

ADDRESS BY  
DR. H.J. BHABHA,  
CHAIRMAN, ATOMIC ENERGY COMMISSION,  
AT THE INAUGURATION OF THE  
NUCLEAR ELECTRONICS CONFERENCE  
ON  
MONDAY, NOVEMBER 22, 1965

It gives me great pleasure to welcome you all here on the occasion of the opening of the Second Conference on Nuclear Electronics to be organised by the International Atomic Energy Agency. We are very fortunate in having with us today Mr Asoka Mehta, Deputy Chairman of the Planning Commission, who has kindly agreed to inaugurate this Conference, and I would like to express to him our very sincere thanks for the trouble he has taken to be present with us on this occasion. This is a recognition of the importance he attaches to electronics in the industrial development of our country and the rôle that we may expect it to play in the future. I would also like to extend a warm welcome to the representatives of the International Atomic Energy Agency, who have been responsible for the organisation of this Conference, and in particular Dr Kuba, who represents the Director General of the Agency on this occasion. We warmly welcome the distinguished participants from abroad, as well as from all over India, who have come to participate in this Conference.

2. The precursor to this series of conferences on Nuclear Electronics, was the "Colloque international sur l'electronique nucleaire" organized by the Societe Francaise des Radio-electriciens in Paris in September 1956. The importance of the results achieved at this colloque resulted in the International Atomic Energy Agency participating in the publication of the proceedings of the conference and supporting its circulation. As a follow up of this conference the first conference on Nuclear Electronics was held in Belgrade from 15th May to 20th May 1961. At both these conferences subjects such as the design and development of nuclear detectors in all fields and the physics of fast electronics were discussed. The present conference will devote special attention to problems of neutron flux measurements, reactor safety and data processing.

3. I would now like to discuss briefly the importance of nuclear electronics in the context of atomic energy developments. Nuclear electronics is a typical modern branch of technology, resulting from the application of electronics to meet the needs, initially of nuclear research, and later of the entire atomic industry. It is now well recognised that without a full-fledged programme for the design and development of nuclear electronic equipment, no country can embark on any meaningful atomic energy programme. Thus, in any developing country, which does not already have an organised electronics industry, a self-reliant atomic energy programme will necessitate not only the indigenous development of nuclear electronic instruments, but also organised work on other aspects of electronics such as computers, process instruments and control systems. It may be useful at this stage to briefly review our own experience in the field of nuclear electronics in the Trombay Establishment.

4. The electronics industry is still in its infancy today, and except for the radio receiver industry, which has taken root, and a couple of plants producing some electronic equipment for communication and defence, there is hardly any production of professional equipment in the country.

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The Atomic Energy Commission therefore recognised at the very beginning, as far back as in the late 40's, that it would either have to depend wholly on imported electronic equipment for its activity, or to take steps to establish powerful research and development groups in electronics to make the electronic equipment it needed. The work first started in a modest way by developing Geiger counters needed for the geological survey of atomic minerals. From there we passed on to the making of power supplies, amplifiers and other standard equipment required in atomic energy work. Since then the effort of the Atomic Energy Commission in the field of electronics has grown with ever increasing momentum till today we have the strongest organisation in the country for research and development in electronics and are now moving to the stage of setting up an electronics factory outside Trombay for the full scale production of the full range of electronic equipment needed for atomic energy work. Today the Electronics Group of the Atomic Energy Establishment employs a staff of over 1,150 persons of whom over 300 are scientists and engineers and over 700 technical staff. In addition, there are smaller but powerful electronics groups in other Divisions of the Trombay Establishment, in the Tata Institute of Fundamental Research, in the Physical Research Laboratory, Ahmedabad, and in our space programme. When it was decided in 1955 to design and build a reactor of the swimming pool type, the Electronics Division was asked to design and build the control system for it. It is of interest to recall that the control system for Apsara, the first reactor in Asia, was built in a temporary hutment about a hundred yards from where we are meeting today, which we inherited on this site with a number of other temporary buildings built during the War. I am glad to say that from the first day on which the reactor Apsara went into operation in August 1956 its control system functioned without giving any trouble, and it continued to operate until 1960 when the reactor was shut down for overhaul. At that time we took the opportunity to redesign some of the control system, and a comparison of some of the more compact and elegant parts of the control rod drives of the present system with the larger parts of the first system will show the progress that was made in the intervening period. In 1964 the Electronics Production Division produced nearly 2,000 different instruments of 30 different types valued at Rs. 4 million (Rs. 40 lakhs). The range of instruments included radiation survey meters, scalars and power supplies, amplifiers of various types, single and multi-channel analysers and complete nuclear spectrometer systems. All the designs for the various instruments were developed in the laboratories of the Trombay Establishment and every achievement in the field of electronics has been accomplished without obtaining any know-how whatsoever through foreign collaboration. As few components of the specifications necessary for nuclear applications were being produced in the country, the fabrication of these instruments necessitated the import of components to the value of nearly Rs. 0.8 million (Rs. 8 lakhs), but as a result instruments were produced, which if imported, would have cost nearly Rs. 5 million (Rs. 50 lakhs) in foreign exchange. Thus, the overall foreign exchange saving as a result of this single operation was nearly Rs. 4 million (Rs. 40 lakhs). In order to minimise even this dependence on foreign components, the development of indigenous electronic components, such as precision high stability resistors, zener diodes, silicon rectifiers, low frequency germanium transistors, germanium power transistors, thermo-electric coolers, metal film resistors, multiturn potentiometers and components for servo instruments has already been successfully

