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Translation

ORGANIZATION OF THE MANAGEMENT
OF CIVIL AVIATION ENTERPRISES

By

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ORGANIZATION OF THE MANAGEMENT OF CIVIL AVIATION ENTERPRISES

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Summary

The book examines the bases of the organization of administration and management, measures to improve the master scheme of management and practical experience in improving organizational structures for management of civil aviation enterprises. The organizational structure of the first republic production associations in the civil aviation industry is set forth. The problems in organization of the work of personnel of management components of enterprises, of furnishing equipment used in management and administration to work stations and of evaluating management performance are discussed. A system of indicators for comprehensive assessment of the effectiveness of mechanizing administrative work and calculation of the efficiency of introducing a computerized management system are presented.

The book is intended for those whose work concerns the problem of organizing, planning and managing production at civil aviation enterprises. It can be used by teachers and students in the higher educational institutions of civil aviation.

Twenty-six illustrations and 5 tables.

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Introduction

In defining the main lines of the national economy's development in the near future and over the long range the 25th CPSU Congress emphasized that one of the key problems in the socialist economy's development has to do with basic changes in the style, forms and methods of economic activity and of the management and administration of the national economy.

In order to solve these problems the party has been pointing out two directions for making social production more intensive and efficient: speeding up scientific-technical progress and improving management.

Scientific-technical progress is bringing about organic qualitative advances in the instruments and subjects of labor, in production technology, and in the organization of planning and management. Ensuring intensification of production, introducing scientific-technical advances and solving the complex social problems are related to the quality of the organization of management of the economy. For that reason the Communist Party and Soviet Government are paying much attention to the various aspects of the organization of management of all sectors of the economy.

Measures to improve management being carried out in our country are a further development of Lenin's conception of management under the contemporary conditions of the construction of communism. A number of factors are now dictating enhancement of the role of management of the national economy. First, the scale of the national economy has grown, its structure has become more complex, and relations between sectors and industries have expanded. Second, the scientific-technical revolution has brought into being industries and production groupings that before did not exist: for example, nuclear power plants and production of nuclear power plant equipment. Third, the dynamic development of scientific-technical progress necessitates the speediest introduction of scientific advances into production. Thanks to the closer relationship between science and production the time between the discovery or invention and its practical realization has been greatly reduced. At present it does not exceed 4-5 years, whereas it took 27 years, say, to put the automobile into production and 14 years for the airplane.

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The objective necessity of a very rapid rise in the efficiency of social production through its intensification imposes requirements with respect to greater responsiveness in the management of the enterprises and sectors of the national economy. The example of educating the new man can be used to demonstrate the importance to the state of solving socioeconomic problems. Given the steady rise in the technical and cultural sophistication of the workers, and above all the improved skill and political and business maturity of the organizers of production, solving socioeconomic problems has an essential impact on the need to improve management.

The process of economic integration of the socialist countries is vigorous under present conditions. That fact provides a motive for formulating an economic policy of our country that takes that process into account.

It is not only the scale of the national economy and the number of entities making it up that accounts for the complexity of the economic system and its management, but also the fact that in each of these entities a large worker collective is employed, and every member of that collective has his own will, interests and desires, which have to be unified and directed into a single channel so that they promote the development of production.

In the years of the 10th Five-Year Plan considerable work was done to improve management of the national economy, and this was manifested in the performance of the industrial sector, transportation, and successes in agriculture and other sectors of the economy. But these achievements cannot be looked upon as a one-time action which can solve all the problems. There is a need for an ongoing systematic effort conducted so as to take into account the systems approach, and individual measures being carried out in this direction are in need of additional work and revision. All measures to improve management are being implemented in stages; having incorporated the experience that has been gained, they have been carried over into the current 5-year period as well.

At the 25th CPSU Congress a program was drafted for comprehensive improvement of management of the economy; its purpose is to bring the entire system of economic activity into line with our country's present level of development. Here again "... organization, i.e., further improvement of management of the economy in the broadest sense of the word, is becoming the decisive link."*

In the party documents for the 10th and subsequent 5-year plans the task is set of strengthening the combined effect of the plan, of economic instruments and incentives, and of the entire system of management on development of production, on raising efficiency and improving product quality and the task of improving management of all sectors of the economy for the sake of fuller utilization of the advantages and potential of advanced socialism.

* "Materialy XXV s"yezda KPSS" [Proceedings of the 25th CPSU Congress], Moscow, Politizdat, 1976, p 58.

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The new scale and conditions of economic development are imposing growing requirements as to the organization of management and as to the technical level of production. The need has arisen to bring management and planning methods into conformity with the present level of the productive forces. It is at solving this key problem that the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" was aimed. Successful improvement of planning and of the economic mechanism, as well as of the style and methods of operation depends in large part on the condition of the organizational structure of management.

Transportation has great importance to the country's economic development, to ensuring the continuous production process of social production and to accomplishment of economic relations among enterprises, sectors and industries, regions within the country and countries. By delivering products to consumers transportation completes the production process for some enterprises and renews it for others. Transportation is a sphere of physical production and performs important functions in the process of social reproduction. In just the years of the Ninth Five-Year Plan and the first years of the 10th the freight and passenger traffic of the transportation system grew approximately 40 percent. Civil aviation plays an important role in providing transportation service to the country's economy and population. It has a share of 28 percent in total passenger traffic, which is approximately 1.5-fold more than highway transportation, almost 19-fold more than river transportation and 54-fold more than the passenger traffic of maritime transportation.

Summing up the performance of civil aviation in the Ninth Five-Year Plan, B. P. Bugayev, minister of civil aviation, observed: "... a new step has been taken toward fuller satisfaction of the needs of the Soviet people for air service."*

By contrast with the other sectors of physical production, air transportation has its own peculiarities which must be taken into account in organizing the management of civil aviation enterprises.

The development of civil aviation is having a vigorous influence on the geographic location of the productive forces in the country and on creation of new regional industrial complexes. In the context of a socialist economy, as the many problems of increasing the operating efficiency of air transportation are being solved, the question arises of that sort of organization of management which is best capable of fitting into the socialist social system and system of government. This organizational system of management must create the conditions most favorable for further development of the country's economic potential and for raising production efficiency and intensifying production through scientific-technical progress.

* Bugayev, B. P., "K novym vysotam" [To New Heights], Moscow, Znaniye, 1976, p 8.

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Progress of Soviet science and technology is guaranteeing a continuous development of civil aviation. It possesses a large network of operating and repair enterprises and a network of air terminals, project planning and construction organizations, and scientific and educational institutions. Such an extensive network of civil aviation enterprises necessitates continuous improvement of management, and this process must take place in line with the development of social production and the new problems as they arise.

It is taken for granted that there are three directions in improving the organization of management of civil aviation enterprises: bolstering theoretical research on management problems, improving the practice of organizing management, and organizing the work of management personnel.

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Chapter I. Methodological Bases of the Organization of Management of Civil Aviation Enterprises

The methodology of management as the sum total of methods and techniques of influencing the production process and participants in it constitutes an interrelated system. Correct combination of the elements of this system largely determines the efficiency of social production. Together with the system of management organization and management techniques, this interrelated methodological system ensures scientific management of social production.

The methods of supervision in the economy cannot remain unaltered. The more complicated the economic organism, the more flexible management must be. The content of production management is examination of the relations among participants in social production.

These relations occur among individual persons--members of the enterprise's production collective (interpersonal relations), among enterprises of the sector or industry, among sectors or industries (intersystem relations), and between the enterprise and the individual (mixed relations).

Management science, then, studies relations specific to each of the management agencies in their interaction and ascertains the patterns of these interactions.

Management has been and is an inseparable element of the production process in which large numbers of people participate through their joint labor.

It arises out of social labor as one of its separate functions and is called upon to organize, systematize and supervise the labor process as a whole.

By contrast with socialist management, capitalist management is used for exploitation and is governed by the tasks of exploitation. "The capitalist's management is not only a separate function arising out of the very nature of the social process of work and pertaining to the latter, it is at the same time a function of exploitation of the social process of work...."*

* Marx, K., "Kapital," Vol 1, Moscow, Gospolitizdat, 1967, p 343.

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It is very important to the development of management science in the contemporary context to ascertain the organizational forms and the content of the methods and theoretical principles of managing each sector of the economy.

1. Content of the Organization of Management

Management is defined as the method of purposive influence on whatever is being managed. In its most general form it may be defined as the alignment of a system, i.e., bringing it into alignment with a particular objective law operative in a given environment.

In all cases management is called upon to promote higher efficiency of management systems and ultimately higher efficiency of social production. In any case, the goal of management can be achieved if what is being managed is in an organized state. For example, a piece of transportation equipment cannot be driven if it has not been serviced and maintained and has not been adjusted in accordance with its purpose. Management, then, is inseparably bound up with organization, and organization comprises the foundation of the management system. By "organization" we mean a particular order of relations among all the aspects of management, an order resulting from the system's goal and purpose and from the interaction, location and cosubordination of the elements of the system. This order is furnished by the process that makes the elements of the system interconnected instead of chaotic. Interaction of the elements is determined by the cosubordination of the levels of management.

Organization of the management system provides for the interlinked and coordinated work of the entire collective and for occurrence of the production process at a given pace. But this order may break down, whereupon departures from the established course of production occur and the need arises for management, that is, for the activity which reestablishes order and the proportions which were upset. In such cases management is characterized by a coordination of actions, while organization is characterized by subordination of relations.

But reestablishing the flow of production does not mean full identity with the previous state. Production undergoes change and growth. New proportions and new assignments are therefore needed. All of this must also be regulated by management, which is closely interlinked with the new organization it sets up. When the transportation process is organized in a straightforward way, less of the work has to be done by operations management. But it does not follow from this that the better the course of the production process is organized, the less need there is for management. Consequently, management preserves and moreover improves organization. So, organization is mostly the statics of production, while management is its dynamics. When production is very highly organized and when the growth of scientific-technical progress is rapid, management's role is not diminished, but is on the contrary enhanced.

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The elements making up the organization of management are the following: the structure, the process, the methods and the hardware of management. The organization of production itself lies at the basis of the management structure.

Structure is the system of interrelated managed and managing components (Figure 1) that ensure achievement of the goals and functions of management. In civil aviation the components being managed are work stations, teams, sections, shops, enterprises and associations.

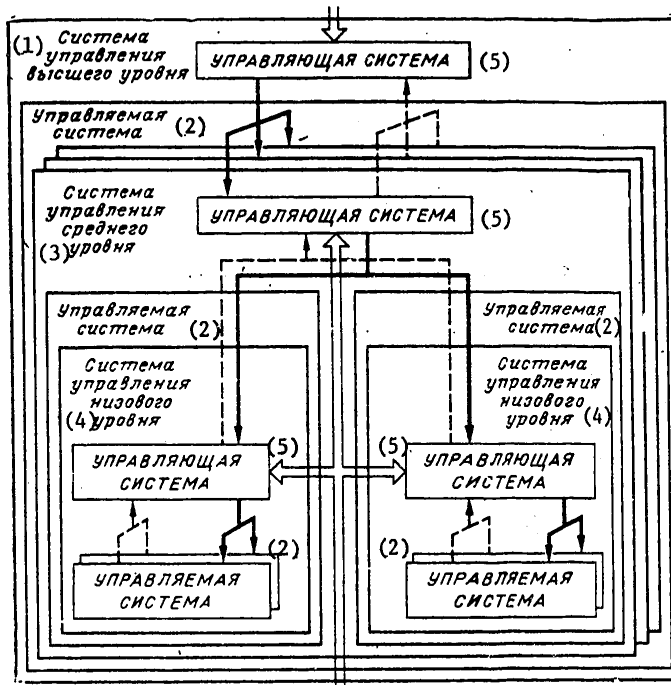


Figure 1. Structure of the management system: = interactions with the environment; — management action; --- communication of information.

- Key:
1. Top-level system of management
 2. System being managed
 3. Middle-level system of management
 4. Lower-level system of management
 5. Managing system

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The management structure is a hierarchy (that is, it consists of ranks). These ranks and levels are as follows in our case: top level--ministry of civil aviation, middle level--the association or administration, and the lower level--the enterprise.

Operations performed in accordance with a particular technology comprise the basis of the process of management. The composition and differentiation of the operations are based on the functional division of labor of management personnel. The process of management is analogous in importance to the technological process of production performed by production collectives.

The methods of management comprise the sum total of procedures and techniques for exerting a purposive influence on workers and on work collectives to ensure achievement of efficient operation of the entity being managed. The methods of management stand in a mutual relationship to the goal of management, and the principles of management are implemented by means of those methods.

Management hardware consists of business and office machines used to mechanize the work done by individual members of the management staff, to mechanize work in particular sections of the operation of the management staff, calculating machines, punched card machines, computer equipment and communications equipment.

2. Principles and Organization of Management in the Various Stages of the USSR's Economic Development

The founders of Marxism, K. Marx and F. Engels, offered in their work on the problems of scientific communism a general picture of the patterns of development of the socioeconomic formation and did not set themselves the task of actually working out the system and the forms and methods of the organization and management of social production under the conditions of socialism.

The first Marxist who did not only theoretical work, but also practical work on the problem of the organization and management of social production was V. I. Lenin.

Immediately following the victory of the Great October Socialist Revolution V. I. Lenin advanced the task of creating a socialist organization for management of the national economy. He considered this to be a basic task for a socialist state.

The tremendous amount of practical work which V. I. Lenin did as the head of the world's first Soviet state and the resolution of the complex problems of administration of a socialist national economy by the state suggested specific principles which have had fundamental importance to shaping the scientific principles of management.

