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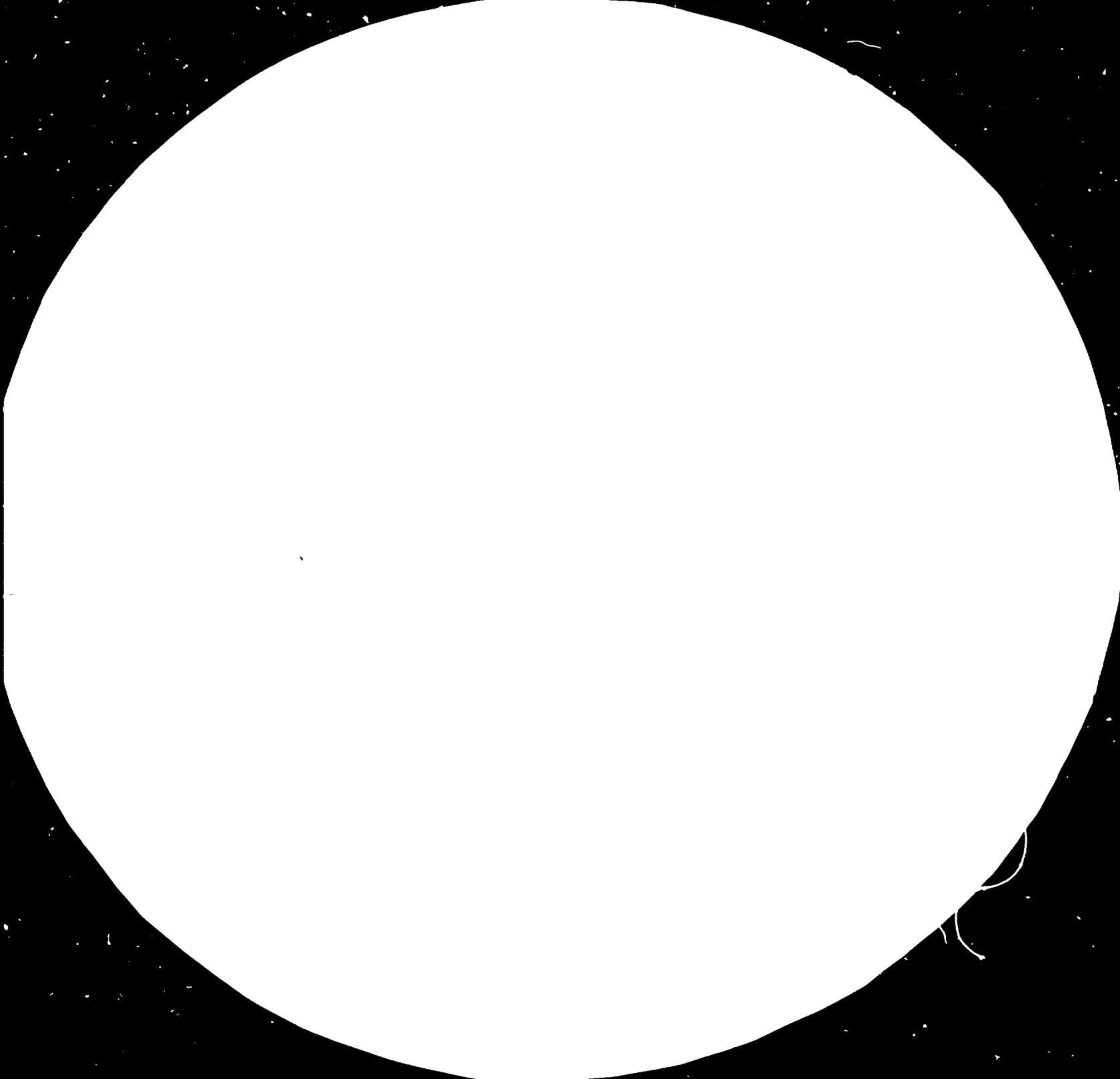

