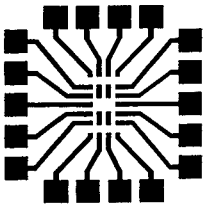
Photo by Paul Cooper

Why North Carolina Needs The Microelectronics Center

by George R. Herbert



It perhaps is not well understood that the basic, primary goal of the program of which the Microelectronics Center of North Carolina (MCNC) is the most visible element is to achieve a significant increase in training and education, at all levels, to prepare North Carolinians for employment in the nation's fastest growing industry. Because the microelectronics industry is becoming increasingly dependent on the availability of highly skilled and educated workers, achieving a quantum jump in training and education, and related research, will have the effect of making North Carolina competitively more attractive than other states and regions, assuring our development as a major center for the industry which is destined to have a profound impact on the country's strength and economy for the rest of this century.

MCNC has *not* been created to provide industry with a facility, nor to subsidize industry. Rather its facilities and activities are to support the educational and research missions of the six participating institutions to enable those institutions to prepare greater numbers of people for careers in this new high technology industry. Simultaneously, the educational and research activities of the institutions and of MCNC will serve as a magnet to assure that opportunities for those careers are created in new industry here in North Carolina.

George Herbert (left) and C.W. Clark stand before the entrance to the temporary offices of the Microelectronics Center of North Carolina at the Research Triangle Park.

The use of integrated circuits" (very complex circuits consisting of thousands of transistors formed on the surface of a tiny ¼" silicon chip) is a development of only the last 20 years. The first integrated circuits consisted of only a few interconnected transistors (replacing the familiar vacuum tubes). Today's "chips" contain more than 10,000 transistors, and the technology is moving rapidly toward 100,000 on a "chip." These integrated circuits are the brains of pocket calculators, digital watches, microprocessors, and new automotive engine controls. They also are essential to modern communications systems and all satellites and space vehicles.

The industry's rate of growth is illustrated by an estimated production of $8 billion of integrated circuits in 1980, projected to grow to $20 billion

George R. Herbert is chairman of the board of directors of the Microelectronics Center of North Carolina and president of the Research Triangle Institute. On May 28, 1981, Mr. Herbert presented a "Statement Regarding Requested Budget Appropriation for Microelectronics Center of North Carolina" before the full Joint Appropriations Committee of the General Assembly. That statement is reprinted here with permission. (The portion on "Worker Safety and Environmental Considerations" appears as a "box" on pages 34-35.)

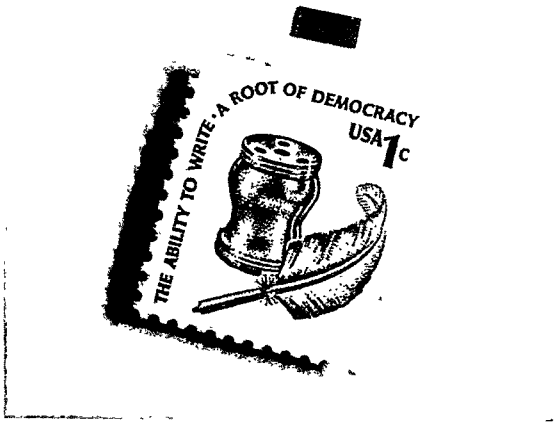


Photo by Chip Henderson, courtesy of N.C. Department of Commerce

A typical integraged circuit chip, compared in size to a postage stamp.

in 1985 and $40 billion by the end of this decade. Increasingly, integrated circuits are being used for control of appliance motors and for industrial controls. Every industry in North Carolina which now has controls using combinations of gears, pulleys, and levers will experience revolutionary changes with the future development of microelectronics.

The microelectronics industry is one of the few for which the United States can claim a position of world prominence, with slightly more than 60 percent of last year's total output of integrated circuits produced in this country. A real threat to our leadership now exists in Japan, where a massive combined effort of industry and government is aimed at overtaking the United States.

This also is an industry whose most critical resource is trained and educated people: engineers, physicists, and chemists for developing new technologies for fabricating circuits and computer scientists for computer aided design of the complex circuitry. It is this "people dependence" which is the focus of the MCNC program and which, if we are successful, can make North Carolina one of the centers of the industry.

Listening to some of us may convey the impression that we are just discovering the microelectronics industry. That is far from the truth, and our state has a strong, existing base on which to build the new program. Among our institutions, we have had teaching and research in semiconductor technology and in computer sciences for many years. And some of the biggest names in microelectronics are among our best corporate citizens: IBM, Western Electric, Data General, and Northern Telecom. This is what makes North Carolina the leader in electronics among the southeastern states.

What we have not had is the integrated circuit portion of the industry, the design and production of the tiny chips that are at the heart of electronic products and systems and are the key to the microelectronic revolution that is taking place.

When we speak of high technology industry, we assume this equates with higher skill requirements and, in turn, with higher wages. It is fair to question this assumption, but a few numbers from a very recent Employment Security Commission survey, as reported in *The News and Observer* on March 22, 1981, answer the question. In January, the average hourly manufacturing wage in North Carolina was $5.77; in textiles $5.23. In electronics it was $6.90. Nationally, in December, the average hourly wage for production workers in the semiconductor industry was $7.22.