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Lenin's theoretical research in the field of management was reflected in a number of his writings in the postrevolutionary period.

V. I. Lenin emphasized that the goals of management under socialism arise out of the basic economic law of socialism and are inseparably bound up with ensuring the complete well-being and free rounded development of all members of society. He launched the task of gradually involving the workers in administration of the state. It is well known that in the last years of his life he returned again and again to work on the problems of management and to organizing more straightforward operation of the machinery of government. V. I. Lenin's last articles and speeches contained advice on how to improve administration and management of the country and of its economy.

The organizational forms of management, the structure of management agencies and the methods of managerial work have undergone changes. But the basic principles of managing a socialist economy still remain as they were worked out by V. I. Lenin.

Democratic Centralism. This principle reflects the need for centralized direction along with broad involvement of the workers in managing production processes.

Unity of Political and Economic Leadership. This principle is based on an outlook that assumes that economics and politics are inseparably bound up with one another. The leader or manager must examine any particular production problem from the standpoint of the state, from the standpoint of performing the basic tasks of socialist society.

Conformity to Plan. The requirements of this principle are realized by the Communist Party and socialist state through planning. The objective basis for planning is the economic law of the planned and proportional development of the national economy.

One-Man Management. The principle of one-man management, of authority, of unity of will in management emphasizes the personal responsibility of the leader or manager in any particular management unit for the job assigned him.

Combination of Sectoral and Regional Administration. This principle makes it necessary for the principles of sectoral and regional administration to be combined in the management of enterprises and for the tasks of management to be correctly distributed between sectoral and regional authorities.

The Systems Approach to Management. This means that the entire thing being managed is regarded as a system, i.e., as a sum total of elements that shape the complex unified whole with a particular internal organization. Management based on the systems approach makes it possible for the administrator or manager at any level to assess the situation as a whole and to

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make a decision only after taking into consideration all the circumstances and possible consequences for the thing being managed as a unified system.

The Scientific Nature of Management presupposes fuller knowledge and use of the operation of the laws of social development in the practical conduct of economic activity so as to take into account contemporary tendencies in development of economics, science, and technology, and the social peculiarities of society.

Material Incentives. This principle makes it possible to achieve higher efficiency in the development of social production in a planned way.

Participation of the Masses in Management and Control presupposes combination of planned guidance by the state with participation of the broad masses of workers in management and with development of social initiative and control at the local level.

Socialist Competition is a specific variety of the socialist organization of production that stands in fundamental opposition to the system of capitalist competition. In stating the importance of this principle in concrete terms V. I. Lenin pointed out its important tasks. They include the following: ensuring the public nature of the competition and comparability of the performances of the competing work collectives; dissemination of progressive know-how among work collectives.

Selection of Personnel. Management is done by people, as is any activity. In the selection of personnel, then, it is particularly important to take into account the manager's ability to work with people and to know their interests and needs.

The principles of scientific management we have enumerated constitute a complete system. These principles are manifested in complex form in the practical activity of managing enterprises. For instance, the principle of democratic socialism is displayed in combination with the principle of one-man management, the principle of one-man management is combined with the principle of participation of the masses in management and control. In various bodies of management the group principle has its organizational forms for embodying the participation of the masses in self-management and control.

Improvement of the organization of management on the basis of Lenin's principles has always been and remains at the center of attention of the party and Soviet Government. For instance, the organizational structural for management of social production in our country is being shaped by combining the sectoral and regional principles. But in the various stages of building socialism one of these principles figured as the leading one. In the initial stage of building socialism, in the period of the New Economic Policy and collectivization of agriculture, the regional principle of administering the industrial sector and transportation predominated.

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Thanks to development of socialist industry in the period between 1932 and 1946 preference was given to the sectoral principle of administration. The sectoral principle of administration and management was retained over the 10 years that followed.

Beginning in 1957 preference was given to the regional principle of organizing administration. The resolute change of direction toward intensive methods of economic development and the growing scale of production necessitated a transition to the sectoral principle of administration. In 1965, then the sovnarkhozes were abolished, and sectoral ministries were reinstated on a new basis that took into account the requirements of the economic reform. The decision of the September (1965) Plenum of the CPSU Central Committee marked the beginning of major transformations in organization of administration of the national economy. To be specific, there was further development of combination of the principles of centralized and sectoral administration with broad initiative of the workers and also of unified state planning with cost accounting and with expanded operational independence of enterprises.

In accordance with the decree of the CPSU Central Committee and USSR Council of Ministers dated 2 March 1973 and entitled "On Certain Measures To Further Improve Management of the Industrial Sector," a decision was made to work out master schemes for management of industries so as to take into account the past experience of the existing associations and combines and in order to increase the level of concentration of production.

The master schemes were drafted in order to meet the following needs:

- i. the need to increase the level of concentration of production by consolidating enterprises and by forming production associations (combines);
- ii. the need to improve the middle tier of management by setting up industrial associations;
- iii. the need to eliminate the excessive number of levels in managing an industry and to bring the agencies responsible for managing the economy closer to production;
- iv. the need to develop the industry's scientific-technical capability through organizational incorporation of scientific and project planning organizations in unified production complexes in the economy;
- v. the need to create conditions for raising production efficiency and improving the quality of products produced.

The organization of the management of production is being improved simultaneously with a two-tier or three-tier system (two-level and three-level) depending on the peculiarities of particular industries. In the first case the ministry is in direct communication with the associations and enterprises. In the latter case this communication takes place through the

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all-union production associations of the industry to which the enterprises are in turn subordinate.

The two-tier system of administration is effective when the number of large enterprises and production associations in the industry is comparatively small. For example, the master scheme of management in the motor vehicle industry calls for a two-tier system.

As a rule the all-union or republic association figures as the middle tier in the three-tier system. Such associations are given the functions of the former sectoral administrations of the ministry.

The USSR Ministry of Civil Aviation is the principal agency for administration of air transportation. This nationwide transportation ministry furnishes the guidance for all civil aviation enterprises and institutions throughout the USSR.

Within the ministry there are civil aviation administrations and associations (UGA), which are located in the union republics and in the krays and oblasts of the RSFSR, operating and repair enterprises, construction and installation organizations, higher and secondary educational institutions and scientific research institutes. Civil aviation administrations are a variety of associations, figuring simultaneously as enterprises (with respect to supervision of the operation of civil aviation) and also as agencies for economic administration (with respect to the operating enterprises making them up, air travel agencies, cluster computer centers and other production enterprises).

In the period of the further construction of communism civil aviation has been developing on an altogether new technical basis. In the interest of maximum satisfaction of the growing needs of the public and the economy for air service extensive use is being made of jet aviation equipment (more than 97 percent of all traffic is performed by airplanes with gas-turbine engines), computerized systems are being introduced for management of the industry, administrations and associations, and enterprises and ticket agencies, as are systems for computerizing control of air traffic.

In advanced socialist society improvement of management is a planned process, an integral part of the party's entire activity to guide the economy. As the scale of the economy has grown and as production relations have become more complicated, it has become necessary to bring the methods of management and planning into line with the present level of development of the productive forces. The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" was published in 1979 to implement the decisions of the 25th CPSU Congress and the principles of the new USSR Constitution. This decree is comprehensive in its solution of the problems of administering our country's economy, including transportation.

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Gross social product and national income are created in transportation enterprises. In 1976 they earned about 15.7 billion rubles of profit, which was 14.8 percent of total profit for the national economy.

The present stage of development of air transportation is characterized by the fact that it has taken a solid second place (after rail transportation) in the total intercity passenger traffic of all branches of transportation. The growing volumes, expansion of the domain in which air service is used in the economy, formation of large transportation junctions, and the increasing complexity of sectoral and regional production connections necessitate ongoing improvement of organization of the management of all civil aviation enterprises. A large effort is being conducted in civil aviation aimed at improving the forms and methods of the industry's management on the basis of consistent development of Lenin's principles of the organization of management. The all-union state industrial association Aviaremont, the association Aviatekhsnab, the construction-and-installation production association Aviastroy, and a number of republic production associations have been organized.

Cluster data processing and computer centers have been created in a number of civil aviation administrations, the organization of production associations is still going on, and a number of other measures are being carried out.

The present stage in building the organization of the industry's management presented the task of intensifying the entire system of management by using the progressive achievements of science and technology. To be specific, it is envisaged that measures will be worked out to save on labor in the administrative apparatus; to make work more efficient in the administrative apparatus; to make extensive use of scientific methods of management; and to use equipment to mechanize and automate information processes.

An important problem confronting organization of the management of air transportation, then, is to create a system capable of operating jointly with the agencies for management of the other branches of transportation. The problem of improving organization of the management of operation of all branches of transportation has great importance in connection with development of a unified transportation system.

This kind of unified coordinating system for the organization of management is indispensable both at the level of the country's entire unified transportation system and also at the level of the areas where the different branches of transportation come into contact and intersect (transportation junctions). As far as civil aviation enterprises are concerned, in order to solve this problem efforts will have to be made to improve the mechanism of administration through planning and economic instruments and the organizational mechanism of management.

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The improvement of planning is the foundation for all measures to improve the organization of management of civil aviation enterprises.

The following are basic among the measures directed toward improving the mechanism of economic planning:

- i. improvement of the system of plans--long-range, 5-year and annual;
- ii. drafting the comprehensive program for development of enterprises and the industry so as to take into account the plans of administrative regions;
- iii. the development and application of scientifically sound methods of drafting plans.

The central task in improving the mechanism of economic planning is to increase the efficiency of operation of all enterprises in the industry on the basis of faster scientific-technical progress.

Improving the organizational mechanism of management presupposes that a number of measures will be taken to develop the structure and functions of the administrative apparatus of the ministry, the administrations, the associations and the enterprises under the new conditions for the conduct of economic activity.

3. Directions for Improvement of the Organization of Management of Civil Aviation Enterprises

The constant improvement of transportation equipment, introduction of the most up-to-date aircraft, the increase in the volume of traffic, and also the need to improve the effectiveness of performance of civil aviation enterprises necessitate ongoing improvement of the organization of management. The system for utilizing plant and equipment and labor resources and also the efficiency of the transportation process depend on the level of improvement of the organization of management.

The main goal in improving the organization of management of civil aviation enterprises is to increase the economic efficiency of management and the responsiveness and optimality of the decisions made and to strengthen its influence on the final results of the production and economic performance of the industry. This content as to its goal has also predetermined the orientation of measures to improve the organization of management. The main ones are as follows:

- i. identification and improvement of unused organizational potential at every level and in every step in the procedure;
- ii. identification of potential for saving on labor;

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- iii. raising labor productivity and the efficiency of labor;
- iv. raising the scientific-technical level of decisions related to improving management;
- v. improvement of the qualifications of personnel.

These directions make it possible to identify more thoroughly and extensively the unused potential of management agencies and then to employ it.

In the enterprise unused organizational potential is identified and improved by improving the management structure and by applying management as a process in the utilization of the subjects and implements of labor (Figure 2). This potential may take the following form: unused time, labor, physical and financial resources, a change in the sequence of the technological operations of management or the content of these operations and organizational forms of management so as to incorporate cooperation in work (division of labor by functions, by occupations and by skills), or a change in the use of management hardware and methods.

This unused potential is classified as either current or future depending on the possibility of employing it. Current potential is activated in the existing organization of management without additional capital investments. For instance, altering the job duties of personnel in the management system in accordance with redistribution and the content of the technological operations of management does not require any capital outlays at all.

Future potential requires sizable capital outlays for its activation, a fundamental change in management methods, the application of new technological means of management and other measures. For example, use of new management hardware such as a computer or in-plant communication equipment necessitate the training of specialists and the reconstruction or construction of new buildings.

Organizational potential is quantitative and qualitative in nature. For example, improvement of working conditions tends to improve the responsiveness of the taking of management decisions, i.e., it improves the quality of management. Organizational potential is identified in the process of surveying and analyzing the performance of the management staff.

Identification of Potential for Saving on Labor of the management staff is mainly achieved by eliminating needs for work time, by centralizing a number of production management functions, by reducing the number of steps and tiers in the management system (concentration of management), by improving the skill pattern of management personnel, specifically by altering proportions among supervisors, specialists and technical operatives; by expanding work specialization (differentiation of operations in the process of management with respect to professional complexity); by improving work discipline and through other measures. Utilizing the potential for saving on

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live labor is the principal source of reducing the size of the management staff.

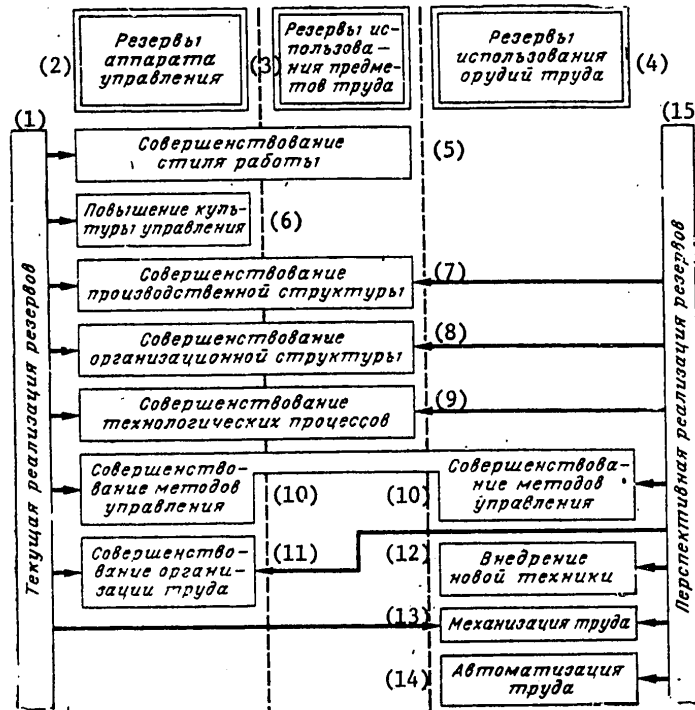


Figure 2. Potential for improving organization of the management of civil aviation enterprises.

