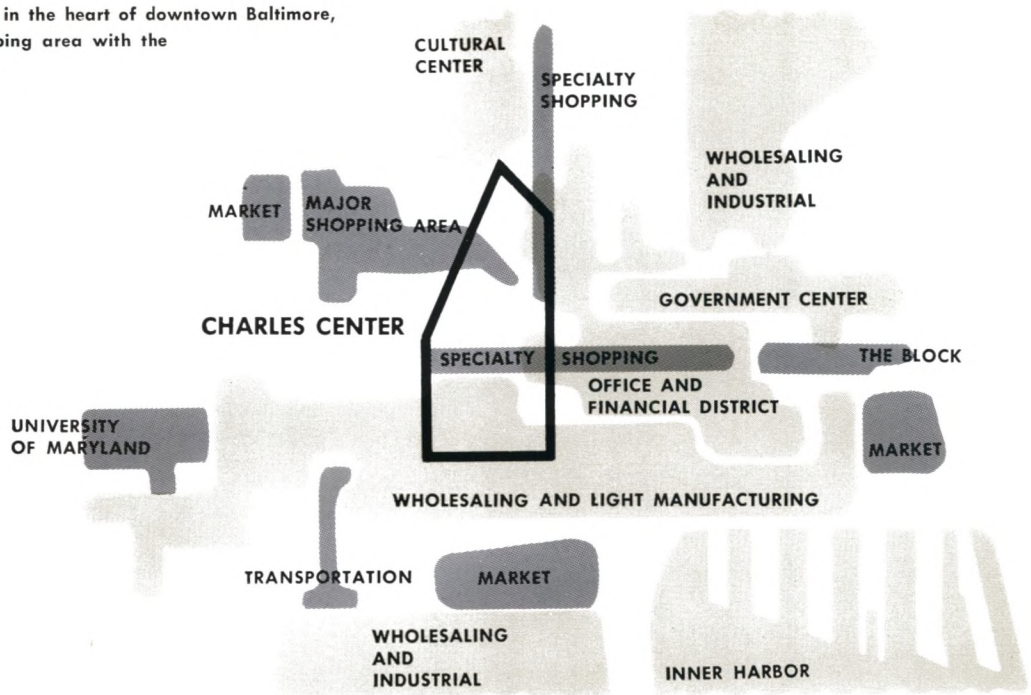
One of the attractive entrances to Charles Center will feature escalators to carry shoppers to a walkway over a busy street.

The eight office buildings will provide two million square feet of office space. This is almost seven times as much office space as has been built in the downtown area since World War II. It is estimated that this construction will meet the demand that will arise over the next decade. Without Charles Center the new buildings, if built at all, would probably have been scattered throughout the city. There will be 428,000 square feet of retail space in Charles Center. This is only about two-thirds of the retail space in the area at the present time. It is, however, in line with projected demand based on recent trends in retailing.

Employment in Charles Center is expected to be 19,000 people with visitors and shoppers swelling the daytime population to 25,000. To take care of the cars that some of these people will drive, Charles Center will have 4,000 parking spaces—all underground. The transportation terminal will be built by the city and will serve local and out-of-town busses. The terminal will also be underground, and escalators will provide passengers access from a public park.

The three parks will continue the open space principle which has been used by many ancient and

Charles Center will be in the heart of downtown Baltimore, linking the main shopping area with the financial district.



modern cities. This is simply a plan to leave open space between buildings for parks with trees, fountains, and flowers. These open spaces are as carefully planned as the buildings. Venice and even older cities used open space to their advantage. American examples can be found in New York's Rockefeller Center, Mellon Square in Pittsburgh, and Penn Center in Philadelphia.

FINANCING AN INVESTMENT The total cost of Charles Center is estimated at \$127 million. This will be paid from private and city funds. The cost to the city will be \$17,205,000, or 13.5% of the total. Private redevelopers will contribute 86.5%, or \$109,965,000. The city is not holding its hand out to Uncle Sam for any financial aid. To qualify for Federal assistance under the Government's urban renewal program, the project would have to include residential slum clearance or new housing construction. There are no residential quarters in the Charles Center site and none are contemplated. Here the guiding principle is provision of facilities for activities most able to profit from a downtown location.

The city's share of the cost will be spent for land for the parks and development of the parks, street widening and alteration, relocating public utilities, and construction of the transportation terminal. The latter is expected to be partially self-supporting. The city plans to issue urban renewal bonds to finance its part of the total cost.

The increased tax revenue from Charles Center is expected to be \$2.1 million a year. This added revenue would repay the city's investment in about nine years.