Purposes, Structure, and Funding

The specific purposes of MCNC are:

• To develop, operate, and make available, to all six participating institutions, facilities and equipment necessary for expansion of microelectronics education and research into areas of sophistication and complexity that otherwise would not be possible. Equipment needed to serve the requirements of all institutions, and of cost that precludes duplication, (electron beam system and central

Average Hourly Wages For Production Workers In North Carolina Industries

January, 1981*

Apparel	$4.38
Lumber, wood	4.91
Furniture	5.17
Textiles	5.23
Food	5.50
All Industry Average	**5.77**
Printing	6.31
Stone, clay, and glass	6.36
Transportation	6.42
Non-electrical machinery	6.53
Rubber	6.89
Electronics	**6.90**
Chemicals	7.06
Paper	8.57
Tobacco	9.02

(Note: Nationally the average wage for production workers in the semiconductor industry, in December, 1980, was $7.22)

*Employment Security Commission survey reported in *The News and Observer*, March 22, 1981.

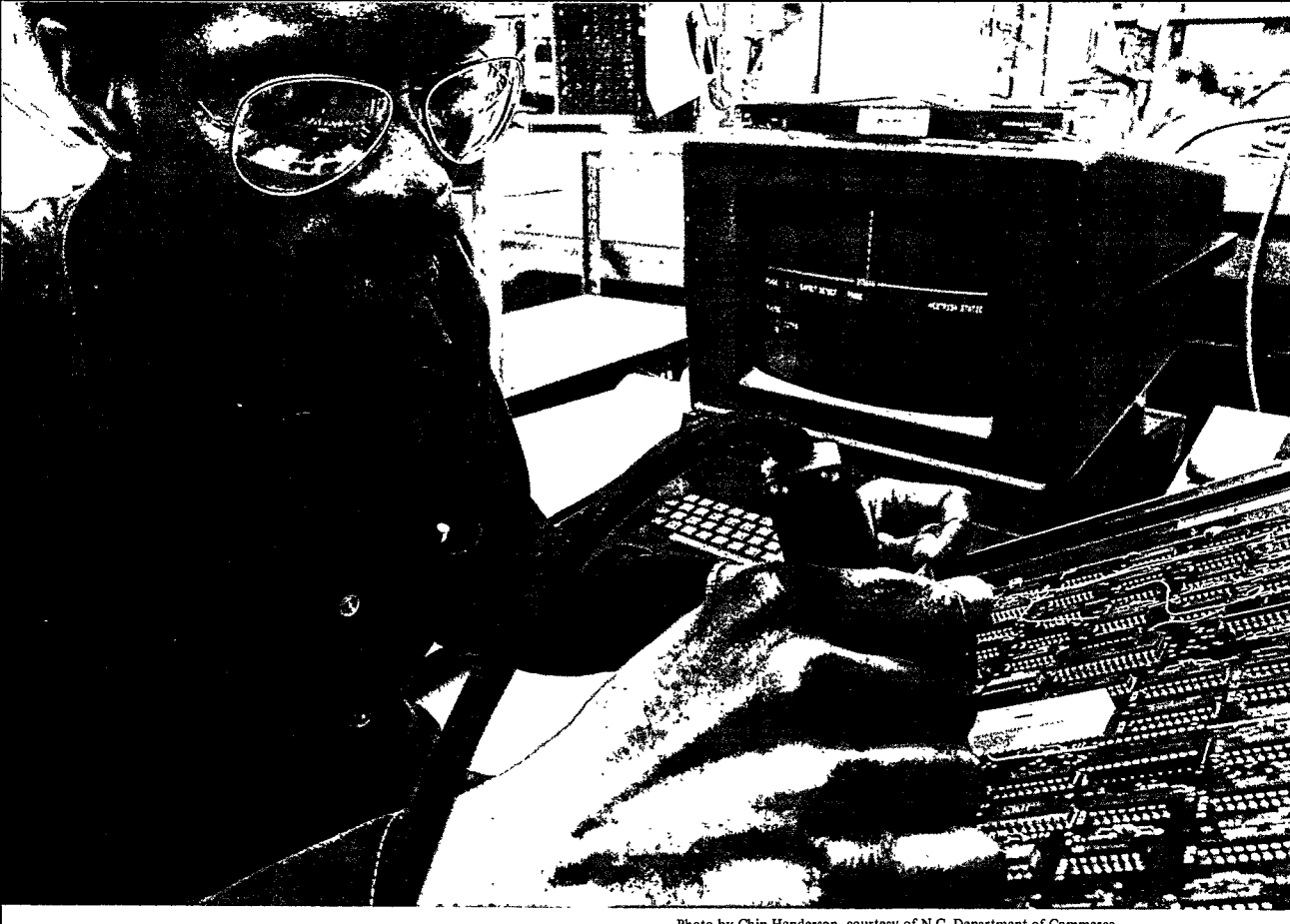


Photo by Chip Henderson, courtesy of N.C. Department of Commerce

Checking a circuit assembly at Northern Telecom

computer, as examples) will be housed in a central facility in Research Triangle Park. Other MCNC equipment more directly related to the programs of individual institutions will be located and operated on campuses but available to all participants.