- Key:
1. Current activation of potential
 2. Unused potential of the management staff
 3. Potential for utilizing subjects of labor
 4. Potential for utilizing the implements of labor
 5. Improvement of operating procedures
 6. Improvement of management standards
 7. Improvement of the production structure
 8. Improvement of the organizational structure
 9. Improvement of technological processes
 10. Improvement of management methods
 11. Improvement of the organization of work
 12. Introduction of new technology
 13. Mechanization of labor
 14. Automation of labor
 15. Future activation of potential

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Raising Labor Productivity and the Efficiency of Labor of management personnel is achieved by various means, the main ones being the following: specialization of management personnel in the functions they perform, improvement of the structure of management agencies, improvement of management methods, the drafting of rules and standards governing work operations and management procedures (Figure 3). Important potential for raising labor productivity of the management staff lies in the "psychological climate" of the management staff.

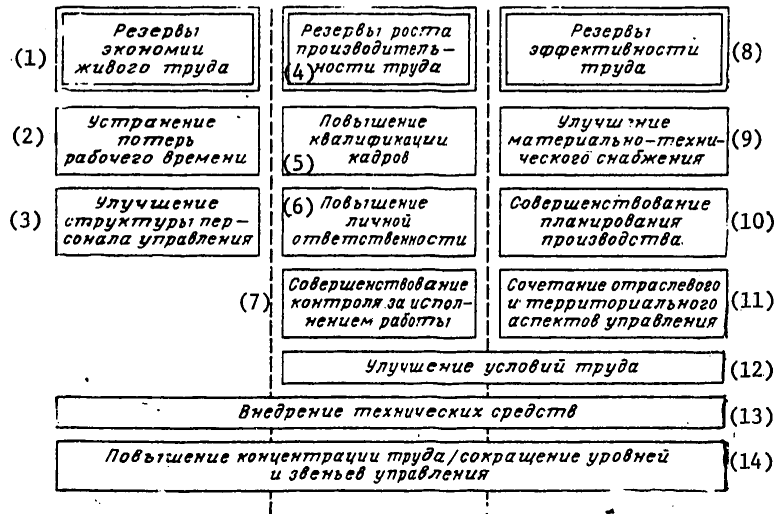


Figure 3. Potential for raising the labor productivity of management personnel in management of civil aviation enterprises.

- Key:
1. Potential for saving on live labor
 2. Elimination of work time losses
 3. Improvement of the composition of management personnel
 4. Potential for raising labor productivity
 5. Improving the skills of personnel
 6. Enhancement of personal responsibility
 7. Improved followup on execution
 8. Unused potential for work efficiency
 9. Improvement of material and technical supply
 10. Improvement of production planning
 11. Combination of sectoral and regional aspects of administration and management
 12. Improvement of working conditions
 13. Introduction of hardware
 14. Improvement of the concentration of work and reduction of the levels and tiers in management

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It is a specific peculiarity of the labor productivity and work efficiency of management personnel that they cannot be measured directly. The work of this category of personnel is creative in nature and in practice is evaluated on the basis of the final production performance of whatever it is they manage.

Raising the Scientific-Technical Level of Decisions Related to Improvement of Management. An important potential for making management systems more efficient and for optimizing them is to reduce outlays for performance of work in advance of projects and for introduction and operation of the management system. To be specific, an effort must be made to reduce the specific number of researchers and designers of the management system and to reduce the growth rate of this personnel, to increase the number of scientific and design developments introduced, to make the study and design of the management system more comprehensive, to achieve the proper proportion in the scheduling of expenditures to conduct research and design projects in the field of management and to increase the economic efficiency of improvement of the management system.

On the whole the scientific-technical level of management is related first to the development of management science and economic practice.

Improvement of the Skills of Personnel. Skill constitutes the sum total of various kinds of knowledge and experience. Experience in management of civil aviation enterprises has shown that the efficiency with which transportation equipment is used depends directly on the level of skills of supervisory personnel. In civil aviation the command and supervisory personnel receive their education, training and characterbuilding in the educational institutions of the industry, which every year graduate and retrain thousands of specialists in management for all the enterprises in the industry.

Research conducted in our country and abroad has shown that improvement of the organization of management guarantees exceptional production efficiency and leads to the attainment of valuable economic results. High efficiency of managerial activity of management agencies is achieved simultaneously with improved organization of management.

Experience in improving the organization of the management of enterprises indicates the need to observe the following principles:

1. Improvement of management is composite in its nature and is manifested in the organic unity of political, technical, economic, organizational, social and ecological aspects in the search for an effective solution to the problem which has been set. When specific problems are being solved in improving the organization of management specific combinations of the various aspects are frequently combined. For instance, whereas in the Ninth Five-Year Plan economic tasks (boosting the efficiency of social production as a whole) were combined with sociopolitical tasks (convergence of the urban

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and rural standard of living), in the 10th economic tasks were combined with social tasks.

2. The target-program character of the decisions taken to improve the organization of management. The program approach pays particular attention to major national economic problems encompassing the activity of transportation ministries and ministries related to them. The importance of the program approach is that it makes it possible to identify first of all the largest potential for raising production efficiency and quickly activate it.

The target approach provides for the enterprise's plans to be oriented toward attainment of high final results.

3. The planned character of the efforts to improve the organization of planning. A goal-oriented, stage-by-stage and properly organized effort with clear instructions as to the "what" and the "who," as to "which resources" and "by what date" serves as a pledge for successful performance of measures to improve the organization of planning.

We have already pointed out that improvement of the organization of management in air transportation is closely bound up with the production structure of civil aviation enterprises. For instance, at small and medium-size operating and industrial (repair and construction) enterprises it is not possible to organize efficient services for economic statistics and general administration, and it is difficult to ensure the labor productivity and work efficiency of production and administrative personnel and thereby to create an effective system for the organization of management. Concentration of production capacities and labor and financial resources on the other hand makes it possible to realize the following advantages in the domain of improving the organization of administration:

- i. reduction of the amount of administrative work by creating consolidated and specialized subdivisions of the administrative apparatus;
- ii. centralization of many functions of management and administration in specialized services;
- iii. extensive use of recent and the latest hardware used in management and administration;
- iv. reduction of the relative share of the costs of maintaining the administrative apparatus;
- v. good conditions for improvement of the qualifications of administrative personnel.

The experience of the civil aviation ministry and other sectors of the economy demonstrates that concentration through combination of interrelated

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groupings, creation of transportation production associations from small and medium-size enterprises, and the formation of large operating, repair, supply and construction-and-installation organizations in the industry makes it possible to reduce the costs of maintaining the administrative apparatus.

The grouping of a number of enterprises with respect to concentration of manpower has shown that at large enterprises the relative share of the administrative work force is 1.6-fold lower than at small enterprises (Table 1).

Table 1. Number of Administrative Personnel as a Function of the Character of Production

	Relative Share of Administrative Work Force in Total Production Personnel, %		
	<u>Breakdown</u>		
	<u>Engineering and Technical Personnel</u>	<u>Employees</u>	<u>Total</u>
Large-scale (1,000 workers or more)	14.4	5.2	19.6
Medium-size (between 100 and 1,000 workers)	15.5	5.4	20.9
Small (under 100 workers)	25.8	5.8	31.6

In practice the problem of improving the organization of the system for administration of transport can be solved by creating large specialized transport enterprises or transport production associations of the regional type. Such enterprises and associations should first meet the needs of their respective economic region or industrial zone.

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Chapter II. Organizational Structure of the Administration and Management of Civil Aviation Enterprises

The vertical and horizontal connections among the various economic entities in the industry (enterprises, shops, flight groups, services and administrations) constitute a ramified system. These connections are being established in accordance with the existing production structure and so as to take into account differentiation of the administrative work and functions performed in the process of management. This interrelationship of production, economic and administrative components, ensuring as it does the goals of production and management, constitutes the organizational structure of administration and management.

The organizational structure of management reflects the operative economic laws of socialism and the peculiarities of air transportation as a branch of the national economy. It is manifested in the structure, functions and methods of management and administration.

1. Structure and Functions of the Bodies by Which Civil Aviation Is Administered

The unified transportation system plays an important role in the national economy. Its unity is determined first of all by state ownership of transportation and by the overall system whereby it is planned and administered. The unity of the transportation system is ensured by the existence of a definite hierarchy of administrative agencies. Without this ramified hierarchical system the uninterrupted functioning of the transportation process could not be accomplished. The strictly hierarchical cosubordination is established in the structure of the administrative agencies.

Under socialism administration and management are performed by the socialist state, public organizations, every citizen of the country and the Communist Party--the unifying and leading force of social production. All the functions of administering social production are performed by the system of government administrative agencies of the USSR Council of Ministers (Figure 4).

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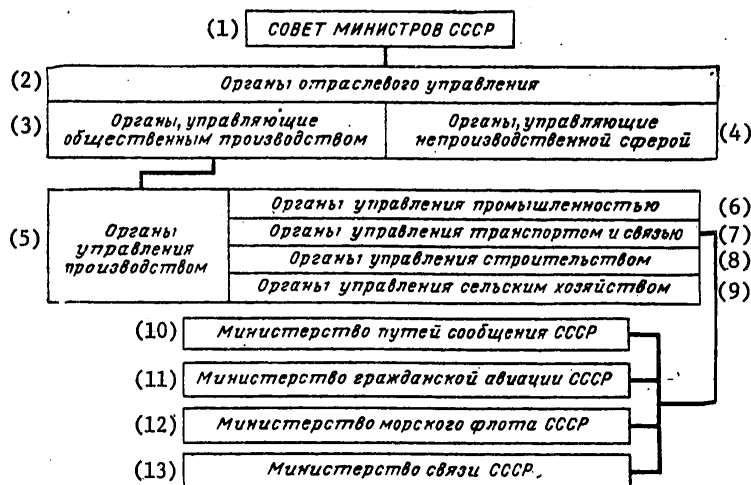


Figure 4. Chart of agencies for administration of transportation.

- Key:
1. USSR Council of Ministers
 2. Agencies for administration of sectors
 3. Agencies administering social production
 4. Agencies administering the nonproduction sphere
 5. Agencies administering production
 6. Agencies for administering the industrial sector
 7. Agencies for administering transportation and communications
 8. Agencies for administration of construction
 9. Agencies for administration of agriculture
 10. USSR Ministry of Railways
 11. USSR Ministry of Civil Aviation
 12. USSR Ministry of Maritime Fleet
 13. USSR Ministry of Communications

The organs of public organizations ordinarily participate in administration and only at times do they figure as agencies for management of production (personnel selection and assignment). Party organs have leadership and monitoring functions.

USSR Gosplan performs the principal functions of managing the unified transportation system of the USSR. It plans and coordinates the development of all the branches of transportation, including the transport of common and private carriers.

The structure of the system for administration of transportation is built on the sectoral principle. This principle makes it possible to conduct a uniform technical and economic policy in each separate branch of transportation. The agencies for sectoral administration of the various branches

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of transportation are all-union ministries: the ministries of railways, maritime fleet and civil aviation. They direct the rail, maritime and air transportation, respectively, within the country. These agencies have their own specific nature and are narrowly specialized and extraterritorial administrative agencies.

Air transportation is directly managed by the Ministry of Civil Aviation. The ministry's organizational structure takes into account the size and peculiarities of air transportation. A collegium has been set up in the ministry to resolve the basic issues in the industry's development and to examine and implement in practice the most important orders, regulations and instructions. The members of the collegium are subject to approval by the USSR Council of Ministers. In conformity with organization of the transportation process administrations, associations, enterprises and organizations are set up in the industry with their appurtenant administrative apparatus.

In all cases the administrative apparatus consists of relatively separate components--administrative agencies (divisions, traffic control services, bureaus, and so on). The system of components within the production units is set up at the various levels of subordination corresponding to the levels of organization of the transportation process or the organizational structure of the association (enterprise). The levels of subordination comprise the hierarchy of management, and the system of administrative agencies their organizational structure.

The principal task of administrative agencies, regardless of the organizational structure of the association or enterprise, is to ensure unhindered interaction of all the component structural parts of the enterprise in order to achieve the best results at the lowest cost.

The peculiarities of the civil aviation enterprise are reflected not only in the structure, but also in the functions performed by its management components. For instance, in management of the transportation process a large number of diverse actions are performed. Consequently, managerial work is divided into specialized operations--the functions of the management components, by which are meant the objectively conditioned forms which purposive influence on the production process takes. Among the functions of the management components are the forecasting and planning of production activity, operational management of the flow of the transportation process and of labor, physical and financial resources, etc.

In practice all functions performed by administrative agencies or management components come down to "who does what" or "should do what" in the process of administration or management. The work performed by individual participants, or, put differently, the function they perform, is not always identical to the function of the management component. In small enterprises the individual participant may perform a portion of a management function or may do all the work pertaining to one or several management

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functions. At large enterprises the individual participant as a rule performs a portion of such a function or, less frequently, performs one management function in its entirety.