undertaken in the Trombay Establishment. These components have been fabricated in sizeable numbers on a pilot plant basis and we are now in the process of producing them on a commercial scale for the country as a whole.

5. In parallel with the activities I have described above, a Reactor Control Division started functioning in the year 1953. This Division was responsible for the successful design and fabrication of the entire control system for Apsara, as I have already mentioned. At the time this was accomplished the know-how on reactor control systems available all over the world was rather limited. This Division has grown in strength. It successfully completed the installation and operation of the control system of the 40 MW CIR. It has also been responsible for the successful design and fabrication of the control systems for the reactor Zerlina, and the Plutonium Plant. It now holds two contracts for power reactor instrumentation, one worth Rs.1 million (Rs.10 lakhs) for India's first power reactor at Tarapur and the other worth Rs.5 million (Rs.50 lakhs) for the second power reactor at Rajasthan. On the basis of an expansion programme envisaged for this group it is expected that it will be capable of handling the entire fabrication of control systems for the power reactors that are to come up in future - at the rate of one reactor per year from the year 1968. This group has also done enough work to be able to make significant contributions to the technology of control systems.

6. The development, design and fabrication of electric computers is another phase of activity on which the Trombay Establishment has embarked recently. A medium speed digital electronic computer was designed and built by the Computer Group at the Tata Institute of Fundamental Research and was on two-shift operation till we acquired the much more powerful CDC 3600 system. The Computer Group here will continue its work in designing new computers in line with developments abroad, and in developing computer technology, and together with the Electronics Group of the Trombay Establishment some of these computers will be produced in considerable numbers to serve the needs of the country as a whole.

7. It was with this background of the importance of electronics and a first-hand knowledge of what can be accomplished in this field in the country, that the Atomic Energy Commission recommended to Government soon after the Chinese attack that an Electronics Committee be set up to survey the needs of the country in electronic components and equipment and to recommend measures for the planned development of electronics, so that the country as a whole may become self-sufficient in this field in the shortest possible time and in the most economical manner. The Electronics Committee, of which I have the honour to be Chairman, was appointed by a Government Resolution in August 1963, and has since then submitted twenty-one reports covering various areas in the entire field of electronics. The final report of the Committee will be submitted before the end of this year. Our country came to recognise rather belatedly in 1963 that electronics is not just something for the entertainment industry, but one of the most vital and essential branches of modern technology. It is, I am sure, in recognition of this that Mr Asoka Mehta has gone to the trouble of coming to Bombay to inaugurate this Conference. The Electronics Committee has estimated that electronic equipment worth some

Rs.16 billion (Rs.1600 crores) will be needed in India in the next ten years, but that to produce this the necessary investment is only about Rs.1.7 billion (Rs.170 crores) of which a little less than half would have to be invested in the Fourth Five Year Plan and a little more than half in the Fifth Five Year Plan. Mr Asoka Mehta, who, as the Deputy Chairman of the Planning Commission, has to deal with plans of Rs.200 billion (Rs.20,000 crores) and more, will recognise that this is a modest investment for such a vital industry. It is moreover an industry in which the value of the annual product may be as high as twice the capital investment, so that it is a high return industry, a fact which must also weigh with him in developing the Plan. Finally, it is an industry with a very high employment potential, the capital investment per skilled man employed being about Rs.5,000 while the corresponding investment in the steel industry is as high as Rs.150,000 per man employed. We expect that in ten years' time no less than some 370,000 persons will be employed in the electronics industry in India, most of whom will be skilled workers, scientists and engineers. I have no doubt that the Trombay Establishment and our laboratories in the space research programme will continue to spearhead developments in electronics in this country.

8. It is therefore only appropriate that the International Atomic Energy Agency should have decided to hold its Second International Conference on Nuclear Electronics in Bombay. As you may be aware, the Agency has already arranged several conferences and symposia in Bombay with the cooperation of the Department of Atomic Energy, and I am sure that this cooperation will grow in proportion to the activities of both these organisations.

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