- To assist in planning, developing and coordinating new educational and research programs, particularly those involving more than a single institution, and to assist in obtaining external funding.
- To provide a new, and additional, channel of communication and liaison with industry and federal agencies.
- To conduct research to advance the technologies necessary for integrated circuit design and fabrication.
- To assist appropriate state agencies in developing a strong microelectronics industry throughout North Carolina.

MCNC was incorporated as a North Carolina not-for-profit corporation in July 1980. The participating institutions are: University of North Carolina at Chapel Hill, North Carolina State University, North Carolina A&T State University, University of North Carolina at Charlotte, Duke University, and Research Triangle Institute.

Articles of Incorporation and By-laws stipulate that the 12-person Board of Directors shall consist of: the Chancellors of the five universities, five persons appointed by the Governor, one of whom shall be a representative of state government, a representative of Research Triangle Institute, and the President of MCNC.

The planned use of requested funds are:

Structure for Central MCNC facility and modification of campus space to be occupied by MCNC facilities	$10,436,000
Initial major equipment	8,650,000
Direct operating costs of Center (Salaries & fringe benefits, materials and supplies, travel, communications, utilities, services, etc.)	2,822,000
Programmatic expenditures and graduate fellowships at the institutions	2,450,000

In addition to the state funds request, it is the goal of MCNC and the six participating institutions to generate approximately $5.6 million in non-state funds (corporate, federal, and foundations) during the biennium for other equipment, operating costs, and activities at the institutions directly

related to the MCNC program.

There are two principal types of accountability: functional and fiscal. The first relates to assuring that the organization serves its intended purposes and the second guarantees responsible and prudent management of assets and use of funds made available. As with any corporation, ultimate responsibility rests with MCNC's Board of Directors. With respect to functional responsibility, the designated membership of the university chancellors assures that MCNC always will serve a primary function of supporting the educational and research activities of the institutions. Similarly, the five members appointed by the Governor assure responsiveness to the broader needs of the state.

In exercising its responsibility for fiscal accountability, the Board approves all major commitments of funds for facilities, equipment, and programs. As an additional guarantee that state monies are used for the intended purposes, the existing contract between the state and MCNC, for conveyance of funds, lists the categories for which funds are to be used and requires that an annual audit be performed by independent certified public accountants (currently Price, Waterhouse & Co.) and submitted to the state.

In addition to state funding, of which a major portion of the 1981-83 request consists of a one-time, non-repetitive investment in building and key equipment, MCNC is expected to generate non-state funding from a variety of sources, including:

- federal grants and contracts to MCNC and to the participating institutions for equipment and research;
- facility use charges for externally funded research performed by the institutions;
- annual Industrial Affiliate Support payment; and
- private foundation grants.

After completing the complement of equipment when the building is completed, the combination of above funding sources will enable state funding to decline to a fraction of the amount currently requested – only that necessary to make the facilities available to the universities, without cost, for educational purposes.

Expected Educational and Economic Impact

Since the ultimate purpose of MCNC is to permit a substantial increase in the number of young people being educated for careers in the rapidly growing microelectronics industry, simultaneously making our state more attractive to that industry, we undertook an inventory of undergraduate and graduate students in electrical engineering and computer sciences at the five universities and asked for near-term and long-term projections based on the establishment of MCNC.

During this academic year there were slightly more than 2,000 undergraduate students in these two fields and 273 graduate students. The near-term projections indicate an expected increase in graduate enrollment alone to nearly 400 by the 1982-83 academic year.

The references here are only to electrical engineering and computer sciences. Other important fields, which also look toward growth in student output, include physics, chemistry, and materials engineering.

In time, I believe we can anticipate the involvement of other universities in the state. This was evidenced by an exchange of correspondence earlier this year with Chancellor John Thomas, of Appalachian State University, who indicated the desire of his institution to participate and contribute. Nor should we overlook the vital role of the Community College System in training technicians for the industry, and President Larry Blake already is guiding the planning for programs to train semiconductor technicians.

As expected, the MCNC program to expand microelectronics education and research in the institutions of the state increasingly is drawing the attention of national industry to North Carolina as the potential new center of microelectronics activity.

One single example, the new General Electric Microelectronics Center, may be seen as a harbinger of what can come. Originally announced as an investment of approximately $50 million, an amount of $100 million has more recently been publicly acknowledged, and, while initial employment has been estimated in the 150-200 range, GE officials have said that, if operations go well and future plans approved, employment could grow to 1000.

Of even greater importance for the future is the fact that every existing industry in North Carolina can expect to have its equipment, processes, or products changed and improved as the microelectronics revolution continues through the rest of this century. In addition, the state or region which becomes a center of the microelectronics industry can expect to attract an increasing share of the manufacturing industries which incorporate integrated circuits in their products.

Whether it happens in North Carolina, or in other states and regions, it will happen. Our goal is to train and educate increasing numbers of young people for careers in this vital industry and then, by creating a magnet for the microelectronics industry, assuring that their job opportunities will be here in North Carolina.□