The size of the group performing a particular function and comprising the structural subdivision of the administrative agency or management component is determined as a function of the number of participants performing each management function.

Planning, organization, regulation and monitoring are distinguished as the basic functions of administrative agencies or management components characterizing the content of administrative or managerial work.

Planning is the most important function of agencies for administration of civil aviation enterprises. To describe the planning functions we might say that it is the effort to project a future state of whatever is being managed. Planning, incidentally, is a stage of preliminary management or a stage in which the future parameters of what is being managed are determined. In this sense the planning function is closely bound up with statement of the goal of management action and with drafting the program for achieving it. The result of the planning function is the writing up of a specific plan, which serves as the basis for the subsequent functioning of the entire system.

Planning is a complicated process conditioned above all by the complexity of production and the dynamic nature of its structure. It consists of several interrelated parts, and they make it a continuous process. Such parts are forecasting, modeling and programming.

Specialized planning agencies have been set up in our country at all levels of administration and management of social production to perform the functions of planning. The system of planning agencies includes USSR Gosplan, which is the central planning agency, the gosplans of the union republics and local planning agencies.

In the system of the Ministry of Civil Aviation the planning function is performed by GlavPEU [Main Economic Planning Administration] and the economic planning divisions of the industry's administrations, associations and enterprises. The scope of their planning activity varies and depends on the content of the tasks they perform.

Organization is a function inherent in the activity of every component of administration or management. The task of organization is inseparable from the task of managing production. Management without organization is just as unthinkable as organization without managerial activity to maintain or alter it.

Selection and formation of the structure of the production facility or bodies of management and definition of the connections between the facilities

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and the bodies of management and their interaction determine the content of the organization function.

Regulation as a function of the bodies of management is expected to make production activity orderly, to identify and eliminate maladjustments, and often to find a more optimum solution under the conditions that have come about. Incidentally, regulation is aimed at maintaining the required relationship between the various components of the body of management or administrative agency.

It is in the process of regulation that personnel is trained, that technology and gear are improved, that managerial orders are issued, that cost-accounting indicators are read and assessments made, and the participants given bonuses and awards. Thus the task of the regulation function is to improve organizational and economic relations among production units.

Monitoring. The task of this function lies in observing and checking to see that the actual flow and development of the production process conforms to the plan drafted previously. In performing this function the administrative agency or management component registers the qualitative and quantitative parameters of the flow of production, monitors the operating reliability of aircraft, equipment, technological accessories, and so on.

These functions of the bodies of management may differ from one another with respect to the management activity and the purpose intended, but throughout the entire structure of administration and management all decisionmaking processes are invariant, that is, they go through the same sequence. For example, in management of the flow of the transportation or production process the functions of management are always performed: planning, organization, regulation and monitoring. It is equally important that the process of management is invariant not only with respect to functions, but also with respect to modes of execution, that is, it does not change for differing degrees of mechanization and automation of the work of administration or management.

The process of creating a body of management begins with a definition of its tasks in conformity with the list of management functions and its differentiation. The legal basis of its creation is a legal enactment stating that by decision of some government or public institution a unit is thereby created in the entire system of management of the enterprise.

Creation of a body of management presupposes a clear-cut definition of its jurisdiction: the kind of management function it performs and the limits of its activity and responsibility. The limits of its jurisdiction must moreover be so defined that other bodies do not duplicate the activity of the newly created body. In all cases jurisdiction is defined by the body of law (regulations, bylaws, instructions, and so on). When a new body is being created or improved it is worth remembering that this body of management may not have its own goals. It must always perform functions (one or several) reflecting the goals which production sets for management.

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The next stage in setting up a body of management, once its tasks and functions have been defined, is to establish its structure. The personnel of the body of management must be organized in a particular way, i.e., the optimum number of members must be found. They must all be distributed among the structural subdivisions, and their qualifications must be defined so that the personnel guarantees performance of the tasks which are the responsibility of that body of management. "For us," M. I. Kalinin pointed out, "organizational structure is not an end in itself, but only a means by which maximum results are achieved in carrying out the political and economic decisions of the party and government."*

The structural subdivisions that exist in an administrative agency or body of management can be divided into sectoral, functional and auxiliary subdivisions. General coordination of the activity of these subdivisions is provided by the top level of management, which administers all the structural subdivisions of the body or agency. This top level consists of the following: the senior official of the body or agency, his deputies, the chief engineer and other members of the management staff.

A sectoral structural subdivision manages the individual production units of the entity being managed. These subdivisions are at the same time line units. The functional structural subdivision performs some one management function. For instance, the economic planning division performs the function of planning with respect to assigned indicators.

An auxiliary structural subdivision ensures the uninterrupted operation of all groups of the administrative agency or management component: the archives, the office, document reproduction, etc.

Tasks are distributed among the structural subdivisions on the basis of the established jurisdiction of the body of management in accordance with the organizational structure set forth in regulations concerning the body and its subdivisions.

NIItruda [Scientific Research Institute for Labor] has worked out instructions concerning methods of designing organizational structures for administration and management.** In these instructions the size of the body of management is the sole factor that shapes its structure. But that is not always the case. In practice one first defines the tasks and functions of the body of management and then determines the staff size.

* Kalinin, M. I., "Voprosy sovetskogo stroitel'stva" [Problems of Soviet Construction], Moscow, Gospolitizdat, 1958, p 566.

** "Metodicheskiye ukazaniya po razrabotke ukрупnennykh normativov chislennosti i topovykh struktur apparata upravleniya promyshlennykh predpriyatiy" [Instructions as to the Method of Working Out Consolidated Standards Governing the Staff Size and Standard Structures of the Administrative Apparatus of Industrial Enterprises], Moscow, NIItruda, 1966, p 76.

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The following sequence is typical of the scientifically sound approach to forming organizational structures of administration and management:

- i. selection of the base for projecting the structure of management reflecting the character of activity of the entity being managed. On the basis of this one shapes the functions of management, areas of work, methods of performance, and so on;
- ii. selection [of a method] for designing the management structure. In practice the computational graph method is widely used. It is based on computation of standard numbers of personnel as a function of management functions performed and subsequent graphic representation of the internal and external connections of the body of management;
- iii. selection of a management system. Of all the types of structures that exist management systems combining line and functional structures have become widespread in civil aviation enterprises. A matrix structure is used in the context of computerized systems of enterprise management;
- iv. efficiency of the projected structure of the body of management. This is defined as the benefit from the outlays made to improve the bodies of management and to mechanize and automate work in administration and management. The benefit is calculated not only as of the moment of planning, but also to take into account the future development of the body of management.

The work of designing organizational structures of management components may be done for an enterprise under construction or being designed, as well as for one that is in operation. In the latter case the design process must be preceded by improvement of the existing system of management. In every case the search for ways of improving the system must be aimed at finding the optimum variant of the structure. It is indispensable in this connection to take into account the existing situation and scientific-practical advances that have taken place in this field.

The structure of the entity being managed is designed in three stages. In the first stage the organizational chart of all the bodies of management is compiled. The chart must be so prepared as to allow for notation of the functions performed by each body and by individual persons within it, and it also must vividly represent the existing scheme of mutual relations in the intrastructural hierarchy of the body of management. Such a chart makes it possible to portray the existing situation, to identify shortcomings and to ascertain the future structure. In general the chart answers the question "how?" but does not answer the question "why?"

An answer to the second question is provided by an analysis of the chart, whose purpose is to discover actual participation and to establish that each function and communication line is indispensable to performance of the enterprise's ultimate goal.

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In the second stage recommendations are drafted for improvement of the structure of management so as to take into account possibilities for mechanizing and computerizing the work of administration and management. Computerization has a constructive effect on the structure of the bodies of management by altering the technology for performance of managerial operations. This change mainly pertains to redistribution of administrative functions between human beings and machines. It is also well known that creation of a ASU [computerized management system] disciplines the personnel of the bodies of management.

In the third stage the staff size of the administrative apparatus is justified. An important direction for determining the staff size is to work out scientifically sound allowances for performance of each administrative or management operation.

Work norm setting is based on a study of work time expenditures. To that end administrative personnel must systematically study the structure of their work time and work time studies should be prepared of jobs by the workers themselves and by others.

An analysis of the activity of the bodies of management of a number of enterprises has shown that there are cases when the number of line personnel is not sufficient, and moreover the actual work of line personnel is organized in one shift (the first). In such cases the absence of standards governing staff size is having an adverse effect on the quality of decisions made. According to data of MIU imeni S. Ordzhonikidze [Moscow Institute of Administration and Management], the staff size of bodies of management of the same type at the industrial enterprises surveyed ranged from 4 to 35 persons. Moreover, work time expenditures of personnel of the administrative apparatus done by the workers themselves indicate that directors of planning and traffic control divisions (bureaus) and economic statisticians of shops spend about 40 percent of their time on functions outside their specific realm.

There is another shortcoming in existing structural schemes of management and administration--a very wide variation in the number of subordinates per supervisor. It was established at the enterprises surveyed that the actual number of subordinates was as follows: from 7 to 21 for the director, from 5 to 17 for the chief engineer and from 9 to 15 for the shop head, and so on. When we take into account that according to computations of NIItruda a single supervisor is able to effectively supervise and work with no more than 5 or 6 subordinates, then these figures show how large is the overload on certain members of the management staff.

The full extent of the functions of managing civil aviation enterprises is performed by the system consisting of the bodies of management. Their makeup, forms of specialization and interconnections are determined by the structure of the management system. The most frequent bodies of management are groups of persons performing one or several management functions and

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bringing them together within a group, a bureau, a division, or the like, and less frequently the bodies of management will be represented by individuals.

2. Organizational Structure of the Management of Civil Aviation Enterprises

Standard management schemes are the basis for the structure of management of civil aviation enterprises. Each such scheme includes the list and differentiation of the functions of the bodies and individuals in the management system and a definition of the rights, duties and responsibilities of members of management bodies. All these and other documents are set forth in regulations and structural subdivisions and job instructions for participants.

The principal problems arising in working out the structure of a system for management of an enterprise are the following:

- i. establishing correct mutual relationships among management entities, which involves defining the goals and conditions of their work and incentives pertaining to them;
- ii. distribution of responsibility among the individual members of the body of management;
- iii. selection of specific management schemes and a sequence of management actions in decisionmaking.

The structure of the system for administration of the industry is built up on the sectoral principle, which makes it possible to conduct a single technical and economic policy in air transportation. Management of civil aviation enterprises is structured on the basis of combination of the regional, sectoral (production) and functional principles of management. For example, the ministry's main administrations manage the respective services of regional administrations, associations and enterprises under the sectoral principle. The functional principle is manifested in the work done on matters of planning, financing, recordkeeping, and so on.

Thanks to measures taken in the industry to improve management the previously existing organizational structure of administration and management has undergone changes. The associations Aviaremont, Aviatekhsnab and Aviastroy and republic production associations have come into being (Figure 5).

An important characteristic of the management structure at civil aviation enterprises is the linkage of its elements. Official, functional and production links are distinguished. Official linkage is in the vertical direction and follows the hierarchical structure of management whereby the body (entity) of management at the lower level bears full official dependence on the superior body (entity) of management.

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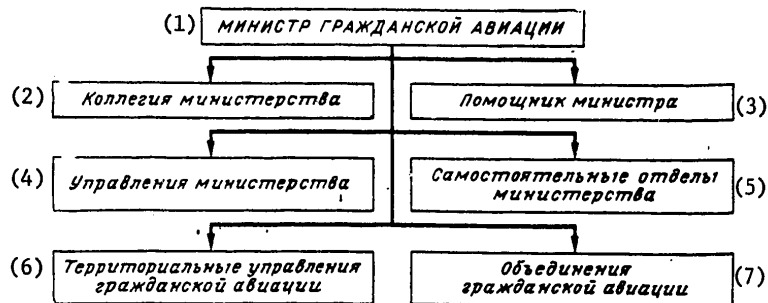


Figure 5. Organizational structure of the Ministry of Civil Aviation following organization of associations.

- Key:
1. Civil aviation minister
 2. Ministry collegium
 3. Assistant minister
 4. Administrations of the ministry
 5. Independent divisions of the ministry
 6. Regional civil aviation administrations
 7. Civil aviation associations

Functional linkage is manifested in the process of the performance of functional duties by individual members of a management body. In this case the superior body (entity) of management may give advice or recommendation to the inferior body (entity) of management.

Production linkage is manifested at the level of a single management body in performance of one and the same management function. In this case the linkage of the management actions comprising a single management function is referred to as production linkage.

Another characteristic of the organizational structure of management is its elements. As a function of the degree of direct participation of the element in the production process and of the functions it performs the elements of civil aviation enterprises are subdivided into line and functional or staff elements.

Line units perform the basic production and managerial work. An example of line units might be production shops, central traffic control services, laboratories for inspection of special equipment, etc.

By contrast with the line units, functional or staff units study separate lines of activity of the enterprise and act in the role of advisory or managing bodies. Auxiliary shops are among the functional production units, and the planning division, bookkeeping department, production and other divisions are among the functional management units.

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Combinations of elements and of links among elements comprise the organizational chart of the structure of management. The simplest organizational structural chart of management covers two levels--the managing level and the level being managed, and it is referred to as a one-step management structure. The group of management steps subordinate to an element at one level comprises the general level of the management hierarchy (Figure 6). Increasing the number of levels is extremely undesirable, since this makes the management system sluggish, makes communication among the elements of the system more complicated and results in other adverse phenomena. That is why it is an urgent task to reduce the number of levels of management.