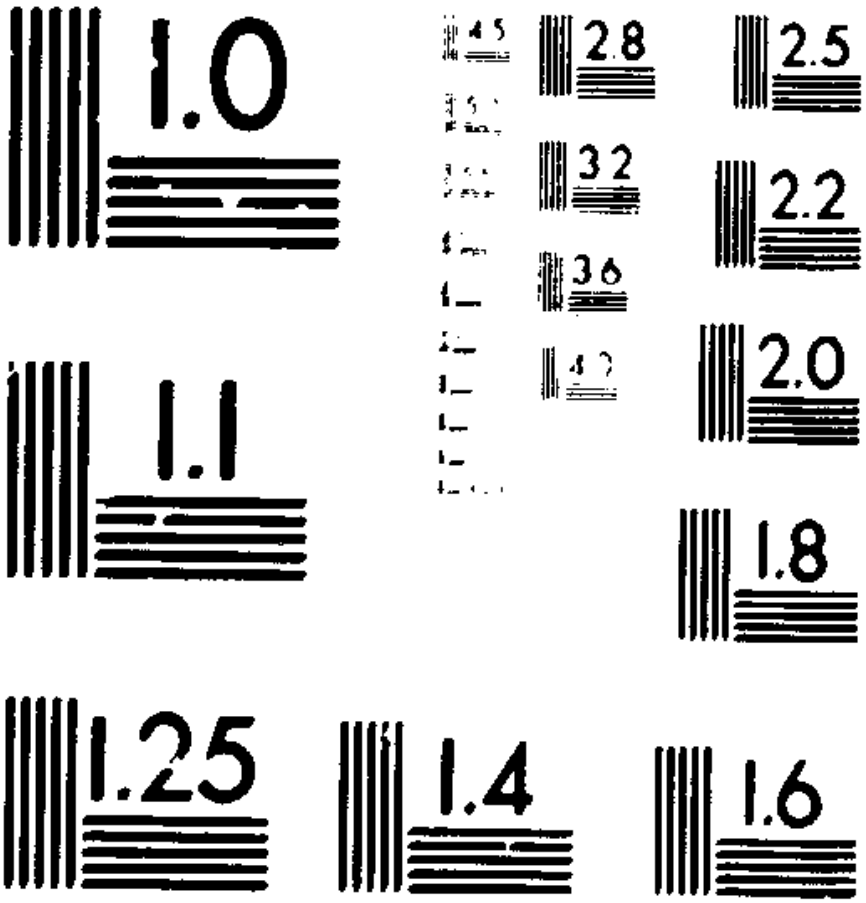

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DEVELOPMENT OF ELECTRONICS

IN

ZAMBIA*

Prepared by

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Contents

1. Introduction

Microelectronics is probably the most dynamic and challenging field in electronics. Positive and negative aspects of introducing microelectronics applications have been identified, but most developing countries are faced with the problem of how best they can enter this field in order to get maximum benefits and avoid pitfalls. This paper examines the impact of microelectronics and the experience Zambia has had in the field of electronics.

Electronics is, relatively speaking, a new field but coupled with advances in solid-state physics, physical chemistry, high vacuum technology and production engineering it has reached maturity very fast.[1/] Within the same field another area which has aroused much interest and activity is microelectronics. This area has overshadowed electronics to an extent that when one mentions electronics it would be right to assume one is referring to microelectronics. Microelectronics encompasses several approaches to the design and production of electronic circuits that result in circuits that are smaller than could be achieved with conventional discrete devices.

The new technology has introduced a new way in which to approach the manufacturing and designing of electronic circuits. To the designer of electronic circuits this has reduced his work to merely selecting and specifying micro-circuits and assembling them. The extra time acquired in this way will go a long way to improving the final end product. This is a welcome change as the product development cycle is reduced, resulting in reduced costs which are subsequently transferred to the consumer. In the case of the manufacturing of integrated circuits the same can be said except that not many will afford the large outlay of capital required to acquire the microelectronics manufacturing capability.

What are the implications of these developments which have been introduced by microelectronics? The most obvious is that the field is characterized by a large number of consumers of microelectronics rather than producers. Equipment sophistication will increase, this will introduce maintenance and service problems especially to developing countries. Microelectronics producers have to come up with better microcircuits almost every year for them to maintain their hold on the market. The consumer or the

designer of electronic equipment using microelectronics will have to adapt himself to designing circuits using microcircuits which will be available on the market. Expected useful life of electronic equipment will reduce not due to malfunction, but due to equipment becoming out-dated very fast.

For large consumers with large unit turnovers, possibilities already exist to go for custom-made microcircuits for their specific applications. This results in reducing costs further but has a disadvantage in that buyers of such equipment will be tied to specific dealers in form of maintenance or service contracts. This is because the equipment manufacturer has a monopoly as to whom he can supply service and replacement parts, further the price of such services can be manipulated easily as buyers have no alternative service from other producers. This situation will affect most of the developing countries who have no microelectronics manufacturing capability.

Taking into account these points, it seems logical that those who are mostly affected by the negative aspects of developments in the microelectronics technology, should find a suitable way at least to protect their interests. This can be achieved by acquiring some microelectronics manufacturing capability. With due respect to the large outlay of capital required in acquiring this technology, it is suggested that this is done on similar lines as the successful INTELSAT programme. A grouping of nations can form a regional microelectronics industry which will save the interest of the group. This will provide a fast and reliable source of microelectronics hardware in reliable sufficient quantities.

