Automatic control systems play an important part in implementing the basic statewide task set by the 25th Communist Party of the Soviet Union (CPSU) Congress of improving the quality of work in all the branches of national economy and raising the efficiency of social production. One of the basic tasks facing the State Metrological Service consists of ensuring the further development and raising the efficiency of the metrological automatic information and control system (AICS), whose first stage has been developed and is operating.

In developing the second stage of the metrological AICS considerable attention is being paid to the automation of planning, the basic control function. In addition to planning with the application of the latest method of systems analysis and mathematical planning and simulation, it is also necessary for this purpose to establish an appropriate information base, develop and improve the normative and reference economic system, analyze the activity of the state metrological service agencies, and check the implementation of the planned activity. This means that within the framework of the second MAICS application stage it is also necessary to develop accountancy, analysis, and checking, whose implementation should ensure satisfactory application of planned tasks. A combination of such tasks should form a closed circuit for controlling one or several types of the state metrological service activity and should be aimed at attaining the set objectives.

The presence of coordinated objectives, compulsory all-round examination of the functional, provision, serviceability, and organizational aspects of the second MAICS development stage leads to the necessity for applying systems analysis methods and planning further development in 1976-1980.

The purposefully programmed planning method was used in working out measures for the second MAICS development stage. The method is based on a program which comprises a set of measures coordinated with respect to time, resources, and application and is aimed at attaining the set objective by the given date [1].

It is possible to envisage within the state metrological service the following programs: developing the theoretical basic foundations of modern metrology; developing a state reference-standards base; establishing and maintaining production of reference measuring equipment and reference materials, as well as providing the metrological-service agencies with testing equipment; developing state standardization of metrological provisions for national economy; developing the state system for testing measuring equipment; improving the organization and control of the state metrological service, etc.

In addition to the above-listed programs specific for the state metrological service, it is also possible to identify a series of general-purpose programs, including: developing international collaboration work, developing work in the sphere of scientific and technical information, improving the system for training and raising the qualifications of cadres, etc.

In each of the state metrological service programs it is possible to identify programs which it is advisable to solve by means of mathematical economics methods and technical means of automation. Moreover, the programs will be somewhat extended by adding to each of them problems for providing the possibility of automation. The combination of functional tasks which are being automated in each state metrological service program together with the safeguarding tasks can be considered as a single metrological MAICS subprogram, and a combination of such subprograms as the working program for establishing the system as a whole.

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By presenting as a program the set of measures required for producing a metrological MAICS, it became possible to use the purposefully programmed planning method for developing the system, and this served to identify a list of tasks which it is necessary to develop within the MAICS framework in order to determine the effect produced by implementing each task and to evaluate the expenditures and time required for their development and application.

Having allocated implementing organizations for each task, it became possible to combine all these prospects for working out an optimal (with respect to the selected criterion) set of measures for producing the second MAICS stage.

The work entailed in the purposefully-programmed planning of the second MAICS development stage was carried out in three steps of building a specific MAICS structure, determining the effects and expenditures on the specific-structure elements, and compiling an optimum plan for developing the second MAICS stage.

First Step. The provisions of a specific structure is the most complicated task when the purposefully programmed planning method is used. This is due to the present lack of the required methodic base. In the case when the planning objective consists of producing an automatic control system (ACS) this work can be carried out by using the following four-level hierarchic structure (Fig. 1): purpose for developing the system, controlled items, control function, and tasks implemented within the system framework.

The structure which is thus set is not, strictly speaking, a purposeful one. It can rather be described as morphological [2], which in our case serves as a basis for analyzing the system potentialities with respect to both its functional and provisional aspects. However, in future we shall adhere to the terminology already accepted in purposefully programmed planning and denote this hierarchical structure as purposeful.

The general top-level purpose of a metrological MAICS consists of ensuring an effective organization and control of the state metrological service at every specific stage of its development. In this respect the metrological MAICS is not considered as a once-and-for-all established system, but rather as a continuously improving organizational and control process [3]. Despite the formulated objective being very general, it serves to pick out of the range of problems solved by the metrological service the one which should be dealt with within the metrological MAICS framework.

The second-level elements consist of the controlled objects and types of activity. They include: scientific-research and experimental-design work, state inspection of measuring equipment, state testing of measuring equipment, production of reference standards and high-precision measuring equipment models, provision of cadres, financial activity, scientific and technical information, and international collaboration.