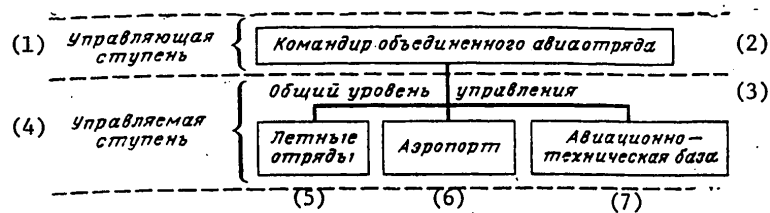


Figure 6. One-step structure for management of an operating civil aviation enterprise.

- Key:
1. Managing level
 2. Commander of the unified aviation group
 3. General level of management
 4. Level managed
 5. Flight groups
 6. Airport
 7. Aviation equipment facility

Accordingly, operational, industrial, supply and construction-and-installation associations are being created in a planned way in civil aviation. In this industry there are several republic operational associations which are referred to as RPO GA [republic production associations in civil aviation] (Figure 7).

RPO GA were created from the administrative apparatus of the republic civil aviation administration and its enterprises and organizations. All its activity is performed in accordance with the "Regulation on the Socialist State Production Enterprise," approved by the USSR Council of Ministers on 4 October 1965.

The All-Union State Industrial Association for Repair of Aviation Equipment Aviaremont (V/O Aviaremont) can serve as an example of an industrial association in civil aviation. It is an independent structural subdivision subordinate to and reporting to the Ministry of Civil Aviation. Its components include plants for repair of aviation equipment and for manufacture of equipment to mechanize work in civil aviation enterprises.

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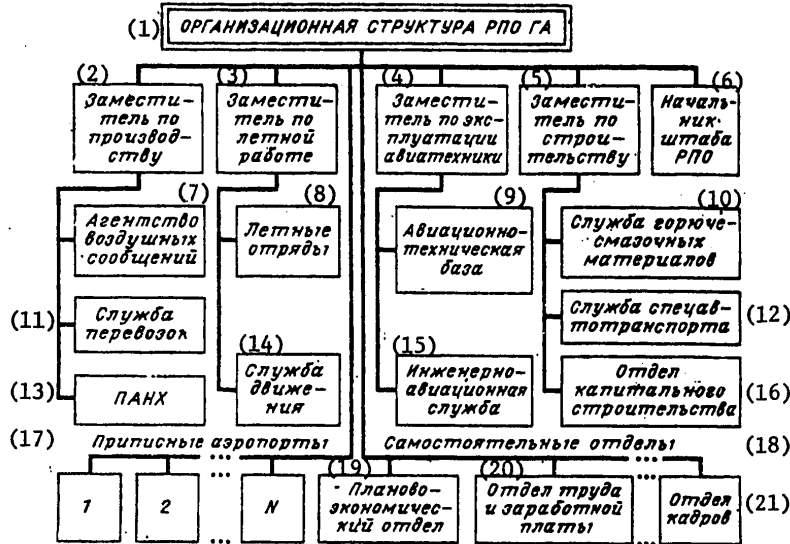


Figure 7. Organizational structure of a republic production association in civil aviation (consolidated).

- Key:
1. Organizational structure of the RPO GA
 2. Deputy for production
 3. Deputy for flight operation
 4. Deputy for operation of aviation equipment
 5. Deputy for construction
 6. RPO chief of staff
 7. Air travel agency
 8. Flight groups
 9. Aviation equipment facility
 10. Fuel and lubricant service
 11. Traffic service
 12. Special air transport service
 13. Administration for use of aircraft in the national economy
 14. Transport service
 15. Aviation engineering service
 16. Capital construction division
 17. Airport components
 18. Independent division
 19. Economic planning division
 20. Labor and wages division
 21. Personnel division

The administration of V/O Aviaremont manages these plants and acts as a superior authority with respect to them. Certain plants have retained their

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juridical independence, but the provisions of the regulation on the socialist enterprise extends even to them. The board of directors is the collegial body of management in the association (Figure 8).



Figure 8. Structure of the board of directors of the association.

- Key:
1. Board of directors of the V/O Aviaremont
 2. Chief of the association
 3. Deputy chief of the association
 4. Plant directors
 5. Representative of the central committee of the trade union

Along with the operational and industrial associations, the following have also been created in the industry:

- i. the association Aviatekhsnab, which plans, organizes and manages the acquisition and movement of all aircraft equipment in the industry. Within it there are several divisions: for the sale of aircraft equipment, automotive equipment and processing equipment used in the trade sector, for aggregate deliveries, for capital construction, etc.;
- ii. the construction-and-installation production association Aviaremont, in which there are several construction-and-installation organizations as well as a number of functional divisions: the production division, the technical division, the planning division, etc.

The possibility of setting up a production association to operate and service the computerized management systems operating in the industry is under consideration for the sake of a further rise in the industry's operating efficiency. In addition, an exploration is being made of the potential that could be utilized by organizing specialized aircraft equipment facilities for repairing particular types of aircraft and of other measures aimed at improving the organizational structure of management of civil aviation enterprises.

In working out an organizational structure for management of an association or enterprise it is important to utilize the principles of optimum combination of centralization and decentralization of management. The following basic organizational structural schemes of management of civil aviation enterprises are distinguished depending on the respective priorities given to these two principles.

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The Line Structure of management is characterized by the fact that all management functions are performed by a single person, and each worker carries out the orders of only one supervisor, i.e., all lower-level subordinate management entities carry out the instructions of the superior body. This concentration of authority has an essential impact on the operational efficiency of management as a whole. A single vertical line of authority and a direct channel for vigorous influence on subordinates are created with this management structure (Figure 9). The advantage of this type of structure lies in its simplicity, its reliability, the absence of contradiction between the taking and performance of the management decision, economic efficiency and the reinforcement of the principle of one-man management. It is the shortcoming of the line organizational structure of management that the supervisor cannot be a specialist in everything and cover all aspects of the activity of the association or enterprise. In this sense the orders issued by its management are not the most effective. The specialists called upon by the manager to perform specific management functions do not bear direct responsibility for the taking of decisions and for the results of production.

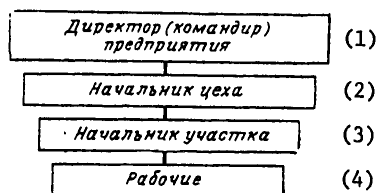


Figure 9. Line structure of management.

Key: 1. Director (commander) of the enterprise
 2. Shop chief
 3. Section chief
 4. Workers

The Functional Structure of management subdivides the entire work of management into separate management functions which are performed by various specialists (Figure 10).

The complexity and scale of operations made it necessary to specialize the management functions. Specialists with particular qualifications who have a thorough knowledge of one or several specific functions or actions in the management of production emerged within the bodies of management. In the functional structure the supervisor specializes in the performance of one management function and is responsible for its performance. For example, the top management of the economic planning division can influence section chiefs (foremen) in order to attain the most efficient economic indicators of the section's performance, and the shop chief can control progress in carrying out the production program, enforcement of work discipline, and so on. The advantage of this structure is that management is highly specialized and the decisions taken are thoroughly worked out and substantiated.

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Management becomes more effective in this structure, since there is a specialist who knows the specific field (operations, service and maintenance, repair, and so on) and who makes more competent decisions. The functional services are more responsive to the individual representing the management staff (recognizing his knowledge, his ability to get along with people, his ability to get things done, and so on). The shortcoming of the functional structure is the large number of divisions and channels along which management commands are transmitted.

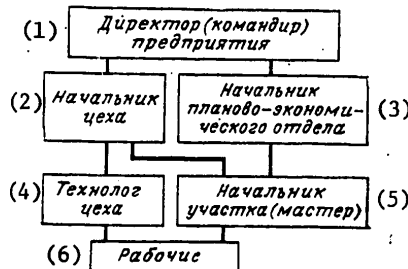


Figure 10. Functional structure of management.

- Key:
1. Director (commander) of the enterprise
 2. Shop chief
 3. Chief of the economic planning division
 4. Shop process engineer
 5. Section chief (foreman)
 6. Workers

The Line-Functional Structure of management is based on combination of line and functional units, but this means forming complex management systems. The line and functional structures of management are combined to guarantee that the problems are resolved speedily and competently. In this structure the staff services work out policy, strategy, methods of attaining the goals and performing the tasks of the unit that is being managed, while the line units act as participants performing those tasks.

The instructions which the functional bodies issue to lower-level line bodies have the status of recommendations. In this structure functional linkage is widely used.

The matrix structure, in which duties pertaining to management functions and actions concerning the specific unit being managed are distributed within the functional units, is an extension of the development of combined management structures (Figure 11). It should be mentioned among the shortcomings of the matrix structure of management that within the line units linkages of dual subordination occur and tend to make the line-functional structure more complicated.

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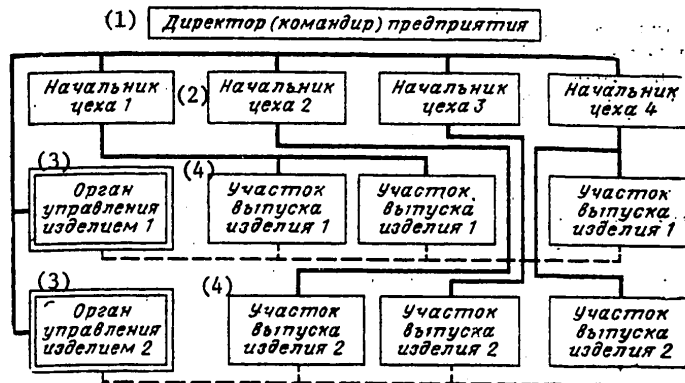


Figure 11. Matrix structure of management: — official linkage; --- functional linkage.

- Key:
1. Director (commander) of the enterprise
 2. Shop ... chief
 3. Body of management for product ...
 4. Section for manufacture of product ...

Combining the different structures is the most realistic way of achieving flexibility and responsiveness of management systems. Experience has proven that the effective organizational structure of management is the one that relieves the highest management unit to the greatest degree from settling the everyday matters that arise in current conduct of business so that it can concentrate its attention on the main directions which are strategic for the industry. Creation of a new link in the hierarchy of economic management--the association--is in this case a necessary condition.

3. Structure of Civil Aviation Associations

The transportation process is the point of departure and the decisive factor in organizing management in a transportation enterprise. It comprises the sum total of interrelated basic, auxiliary and service processes contributing to the movement of freight and passengers. The transportation process necessitates division of labor among worker collectives and a corresponding distribution among them of transportation equipment, operational equipment, machines, and so on.

A particular structure of management is formed in order to ensure efficient functioning of the transportation process and management of work collectives. Associations are an example of a progressive new structural form of socialist production. The first associations, or, as they were then called, firms, came into being in 1961. Having emerged in light industry,

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the production associations soon became widespread in many industries. In 1968 the first association was set up in highway transport, and in 1969 the first association came into being in civil aviation--the construction-and-installation production association Aviastroy.

All civil aviation associations have certain differences from transportation enterprises both in the nature of the regional organization of production and also in its structure. At the same time the associations also have a number of features in common with enterprises. For instance, the association is a multiplant enterprise.

In the language of political economy the association and enterprise should be regarded as phenomena of the same order. In our discussion that follows, then, associations and enterprises will be referred to as enterprises.

The transition by and large to a three-tier system of management in civil aviation calls for abolishing the regional administrations. The production associations become the largest production and economic units in the industry. With respect to their functions and rights they differ fundamentally from the administrations being abolished.

The production association is not restricted in its activity to administrative functions, but is an economic organization which operates on the basis of cost accounting, has financial independence and bears the full extent of responsibility for the results of the production and economic performance of all the production units making up the association. Transport associations better suit the requirements of the scientific-technical revolution than separate enterprises, technical improvement of production and specialization of labor take place in them faster, and they also have the following inherent peculiarities.

First, associations figure as a new form of economic organization in which the principal economic planning and scientific-technical functions in management of the transportation process have been centralized. Second, the responsiveness of management of the transportation process is enhanced when associations are set up.

At present there are about 10 associations in operation within the Ministry of Civil Aviation. Each association represents a complex unifying previously separate enterprises and their physical, labor and financial resources on a new economic basis. The basic principles in organizing associations in civil aviation were the following:

1. the sectoral unity of enterprises whose production process is characterized by the technological kinship and by similarity of the product produced. This principle has been entirely adhered to in setting up all the existing associations in civil aviation;

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ii. industrial cooperation of enterprises based on development of technological specialization has been applied to a limited extent in setting up associations in the industry. The reason for this is that civil aviation enterprises are characterized by a closed production cycle;

iii. combining the production of enterprises in the different branches of transportation. The creation of associations on the basis of this principle will offer a comprehensive solution to the problem of meeting the transportation need of the economy and the public. This principle is under study and has not yet been applied in air transport.

Centralization of management functions and the productive and economic relations taking shape in the association constitute important and decisive characteristics determining organization of management of the association. Three types of association are distinguished on the basis of these characteristics.

The first is the association with a central (head) enterprise and branches (filialy) which are part of the association (Figure 12). The staff for managing the association is at the same time the body for management of the central enterprise. The functional bodies of management are centralized to the greatest degree within the management staff. The republic production associations of civil aviation have been set up on the basis of this kind of organizational structure.