Of the \$109,965,000 investment by private redevelopers, \$92,735,000 will be for construction of the office buildings, stores and TV theater, the hotel, and the underground parking garage. The rest of the cost will be for the purchase of the land from the Urban Renewal and Housing Agency. The Greater Baltimore Committee has set up a special committee to work with people who may be interested in investing in Charles Center.

THE CITY'S JOB Through this brief description of the Charles Center have been numerous statements of problems plaguing downtown Baltimore. The present economic environment is not such as to provide private enterprise much incentive to invest in new facilities in downtown Baltimore. Through its urban renewal powers and projects, Baltimore hopes to provide opportunity and incentive for investment in new buildings and equipment in the downtown area.

The downtown district is the heart of the city. Baltimore, along with many other cities, has heart trouble. Its prescription to cure the disease is an urban renewal program based on an effective partnership of private and public interests. Charles Center is a vital project of this master plan.

The Fifth District

Last month brought new evidence of a strong and continuing expansion of economic activity in the Fifth District. Seasonally adjusted nonfarm employment rose in April to continue a virtually uninterrupted year-long rise, and man-hours rang up yet another healthy increase. In the textile industries, production has increased, order backlogs have expanded, and mill inventories are down. Further reports now confirm the earlier indications of a good spring furniture market. Bituminous coal output has registered very modest gains, and the inventory situation there gives promise of further increases.

EMPLOYMENT Substantial gains in April in manufacturing employment led total nonfarm employment, after allowance for seasonal forces, to a rise for the fourth consecutive month. Since December the total number of persons employed in the District has risen by 1.5% as compared with 1.8% for the national total. Among District states, North Carolina has led the gain this year with an increase of 2.5%, and it also had the largest gain in April over the previous month.

All major industries registered month-to-month rises except construction, mining and trade. The increase in employment in durables manufacturing was especially strong in each state, with West Virginia posting the largest percentage gain of 1.2%. District nondurable employment showed continuing strength also, with an increase of 0.7%.

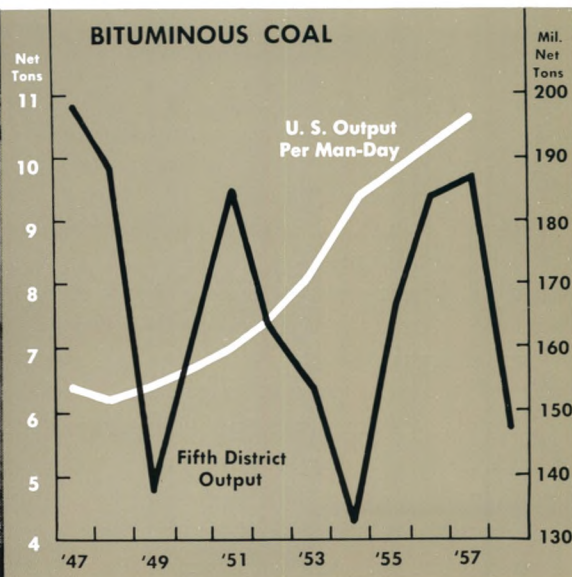
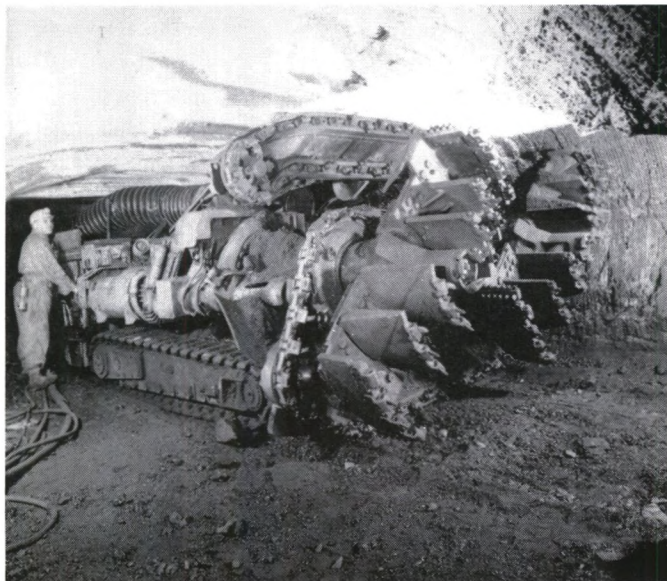
Rising employment in April was accompanied by longer work-weeks in manufacturing industries, and man-hours, seasonally adjusted, added another month of vigorous increase. All states posted March-to-April gains. Among the industries, fabricated metal products rose 2.8%; textiles, 2.6%; apparel, 4.7%; and chemicals, 4.5%.

