knowledge, to acquaint them with modern problems in cybernetics, and to attract people taking their first steps in science.

The leading scientists of the institute were invited to give lectures on problems of the development of research in cybernetics.

The opening address to the conference was given by E. L. Yushchenko of the Academy of Sciences of the Ukrainian SSR.

At the plenary session particular attention was given to the address by Academician V. M. Glushkov entitled "Some problems in developing methods of cybernetics and computational techniques facing young scientists of the Institute of Cybernetics of the Academy of Sciences of the Ukrainian SSR," in which he commented on the most important and promising developments in computational techniques and automated control systems, and on the main problems which need to be solved by the young scientists and specialists of the institute in developing new methods and techniques in cybernetics.

The work of the conference took place in six sections: theoretical and economic cybernetics, engineering cybernetics, systems software, physicotechnical and theoretical problems of computational techniques, cybernetic techniques, and biological and medical cybernetics.

More than 150 papers were presented at the conference, the best of which were recommended for publication in the following journals: Kibernetika (Cybernetics), Upravlyayushchie Sistemy i Mashiny (Control Systems and Machines), and Avtomatika (Automation).

SOME PROBLEMS CONNECTED WITH THE CREATION AND DEVELOPMENT OF METHODS AND HARDWARE FOR CYBERNETICS AND COMPUTER ENGINEERING FACING THE YOUNG SCIENTISTS AT THE INSTITUTE OF CYBERNETICS OF THE ACADEMY OF SCIENCES OF THE UKRAINIAN SSR

V. M. Glushkov

The present stage in the development of cybernetics is characterized by what is perhaps the most intensive use of computers. In this context, an important factor is that any one experiment or any one investigation employs a large variety of hardware which is usually created during the job itself. This results in a need for the modern investigator and cyberneticist to possess a knowledge of systems programming. Such an approach assumes that the investigator or experimenter not only makes a habit of working with one or another form of computer system or equipment for automated programming or means for organizing the operation of a computer, but also that he has a profound knowledge and understanding of the internal mechanisms of modern computer systems, together with methods of effectively adjusting them or even readjusting them for a given class of problem.

There have been several periods in the history of programming. Each of these is characterized by its own range of software. The development of this software has, on the one hand, been directed towards bringing it into line with the concepts in which the user is interested, while, on the other hand, the need for the effective solution of problems by computer has led to a position in which the hardware tends to reflect the properties and features of the structure and internal mechanism (hardware) by which the calculations are organized. Consequently, the modern programmer, despite the fact that he himself has not developed the program (there will be the problem of identifying the control subjects of an automated control system, of recognizing samples, of solving systems of equations in linear algebra, or optimizing graphically), will have to create his own algorithm for solving the corresponding problem, in addition to creating the packages of programs, even in the case of a special control program (and sometimes a specialized operational system), a general purpose system.
for conducting dialogue between the operator and the programs of the package that he has developed, and other necessary services. We have already noted that it is almost always advisable to have a special system of programming for each class of problem, the use of which will greatly reduce the work of the programmer.

The programmers themselves can be divided into three categories: systems programmers who work improving software in the modern sense of the word, programmers who possess knowledge of some of the technology and can formulate the results of activity in certain fields in the form of packages or special systems of programs, and, finally, wide plan users having the minimum knowledge of programming but who are specialists in a particular field. We should note that programming is an essential tool of the present-day investigator and cyberneticist carrying out experimental work on computers, and the better qualified he is as a programmer, the quicker he can reach the target of his studies.

Our institute carries out a variety of work on the creation of new software. We have developed formalized technical tasks for designing programs, acknowledged by the State Commission PTK, the technical programmers' complex, an automated system of producing programs has been developed, etc.

On the other hand, work has been carried out on the creation and introduction of data banks, particularly the Oka and Pal'ma systems.

The provision of working conditions for programmers to ensure that these systems will be "bound" into a unified complex is an important problem.

Our computer center is at present experiencing a stage in which new conditions of work and new user demands are being formulated. This involves extensive investigations and experimental work for the computer center in the introduction of new computer software developed within the framework of Comecon (the agreement concerning this was entered into not long ago).

Furthermore, the computer center has seen a sharp increase in the supply of peripheral equipment, particularly large capacity disk stores. In this regard, one of the more important problems is that of building up the equipment for the computers. It is important not only to solve this problem as far as standard software equipment is concerned and for the equipment of other types of computers with instruction systems differing from the standard software system, but also to extend and realize the idea of building up a system of equipment for use in programming. This same problem also exists in relation to the expansion of our computer center by the incorporation of a high-speed computer center for general use with remote access. The participation of young investigators in this extensive and important work is very desirable. We should bear in mind that this work is particularly inconvenient and difficult, concerning as it does the almost direct replacement of a computer and the practical incompatibility of the software when changing over from the smaller to the larger model of computer (although this should not be the case in principle).

The problem of automating scientific investigations is receiving a great deal of attention at the present time. It is precisely this question that was discussed at the first meeting of the presidents of the national academies of sciences concerned with mutual economic assistance, which was held not so long ago in Moscow. The solution to this problem depends on a great extent on computers being put to their proper use. This involves not just, or even not chiefly, solving the problems involved in processing experimental results, but also a whole range of other problems concerned with investigations and, particularly, those of an organizational character, such as the creation of special program systems and packages upon which we have already remarked, the regulation of calculations, the creation of powerful computer centers for general use, the creation of networks of computers, including specialized data banks specializing in particular fields of study, etc. Specifically, the Academy of Sciences of the Ukrainian SSR has initiated the creation of several of these data banks, such as that in the Institute of Material Science. We are faced with the problem of developing and introducing the appropriate programming and technical services for this work, primarily for the Academy of Sciences of the Ukrainian SSR. The problem of creating a network of computer centers is interesting from the point of view that at the present time we have the prerequisites for connecting our network to the European network and, through this, to the American system. This possibility is interesting, on the one hand, in view of the possibilities of utilizing new computer power, and, on the other hand, from the point of view of combining the resources of the Communist countries to create specialized data banks. Furthermore, this is linked with the use of international standards on information science, and also with the exchange and marketing of computer software and hardware.

Let us now look at the problems that arise in connection with the development of automated control systems of various classes. The center of gravity has now shifted towards the solution of problems concerned with the creation of software complexes with the focus on classes of application. If we are talking about automated programming control systems, then we should give some thought even to the creation of integrated