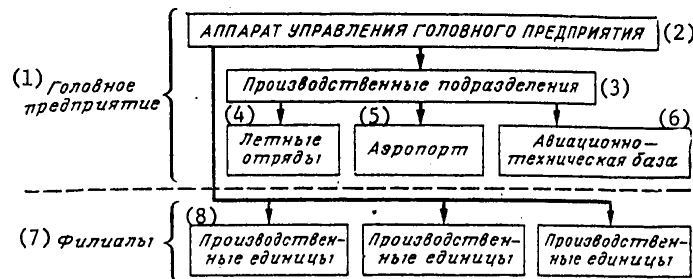


Figure 12. Consolidated organizational structure of the first type of association.

- Key:
1. Head enterprise
 2. Management apparatus at the head enterprise
 3. Production subdivisions
 4. Flight groups
 5. Airport
 6. Aircraft technical facility
 7. Branches
 8. Production units

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The second is the association with a central (head) enterprise (the other enterprises within the association are affiliates [filialy]) (Figure 13). The management of the association centralizes all management functions, but it is separate. All the association's enterprises have their own management apparatus.

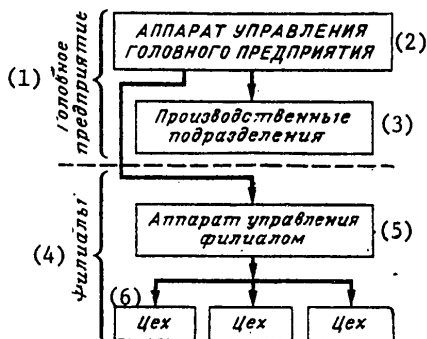


Figure 13. Consolidated organizational structure of the second type of association.

- Key:
1. Head enterprise
 2. Management apparatus of the head enterprise
 3. Production subdivisions
 4. Affiliates
 5. Management apparatus of the affiliate
 6. Shop

The third is the association without a central (head) enterprise. All the enterprises making up the association are affiliates (filialy). The association's management staff centralizes all management functions and is separate from the bodies of management of the affiliates. The V/O Aviaremont was shaped on the basis of this kind of organizational structure.

An analysis of the activity of the associations which have been set up indicates a number of peculiarities in the functioning of the mechanism within the industry.

1. Enterprises making up an association figure as branches with respect to the central (head) enterprise, and if there is no central (head) enterprise--with respect to the association's body of management.
2. The enterprises making up the association do not have economic and juridical independence. The central (head) enterprise is an exception.
3. The economic mechanism of the enterprises is being converted to internal cost accounting.

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4. At the enterprises making up the association there are no functional subdivisions for planning, accounting, monitoring, personnel training, etc. They are all centralized in the headquarters of the association.

5. The association's headquarters is at the same time the body for management of the central (head) enterprise. In certain cases there may be an exception when the headquarters of the association is set up separate from the bodies of management of the central (head) enterprise.

6. Creation of a centralized operations service--this is the principal organizational measure in organizing management of the association. The operations service is responsible for performance of the entire set of operations related to organizing the transportation process: conclusion of contracts, traffic planning, and followup on progress in fulfillment of contractual obligations.

7. Subsequent centralization of the association's functional subdivisions.

8. Creation of a computerized management system within the association. The use of computers and scientific methods of planning and management are effective means of increasing the productive and economic performance of all structural units of the association.

Experience with the performance of the industrial associations indicates that they are achieving a systematic improvement in the quality of the product produced and of rise in production efficiency at a faster pace (than industrial enterprises as a whole). For instance, the average annual growth rates of the volume of production for the associations have been approximately 9.6 percent, whereas for the entire industrial sector this indicator is 7.8 percent; the rise of labor productivity in the associations has been 7.9 percent, while for the industrial sector as a whole it is 6.3 percent.*

The new conditions that have arisen in connection with formation of the associations necessitate improvement of the other elements in the integral structure for management of civil aviation enterprises. Whereas in the first stage work was done to set up the associations in the industry, in the next stage an important role is given to optimizing the methods and the process of management of civil aviation enterprises.

* Taksir, K. I., "Upravleniye promyshlennosti SSSR v sovremennykh usloviyakh" [Management of the Industrial Sector of the USSR Under Present Conditions], Moscow, Vysshaya Shkola, 1972, p 278.

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Chapter III. Methods of Managing Civil Aviation Enterprises

The way in which the goal of management is achieved is called the management method. Each method is characterized by its content, its orientation and its organizational form (Figure 14).

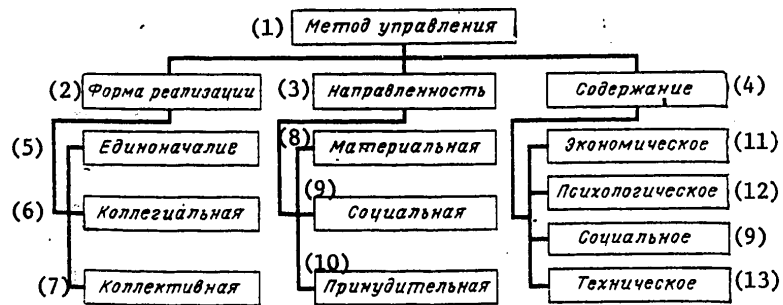


Figure 14. Characteristics of the management method.

- | | |
|----------------------------|-------------------|
| Key: 1. Management method | 8. Financial |
| 2. Organizational form | 9. Social |
| 3. Orientation | 10. Coercive |
| 4. Content | 11. Economic |
| 5. One-man management | 12. Psychological |
| 6. Management by committee | 13. Technical |
| 7. Collective management | |

The content of the management method has to do with meeting the requirements of objective laws. Orientation in its general form is determined by the characteristics of those motives by which the operative is guided. The organizational form of the method is manifested in the modes or procedures by which it is carried out.

The economic, organization-and-command, social and psychological methods of management have become widespread as the management of civil aviation enterprises has been organized.

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1. Economic Methods of Management of Enterprises

Improvement of the economic mechanism of the industry's enterprises necessitates introduction of effective methods of management capable of enhancing the role of cost accounting, economic instruments and incentives for increasing production efficiency. An important role is to be played here by economic methods, by which we mean economic accounting, which is based on deliberate use of the entire system of production relations and the economic laws of socialism and on the financial motivation and accountability of personnel for the consequences of the decisions they make. The content of economic methods comprises the entire sum total of socialist production relations, economic instruments are the tools for carrying them out, and the enterprise is the entity which is managed.

In the entire set of the system of economic methods of managing the enterprises of the industry we should distinguish direct economic accounting (pryamoy ekonomicheskii raschet) and full cost accounting (polnyy khoz-yaystvennyy raschet) (Figure 15).

Direct Economic Accounting is based on social relations and direct distribution of all resources. This method is used in managing economic and production processes and also to determine the social efficiency of production in the process of conducting a unified policy for the scientific-technical development of the industry and to achieve future socioeconomic and other goals. Electronic computers are used to employ the method of direct economic accounting at enterprises.

The analytical, normative and balance methods of computation have become widespread in conducting economic analyses of the performance of enterprises based on direct economic accounting.

The analytical method consists of determining the directions that are conducive to a planned rise in production efficiency on the basis of evaluation of enterprise performance and the unused potential revealed. At the same time this method makes it possible to assess qualitative changes in enterprise operation and at the same time to identify the progressive and undesirable tendencies in their changes.

Experience in using the analytical method at civil aviation enterprises suggests the following procedure governing its use. Analyses are made of fulfillment of the production program, of labor indicators (labor productivity, staff size, the wage fund), of financial indicators (proceeds, income and profit), and also of economic incentive funds.

In the final stage of conducting the analysis a plan of organizational and technical measures is drafted according to the results of enterprise performance. The plan presents specific proposals for correcting the shortcomings discovered, and the economic efficiency and anticipated annual saving are calculated for each proposal.

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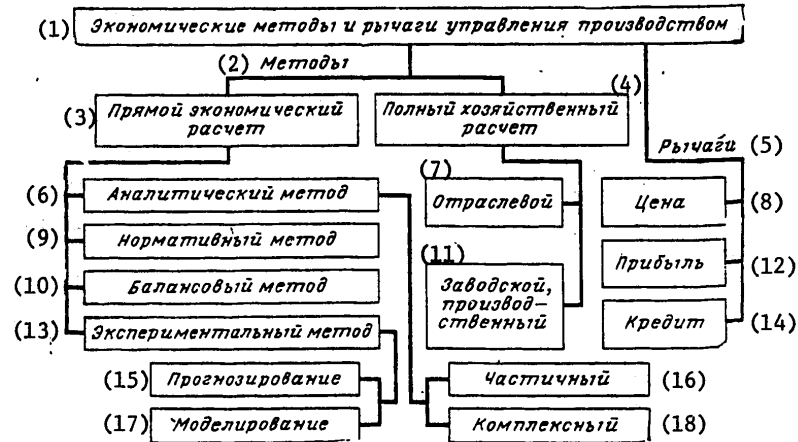


Figure 15. Classification of economic methods of management.

- Key:
1. Economic methods and instruments for management of production
 2. Methods
 3. Direct economic accounting
 4. Full cost accounting
 5. Instruments
 6. Analytical method
 7. Sectorwide and industrywide
 8. Price
 9. Normative method
 10. Balance method
 11. Plantwide and in the production unit
 12. Profit
 13. Experimental method
 14. Credit
 15. Forecasting
 16. Partial
 17. Modeling
 18. Comprehensive

Two varieties of the analytical methods can be used at enterprises in the industry: the partial (special-topic) and the comprehensive. The partial method has to do with solving specific local problems in the production and economic performance of the enterprise. For example, in analyzing the level of utilization of fixed capital the comprehensive study of this matter is set up, possible consequences of the decisions prepared are elucidated, and their impact on performance of subdivisions and the enterprise as a whole is evaluated.

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Comprehensive analysis is applied in solving major production and economic problems facing the enterprise or association. For example, a comprehensive analysis includes an assessment of enterprise performance, determination of its growth potential and the drafting of multiannual and annual plans, measures related to reconstruction of the enterprise, and so on.

These analytical methods of management make use of a common system of planning, reporting and analytical indicators to evaluate past, current or anticipated changes in the production and economic performance of enterprises and associations. The assignment for the new planning period is determined on the basis of the results of the economic analysis conducted.

The normative method or the method of technical-and-economic substantiation is aimed at determining the quantitative scale of the planning target. The principal task of this method is to work out a mechanism for substantiation of economic decisions.

In the course of the analysis a determination is made of the factors inhibiting and promoting development and attainment of the goals which have been set for production, and the method itself makes it possible to describe and quantitatively evaluate how efficiently the entity being managed is performing. The technical-and-economic norm--the basis of comparison--is the sole quantitative scale used to evaluate economic decisions.

The most widespread basis of comparison at the enterprises of the industry is the planned level of indicators and data from past years. The shortcoming of this basis is that it is objective. To eliminate this shortcoming it is advisable to use the standard level of indicators, since on the one hand they are common to groups of production units, and on the other they orient production toward the most progressive and advanced standards for utilization of production resources.

The methods of mathematical economics and electronic computers are an effective means of improving technical-and-economic norms at enterprises. Their use makes it possible to build models of the optimum state of the entity being managed and of technical-and-economic norms at which optimum utilization of all resources can be achieved.

The balance method makes it possible to link together the balances of consumption and accumulation, of income and expenditures, and of the national economy's freight traffic and passenger traffic within the country's unified transportation system. This method has been widely applied at enterprises in the industry because of its simplicity.

The experimental method is used in devising the optimum and economically efficient variants of the plan. This method has come into wide use in the conduct of scientific and design projects in the industry. Forecasting and modeling are among the experimental methods.

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Scientific forecasting is the initial basis for carrying out the process of planning, but it is no substitute for it. A graphic representation of the future state of the entity being managed can be obtained by modeling (re-producing) the behavior of the entity being managed. In this case modeling is a method that makes it possible to analyze the impact of various factors on the economic model of the entity being managed, to observe future situations and to conduct scientific experiments.

Full Cost Accounting is based on a measuring of costs against the results achieved. The following are among the basic principles for organizing cost accounting at enterprises of civil aviation: independence in economic activity and operations; the pay-as-you-go principle and profitability; and economic motivation and financial control.

The principles of cost accounting have been introduced in all structural units of the Ministry of Civil Aviation. The experience of introducing it is most interesting at repair enterprises, where plantwide (internal) cost accounting has become widespread. In the industry's operational enterprises cost accounting within the production unit is being used more and more.

The multisector activity of enterprises has an influence on the specific nature of cost accounting in the industry. For example, operational enterprises not only do the work of commercial handling and technical servicing of airplanes and helicopters and carry the mail, cargo and passengers, but they also do work related to the use of aircraft in the national economy.

Assignment of internal cost accounting indicators is accordingly a power of the enterprises themselves, and the list of indicators which are planned--production, labor and financial--is a standard list.

On the basis of the performance of enterprises structuring their operation on the principles of cost accounting it is advisable to recommend one or two production, labor and financial indicators and between one and three qualitative indicators for each of the subdivisions to be used for purposes of awarding bonuses on the basis of results in plan fulfillment. Targets for the total amount of income and expenditures are assigned to subdivisions in order to determine the degree of their impact on the profitability of the enterprise's operation. Specific selection of the indicators is determined by the nature of the work done by the specific subdivision and the possible influence they might have on the level of that indicator.

For most basic production subdivisions (flight groups, aircraft equipment facilities, fuel and lubricant services, special automotive transport, etc.) the number of operational or standard ton-kilometers of the section is recommended for assignment as a production target.