BITUMINOUS COAL District coal production in the week ended May 9 achieved its highest level thus far this year. In the four weeks ended May 9, District production was 6% higher than in the previous four-week period and one-fourth above the same weeks last year. U. S. output was also up from these periods, but District increases in both instances were greater. District production, however, was still 18% below the like 1957 level.

Overseas shipments through District ports remained quite low in comparison with a year ago and were down 60% from the 1957 level. Coastwise shipments, under a continuing glut of fuel oil, were also down from a year ago and almost one-fifth under the 1957 figure.

Consequently, employment in mining areas continued downward. This decline in employment is not just a recent development. It has been most severely felt in West Virginia—the center of District mining operations—where the number of miners has declined by 54,400 persons from 1951 through 1958, despite a temporary slowing of the downward trend in 1956.

Marvelous labor saving machines that dig and load coal in one operation have almost doubled output per man-day since World War II. At the same time, total production of coal in the District has been in a downward trend from the record level achieved in 1947.



Even greater declines in mine workers have occurred since the '40's. Coal production in the District and in West Virginia reached a peak in 1947, and although there have been good years since then, output never regained the record level. At the same time, heavy mechanization of coal mines raised production per man per day from 6.42 net tons in 1947 to 10.73 net tons in 1957.

A bright spot in the outlook, however, is that coal stockpiles in the hands of U. S. consumers are estimated by the Bureau of Mines at 65.9 million tons as of March 31. This is 5 million tons under a year ago and is the lowest March figure since 1956. Normally coal-consuming industries add from 8 to 12 million tons to their inventories between March and October, and the present low level indicates that demand for rebuilding inventories may provide a considerable push for production before winter comes.

TEXTILES Backlogs of unfilled orders held by many District cotton textile mills have reached substantial proportions. Orders continued to expand during the past month as buyers placed an increasing volume for delivery later this year. An impressive amount of orders is held for fourth quarter shipment, and availability of supplies of many fabrics for delivery during the third quarter has become quite scarce. There has even been some limited buying for first quarter 1960 needs. However, most mills have been wary of quoting firm prices as far ahead as this.

Mills have continued to operate on a five-day-week schedule, although in some cases they are said to have lost business by doing so. The mill margin (difference between the cost of a pound of cotton and the selling price of a pound of cloth) in April was 27.18 cents a pound—the highest level since January 1957. The selling price of cloth used in computing the mill margin rose for the tenth month in a row. Mill inventories continued to decline, and by March stocks on hand had declined 39% from the peak of May 1958.

Demand for industrial gray goods improved and lengthened out during May. Most mills weaving industrial fabrics entered June with substantial backlogs of orders for third quarter delivery.

Synthetic yarn fabrics also shared in the active buying last month, and production is substantially sold through the third quarter. Prices have been increased on spun rayon and acetate goods and Dacron-cotton fabrics. Mills weaving rayon filament yarn goods have found the supply of yarn becoming tighter, and yarn prices have been

strong. Backlogs of unfilled orders for third quarter shipment of rayon and acetate filament fabrics are substantial.

Business for knitting mills has been better than seasonal with mills knitting cotton outerwear and underwear having large backlogs of orders. Seamless hosiery mills generally are sold up 4-6 weeks ahead with some having substantial backlogs of orders for third quarter. Ordinarily, this is a time of seasonal slack in orders and price softening.

FURNITURE Earlier general reports of a good spring furniture market were confirmed by information on new orders booked by District furniture manufacturers. For the first four months of 1959 new orders have been one-third ahead of the same period last year and almost one-fifth above both 1956 and 1957. Man-hours worked in District furniture factories in April were up 3.5% from March after seasonal correction, indicating that the March-to-April seasonal letdown in production was somewhat less than usual.

CONSTRUCTION The April dollar value of construction contracts awarded in the District broke all previous records with the single exception of May 1951. The upward push came from large gains in both residential and nonresidential building awards. These strong increases evidence a high level of building activity in coming months.

BANKING Nowhere is the rapid step-up in District business activity more evident than in the loan activity of District banks. Loan demand—already quite strong by historical standards—intensified somewhat during the first three weeks of May, forcing member banks to liquidate additional Government securities and to lean more heavily upon the discount window at the Federal Reserve.

The three most important types of loans—commercial and industrial, real estate, and consumer—continued to contribute impressively to the loan expansion. Commercial and industrial loans of District weekly reporting banks climbed even more rapidly the first three weeks of May than during these weeks of the boom years, 1955 and 1956. Both real estate and consumer loans showed signs of hesitation but still turned in quite strong performances in comparison with earlier years.

PHOTO CREDITS

Cover—Washington Air Defense Sector, United States
Air Force 11. National Coal Association.