2. Experience in Zambia

Like in most developing countries Zambia's experience in the field of electronics is that of an end-user of electronic equipment. This trend was inherited at the time of independence from the previous colonial government whose only interest in Zambia was financial rather than development. Unfortunately after independence the nation was faced with other important tasks rather than concentrating on microelectronics.

Initially the electronics products were imported into the country. These included items like radios, television sets, and other consumer items. With the development of Zambia's industries, need arose for highly specialized electronic equipment to be imported for use in some of the industries. The equipment in this category included semi-automatic machines and control processes.

In the early 1970s there was a drastic change in Zambia's electronics imports - Zambia joined the computer age. Computers were imported into Zambia mainly for accounting and administrative purposes. Later developments in the field of telecommunications required large usage of electronic systems. In an effort to improve telecommunication facilities, the Post and Telecommunications Corporation switched to electronic telephone and telex exchanges, and the construction of the Mwembeshi Earth Satellite Station with aid from Japan. The mining companies in their efforts to reduce costs almost at the same time went into computerized accounting, administrative and planning systems. The Zambia Copper Mines, which are faced with stiff competition from abroad, are now introducing more and more automated processes in their mineral extraction programmes.

The consumer market for electronic products has provided an impetus for the "near" introduction of an electronics-based industry within the country. Companies like ITT Supersonic, Philips, National Cash Register and Erricsons have seen this need for electronic products and some of them have responded by introducing assembly facilities for their products. Though this technology is in the hands of internally based multinational corporations it goes a long way in showing that a potential market exists for electronic products in Zambia.

Most of the problems encountered by Zambia in its effort to use electronic technology have not been in the widely held views of displacing people from employment, but in servicing the technology. Faced with lack of foreign exchange reserves for purchase of spares to maintain and service equipment most of the equipment is not functioning. This problem has been compounded by the lack of suitably qualified personnel to innovate and service this sophisticated electronic equipment.

3. Present Situation

Most of the advancements in microelectronics have been due to research undertaken in universities in developed countries. The research undertaken in these universities formed the basis for a microelectronics industry to be established. It can be rightly concluded that the future of Zambia in microelectronics has a bearing on what the University of Zambia is doing in this field at the moment. A university forms a central core of any nation and it is from this body that ideas must emanate. The university in its research efforts must prove to the nation that the country is capable of developing and sustaining a given technology. Only then will industry move towards using research findings and implement that technology. It must be realized that industrial concerns are not prepared to experiment on technologies which in their view are not proven.

The University of Zambia, through the Department of Electrical and Electronic Engineering is making this a reality by introducing courses which prepare students for this eventuality. The Department has changed from offering a general electrical engineering degree programme to a more specialized one encompassing electrical machines and power, and electronics and telecommunications (ET). This trend enhances the fact that the development of an electronic manufacturing capability within the country cannot be overlooked. To this effect programmes at the University of Zambia include courses in physical electronics; microprocessors and microcomputing; and microprocessor industrial applications.[2/]

The Department has gone a far step further in achieving this task by taking technology to where it is needed - in industry. In its effort to spread positive aspects of electronic technology, the Department conducts courses in microprocessor applications,[3/] to industries within Zambia. Zambia Consolidated Copper Mines, which is the country's main foreign exchange earner, has benefited from contracts with the University. This not only helps the concerned industry by introducing new ideas to its employees but also helps in giving electronic technology a wider acceptance in Zambia.

4. Electronic Engineering Training Facilities

Training programmes can never be meaningful without equipment to back the theoretical knowledge with practice. The department maintains a number of laboratories for instruction purposes in ET. These laboratories include:

1. Electronic engineering laboratory: with facilities for processing printed circuit boards;

2. Microprocessor laboratory: facilities include microprocessor development systems, printers and trainer units;

3. Microcomputing laboratory: facilities include five ABC 800 minicomputers and supporting hardware. This laboratory was established together with a new course in microcomputing to preparing students to have software development expertise;

4. Control systems laboratory;

5. Telecommunications laboratory.

The facilities provided combine to give a good understanding of the electronic technology and the role of software in Zambia. The main driving force towards the microelectronics manufacturing will be the introduction of postgraduate programmes in the near future. These will provide suitable candidates for persuing research programmes in the field of electronics.

5. Conclusion

Though it is possible to develop a microelectronics manufacturing capability, without any contacts with the University, note here must be made that an industry will only be self-sustaining if the manpower requirements are satisfied. To develop local expertise in this field it must be stressed that this capability be developed at all levels. In Zambia though no direct efforts have been made to introduce microelectronics capability, the efforts by the University are directed towards such a goal in the near future. With the results of present programmes it can be said that by the year 2000 Zambia will have a microelectronics capability.

References

1/ J.M. Carroll, Microelectronics Circuits and Applications.

2/ School of Engineering Undergraduate and Postgraduate Handbook.

3/ C.C.M. Hendricks, An Introduction to Microprocessors.