For other subdivisions it is advisable to assign the volume of the section's passenger traffic (traffic department, management apparatus),

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operational passenger turnover (stewards service), the volume of capital construction (capital construction division), the amount of technical servicing and maintenance in converted units (aircraft equipment facility), and so on.

Breaking down the plans of the subdivision to shifts, sections, crews and individual operatives is a pledge for successful introduction of internal cost accounting at civil aviation enterprises.

Improvement of the mechanism of economic management also affects the highest body of management in the industry. The typical features of cost accounting in the industry are the following: conversion of the industry to the pay-as-you-go principle; profit as the principal source for expansion of reproduction; material incentives of the ministry staff for fulfillment of the targets for the industry's performance.

In the present stage of development of civil aviation cost-accounting methods of management are effective because they are not restricted to the sphere of microeconomic relations, and in a planned way they penetrate into economic relations and linkages all the way to the top levels of the industrywide hierarchy for management of air transportation. As cost-accounting methods improve, the top level of economic management figures no longer as an administrative level, but as a system for economic guidance equipped with an arsenal of economic instruments.

Among the economic instruments used in planned management of civil aviation enterprises are prices, profit and credit. The price makes it possible to stimulate higher production efficiency and faster scientific-technical progress. Profit is an important indicator in evaluating enterprise performance and the source for formation of economic incentive funds. Credit is an essential factor in raising production efficiency. Credit is involved in building up nearly 50 percent of working capital; it is also involved in making more than 75 percent of payments for goods and services.

2. The Organizational-and-Command, Social and Psychological Methods of Managing Enterprises

Through the bodies of management of the regional administrations, associations and enterprises the Ministry of Civil Aviation exercises an organizational-and-command influence on production. To that end heads of economic entities, crew chiefs, shop heads, plant directors, and commanders of aviation enterprises perform the role of organizers (administrators) of production. The activity of these managers involves the use of organizational and command methods of management in various forms.

The Purpose of the Organizational Method of Management is to work out a decision in accordance with accepted economic standards, to designate those who are to carry it out and to fix the date for implementation of the decision. In practice this method is manifested in the form of organizational actions.

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An organizational management action has an influence on the qualitative state of the entity being managed both in time and also in space, as well as on the quantitative relationship among the elements in production. The targets of the organizational action are the functions and structure of the entity being managed.

An organizational impact is exerted in the following sequence:

- i. statement of the purpose of the action;
- ii. analysis of the possible directions, ways and methods of attaining the goal;
- iii. selection and modeling of the specific direction and method of attaining the goal;
- iv. issuance of the specific instruction in accordance with the organizational chart for attainment of the goal that has been worked out;
- v. followup on progress in carrying out the specific instruction;
- vi. adjustment of the process of organizational impact in all stages of the practical performance of the specific instruction.

When fundamentally new directions for attainment of a goal are worked out, in addition to modeling it is recommended that expert evaluations be used, which will make it possible to anticipate the consequences of the organizational impacts on the entity being managed.

The content of the organizational management action is not the same at every level of management. But in all cases it is put in legal form. The organizational methods of managing the enterprises in the industry can be further subdivided into two types: adoption of organizational regulations and assignment of organizational standards.

Use of the method of adopting organizational regulations exerts an impact on the management system in order to establish its organizational structure and the limits of its juridical independence.

Performance of scientific management is unthinkable without technical regulation of management actions. This form of management is an organizational action subject to standards. The sphere of its influence, which is based on the method of setting organizational standards, is determined by the system of technical performance standards, physical standards, and design and process documentation. In view of the fact that the system being managed and the managing system constitute a unified economic organism, it is quite natural that each of them should advance its own requirements as to the scale of the organizational impact. For instance, the system being managed requires observance of production norms (such as partial completion

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of production, the size of the optimum lot in product manufacturing) and economic standards (for example, consumption of physical resources, rate of delivery of freight and passengers, utilization of aircraft, output-capital ratio, etc.).

The managing system has in turn its own standards such as its internal set of procedures, standards governing staff size, deadlines for resolving production problems, etc.

Use of the organizational impacts of adopting regulations and assigning standards in conjunction with one another imparts a systematic and objective nature to the management process and nothing is left to chance.

The Command Method of Management. The organizational impact will not be fully realized unless it is supplemented by the impact of a command; command methods, which are an active form of management, are aimed at correcting departures from fulfillment of the established goals that occur in the course of production.

If the methods of organizational influence reflect the statics of production, the command methods reflect its dynamics. Thus command methods elaborate the organizational measures in accordance with the actual state of affairs in production.

The task of the command method is to ensure straightforward actions by the body of management aimed at organizing the smooth operation of all the enterprise's subdivisions. Depending on the functional tasks of the body of management and its powers and duties all command methods of management can be divided into those which implement and those which embody commands.

The activity of implementation arises when there is an external impact on the body of management. This external impact may be the order of a minister, a decree of Gosplan or the republic council of ministers or the USSR Council of Ministers, and so on.

By contrast with implementation, command activity arises on the initiative of the enterprise's own management or that of the association when it becomes objectively necessary to coordinate or regulate the flow of the production process. One of the reasons for exerting an impact through a command may be a progressive initiative in the collective, the initiative of individuals in the bodies of management, and so on.

The combined use of these methods in management practice constitutes an important potential of the bodies of management for increasing the effectiveness of production management.

Social management has certain specific features that distinguish it from economic management. They are manifested above all in that the people using equipment and technology and relations among them, including social

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relations, are the target of social management. Thus management of social relations signifies management of people.

Work collectives are managed in accordance with the policy of the party and state by the administration of enterprises, which relies in its practical activity on party, trade union and other public organizations. The purport of social management lies in the following:

First, each man's role and his place in the work collective are defined. At the same time the scope of the rights and responsibilities is outlined for performance of the functional duties he is responsible for. The role of the member of the collective is set forth in legal regulations, flow charts, bylaws, statutes and instructions. Second, each person studies his own social role, his functions, rights and duties. Third, each person performs his social role. This is achieved thanks to the adequate level of general and occupational training, discipline and responsibility, and also thanks to operation of the system of moral and material incentives.

Sociological methods of management are distinguished from social planning in the overall context of social methods of management.

The Sociological Method is used to manage the following as a function of the target of research:

- i. large-scale phenomena such as personnel turnover, vocational training, seasonal movement of manpower, the pattern of occurrence of rejects, and so on;
- ii. group processes--purposive orientation in the activity of a collectivity of people;
- iii. intragroup phenomena--socialist competition, political education, etc.;
- iv. behavior of the subordinate as an individual.

The management of large-scale phenomena ultimately has the regulating impact on the volume, structure and direction of vocational retraining of personnel on a large scale. At the enterprises of the industry measures are being taken toward purposive orientation of personal interests, to manage the placement of personnel, toward rational location of shops, services and divisions (Figure 16).

Authoritarian, liberal and democratic methods of management have become widespread in managing group processes (the production collective). The principle of democratic centralism is the basic principle governing management in all these methods. The authoritarian method of management is characterized by the fact that full responsibility for the performance of the collective is concentrated in the manager, he restricts the responsibility

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of his subordinates, and he makes decisions alone for which he bears sole responsibility.

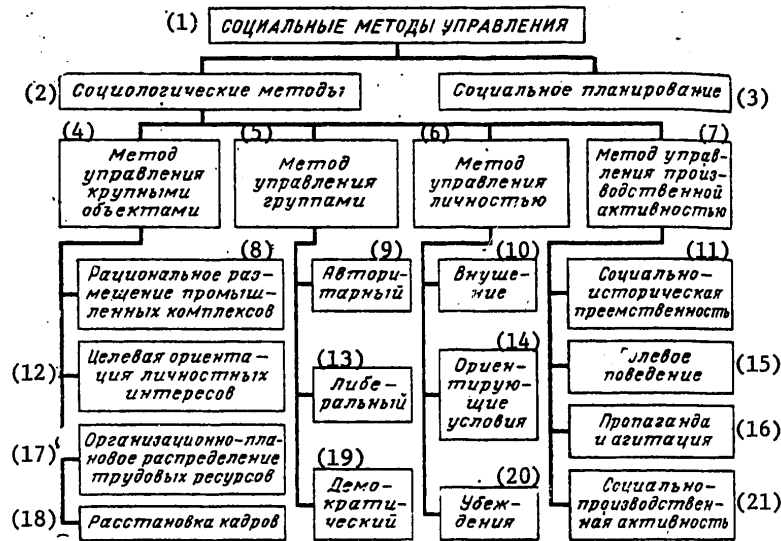


Figure 16. Classification of social methods of management.

- Key:
1. Social methods of management
 2. Sociological methods
 3. Social planning
 4. Method of managing large-scale facilities
 5. Method of managing groups
 6. Method of managing the individual
 7. Method of managing productive activity
 8. Optimum location of industrial complexes
 9. Authoritarian
 10. Suggestion
 11. Sociohistorical continuity
 12. Purposive orientation of personal interests
 13. Liberal
 14. Conditions which furnish orientation
 15. Roleplaying
 16. Propaganda and agitation
 17. Planned organizational distribution of labor resources
 18. Assignment of personnel
 19. Democratic
 20. Conviction
 21. Socially productive activity

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The granting of freedom of action to subordinates is typical of the liberal method. Only punctuality and the quality of the results obtained are monitored. This method is applicable to subordinates psychologically cut off. This method of management is counterindicated with respect to subordinates oriented toward the collective, and at times it is even harmful, since it does not provide ongoing and current followup on the part of the manager.

Broad involvement of the working masses in management is inherent in the democratic method. The manager distributes responsibility for the performance of subordinate production units among individual operatives or groups of them.

Use of each of these three methods is determined by the importance of the task which has been set for the production collective, by the competence of the management staff and by other factors.

Among the methods of managing phenomena within groups such as increasing productive activity of all members or of an individual member of the collective, occupational training, and the staging of socialist competition, management by roleplaying, management by social continuity and the method of propaganda and agitation are distinguished from one another.

As a method of management social planning is an effective system for social development of the collective. In performing the task of increasing production efficiency, civil aviation enterprises compile multiannual comprehensive plans for the technical, organizational and social development of collectives. To be specific, such a plan provides for solving the following social problems of the collective: the meaningfulness of work, the cultural and technical level of the collective, consciousness, work activity, etc.

The conversion of civil aviation enterprises to the new conditions of planning and economic incentives is bringing about a substantial increase not only in economic independence, but also in the social role of the enterprises. For instance, in its public life every enterprise figures as a unity of two aspects. On the one hand it is a production unit, while on the other it is a social collectivity in which socioeconomic relations taking place in our society are manifested.

The makeup of the comprehensive multiannual plan may vary as a function of the enterprise's size and specific nature, but its principal directions are the following: development of production; improvement of the technical base; organization of production, of work and of management; employee facilities in the workplace; and the collective's social development. Experience in drafting comprehensive plans at transportation enterprises shows that any of these directions could play the leading role in a particular stage depending on the specific conditions.

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The plan for social development must include realistically attainable targets, based first of all on the given enterprise's capabilities. It is advisable for a small transportation collective to carry out certain measures in cooperation with related enterprises. A number of problems in social life, home life and optimum leisure time can be solved jointly with rayon, city and oblast organizations. That is why certain propositions and targets in the plan must be coordinated with the respective organizations and achieved by united effort.

Projects to carry out the measures of the social plan are included in the operations schedules of the respective divisions and shops, which must bear the same responsibility for their performance as for fulfillment of plans for technical and economic development.

Psychological Methods of Management are widely used in selection, training and assignment of personnel, in shaping work collectives, in their stimulation, and in establishing the necessary style of leadership.

Since management is in essence a form of leadership of men, a knowledge of psychology, especially social, engineering and industrial psychology, is an important factor for raising labor productivity and the individual's self-expression.

Personal motivation is an exceedingly important psychological factor in the worker's conscious attitude toward his work. Personal motivation can be represented in the form of three main components: the material interest, the interest in creativity and learning, and the interest in human relations. All of these interests of the individual should be considered in relation to one another. Only in this case can one count on the individual's favorable reaction in terms of his conscious attitude toward work.

Work ability is a factor determining the efficiency of the worker's work activity. We should point out that work ability is not a stable characteristic of the human organism. It varies from one phase to another in the work process (Figure 17).^{*} Four principal phases can be identified in the dynamic pattern of work ability. The first--the phase of coming to work--is characterized by rising work ability. The second--the phase of stable work ability--is characterized by mutual adjustment of the rhythm and pace of the various psychophysiological processes. The third--a phase of unstable work ability--is characterized by fluctuations in work ability. The fourth--the phase of progressive decline of work ability--is characterized by disruption of the pace and rhythm of the various psychophysiological processes.

^{*} Shorin, V. G., "Pravovyye i sotsial'no-psikhologicheskiye aspekty upravleniya" [Legal and Social-Psychological Aspects of Management], Moscow, Znaniye, 1972, 316 pages.

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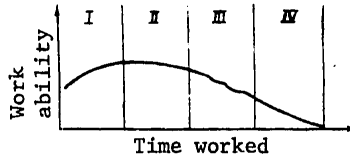


Figure 17. Dynamic pattern of work ability.

The length of each of the four phases depends on the character of the work and the level of the worker's training. In principle the more complicated the work and the less prepared the worker, the longer the first phase and the shorter the second phase.

One of the factors affecting efficiency of the activity of a small group of people who have come together in space and time and are jointly performing a particular activity is the size of that group. If we plot the dependence of the efficiency of group activity on the size of the group on a graph, then it will take the form of a parabola (Figure 18).

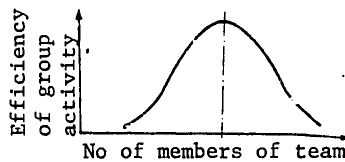


Figure 18. Dependence of the efficiency of group activity on the size of the group.

As the size of the group increases, its efficiency at the outset rises to a certain level. When a certain critical value is reached, the size of the group ceases to have a favorable effect on the efficiency of its activity, and then as the size increases further, efficiency drops. The specific values are determined by the character of the task and the skill of the workers enlisted to perform it.

The methods of social psychology and the methods of psychological motivation have a leading place among the psychological methods. The method of social psychology studies and manages phenomena conditioned by joint human activity. Something that has come to be called the "psychological climate" comes about under the conditions of joint activity. The psychological climate in a collective is noticeably affected by the attention the supervisor pays to subordinates, his concern about their needs. It has been noted that psychological factors have an essential influence on such characteristics of the work collective as the level of organization (harmony), collective initiative or creative "potential," the size of the collective, etc.

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The method of psychological motivation is based on a knowledge of the laws of human motivation. It is accordingly a very important attribute of the supervisor to be able to understand the motives and interests involved in the activity of his subordinates, to present them with specific tasks, and to discover each one's potential.

Method and manner play an operative role in the overall management chain of "goal--principle--method--manner." The basic features of the mode of production are expressed in them. At the same time the use of methods in the practical activity of bodies of management is a very important task confronting supervisors and operatives. The ability to master them makes management more effective.

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Chapter IV. The Process of Managing Civil Aviation Enterprises

The production process is the organizing principle of the management process. In the transportation sector both the production process and the process of management are cyclical in nature. The length of the cycle and the frequency of recurrence of the production process have a definite impact on the structure of management and on the process whereby the bodies of management take shape.

In the process of the management's activity a large number of diverse actions are performed which are classified as management functions. The content of management actions may vary from one transportation enterprise to the other, but the list of them remains the same. At all enterprises and organizations in the transportation sector the functions performed are those of planning, operations management, material and technical supply, and so on, but the content of these functions varies and is characteristic of each specific entity being managed.

1. Structure of the Management Process

In its general form the process of management performed by any body of management is characterized at any level by its content, its organization and the technological sequence in which each management action is performed.

The content of management action is determined by the purpose and level of the body of management. The purpose is in turn largely determined by the functions of management, which are based on the division of managerial labor. At various levels of management of civil aviation enterprises the same functions are performed (for example, the planning of material and technical supply) in the management of different entities. For example, the Ministry of Civil Aviation manages civil aviation associations and regional administrations, and the republic production association and regional administration manage the associated aviation groups and airports. The associated aviation groups in turn manage the flight groups and squadrons.

Combination of the economic, production, technical and social aspects makes it possible to view the process of management as an integral system in

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which Lenin's principles of scientific management are observed. Each of these aspects characterizes the process of management from its respective aspect. For instance, the economic aspect looks upon the process from the standpoint of attainment of the most effective results of production, of maximizing or minimizing particular economic indicators characterizing the enterprise's productive and economic performance. The following are among such indicators for operations enterprises in civil aviation (associations, administrations, associated groups, etc.):

- i. with respect to traffic--section passenger volume;
- ii. with respect to use of aircraft in the national economy--productive flight in hours;
- iii. with respect to labor--labor productivity and the total wage fund;
- iv. with respect to finance--total income, profit, profitability, and so on.

The economic indicators for industrial enterprises (repair plants) are the following:

- i. with respect to production--volume of sales and products list;
- ii. with respect to labor--productivity and the total wage fund;
- iii. with respect to finance--total profit and profitability.

The productive aspect considers the process from the standpoint of the clear-cut and unhampered interaction of all subdivisions of the enterprise, and the technical from the standpoint of the organization of the technological process of producing the product. And finally, the social aspect of the process of management studies the process from the standpoint of the state and development of socialist relations.

Organization of the process of management consists of arranging all of the functions of management in a strict time sequence and of their performance by participants in that process. Thanks to research done by GosNII ERAT GA [State Scientific Research Institute of Civil Aviation for (?) Experimental Work on Aviation Technology] it has been recommended that enterprises in the industry construct organizational charts of the management process. They make it possible to view as a whole the entire entity being managed and to ascertain the actual participants in the management process and the sequence in which management functions are performed. The network shown in Figure 19 is an example of such a chart. Networks (models) have become widespread at civil aviation enterprises in management of the production processes of technical servicing and repair of aircraft, since it takes little time and small material costs to work them out and use them in practice.

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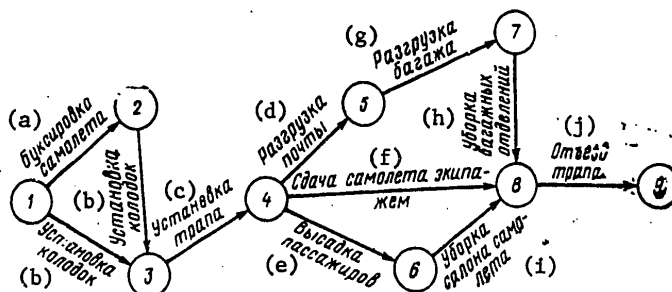


Figure 19. Network chart for servicing an aircraft arriving at an airport (consolidated).

- Key:
- a. Towing the aircraft
 - b. Placing the chocks
 - c. Placement of the boarding stairs
 - d. Unloading the mail
 - e. Disembarkation of passengers
 - f. Crew's delivery of the aircraft
 - g. Unloading the baggage
 - h. Cleaning baggage compartment
 - i. Cleaning passenger compartment of the aircraft
 - j. Removal of the boarding stairs

The following basic conditions must be observed in drawing up organizational charts:

- i. the scale and dimensions should be chosen so that the entire chart can be scanned;
- ii. flows of documents for each management function should be reflected;
- iii. flowlines of management functions should be shown for each entity being managed and each participant performing a management function;
- iv. the notation should be brief and reduced to the minimum;
- v. minimum number of breaks and intersections of lines reflecting the flows of documents.

The method of constructing the organizational charts is as follows:

- i. all entities and participants in the system being managed and the managing system in the entire system of management are determined;
- ii. structural subdivisions of the management systems are distributed among the levels of management;

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iii. the flowlines of management functions and flows of documents for each management function are ascertained;

iv. an evaluation is made of the level of interaction of structural subdivisions with respect to each management function and of the sequence of performance of management actions.

The technology of the management process is characterized by the makeup of operations and work items involved in the makeup of the specific management function (management action) and by the sequence of their performance. A technological description of the management process is the initial element in organizing the entire process of management. Development of the technology of the management process is preceded by organizational work to distribute performance of the various work items and operations among specific participants. During this preparatory work it is advisable to work out an organizational chart of the technology of performance of the specific management function (Figure 20). Participants, the work they perform and the sequence of execution should be indicated on this chart. The requirements they must meet remain the same as for the organizational charts of the management process.

Aside from its inherent characteristics, each management process also has its own specific peculiarities, which are manifested in the fact that it is not aimed directly at the creation of values, but indirectly, through organization of the work of members of the body of management. The content of the management process varies as a function of the body of management, its level and its purpose.

The actual content of the management process is determined by the character of the production process of the entity being managed. Moreover, it is influenced by organization of the process of management in the superior body with which there is interaction in the process of the functioning of the entity being managed. The content of the management process of the Ministry of Civil Aviation is as follows:

i. planning development of the industry as an integral part of the national economy, the rates of development of production and the rates of labor productivity on the basis of scientific-technical progress toward the end of fuller satisfaction of the need of the national economy and the public for the carrying of cargo, mail and passengers and also for the operations of the use of aircraft in the national economy;

ii. the planning and introduction of the most recent advances of science and technology, of airplanes and helicopters, and of equipment to mechanize loading and unloading operations;

iii. planning the optimum use of capital investments and the rise of their efficiency, construction times and deadlines for activation of production capacities and fixed capital;

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iv. management of the utilization of fixed capital and labor, physical and financial resources;

v. monitoring fulfillment of the targets of the state plan and observance of state discipline and other management actions.

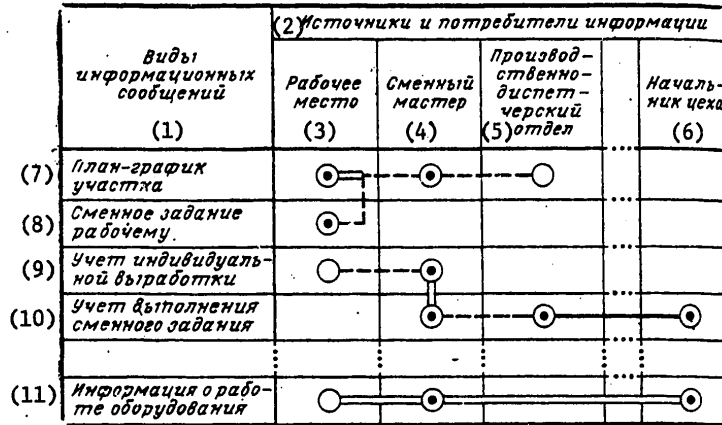


Figure 20. Organizational chart of management of an entity: o formation of information; e use for formation of production information; — interconnection of flows of information; = oral information; --- documentary information.

- Key:
1. Types of communication of information
 2. Sources and users of information
 3. Work station
 4. Shift foreman
 5. Production scheduling division
 6. Shop chief
 7. Section's plan-schedule
 8. Worker's shift assignment
 9. Recording individual output
 10. Recording performance of the shift assignment
 11. Information on the operation of equipment

The entire list of management actions in the process of management of a transportation industry at the ministry level are performed by the sectoral and functional bodies of management. In connection with the current creation of transportation production associations, a portion of management actions of a sectoral nature are being transferred to the management apparatus of those associations. The content of the management process at the association level is as follows:

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i. planning, management and followup on performance of the plan in ton-kilometers and also with respect to the composition of cargo and passenger departures;

ii. planning, management and followup of the operation of aircraft in order to attain the highest qualitative indicators of its utilization at all enterprises which are part of the association (above all utilization of carrying capacity, the productivity of flights and reduction of the costs of shipment);

iii. planning, management and followup on the operation of transportation equipment of the unified transportation junctions and other management actions.

The content of the management process at the level of transportation enterprises is aimed at accomplishing the entire program of measures to draft production plans, to organize their fulfillment, to keep records and to analyze enterprise performance.

2. Technology of the Management Process

The technology of the management process reveals the content of management activity and comprises the interrelated group of relevant measures aimed at attainment of the goals which have been set. This set of measures can be divided into two groups: management decisions and management actions.

By management decisions we mean the internal activity of members of the bodies of management aimed at resolving a particular situation (production, economic, organizational or social situation). The management action is an external action of members of the body of management and is manifested in the form of a command, an order, and so on.

Thus the technology of the management process means the process of activity of management personnel in preparing and making decisions and in organizing execution of decisions once made.

The decision is the principal form of management activity; it reflects the content of the work of the member of management and the process whereby he exerts an impact on the production and management collectives. Every decision, its content and form, are related to the occurrence of a specific problem faced by the management. As a function of the character of the problem the decision may have long-range or current orientation (Figure 21). Long-range decisions determine the main lines of development of the system being managed over a length period of time (for example, specialization of aviation equipment facilities with respect to types of equipment they service).

Current decisions are aimed at attainment of the most immediate goals and at solving specific problems, as well as at handling operational measures

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through immediate intervention in the course of development of the situation being managed.

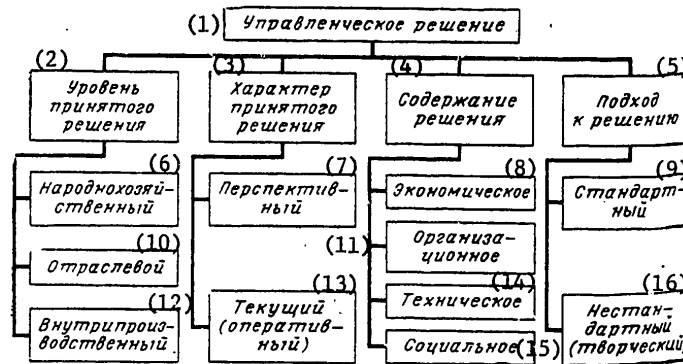


Figure 21. Classification of management decisions.

- Key:
1. Management decision
 2. Decisionmaking level
 3. Character of decision made
 4. Content of decision
 5. Approach to decisionmaking
 6. National economic
 7. Long-range
 8. Economic
 9. Standard
 10. Sectorwide
 11. Organizational
 12. Within the production entity
 13. Current (operational)
 14. Technical
 15. Social
 16. Nonstandard (creative)

The social relations of people in the production process are the principal target of the economic decisions of management made in civil aviation enterprises. When the people making the decisions carry them out, they exert a vigorous impact on the specific forms of those relations, they alter them within certain limits so that those relations actively promote the development and growth of the productive forces and the fullest satisfaction of the needs of the national economy and the public for transportation services.

In the practice of managing civil aviation enterprises decisionmaking methods based on knowledge, practical experience and intuition of the manager were used for a long time and are still in use. This approach to decisionmaking yielded favorable results up to a certain point. The situation is

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changing at the present time. As the scale has increased and the organization and management of the transportation process have become more complex, it has become obvious that the approach to decisionmaking had to be put on a scientific basis. At certain enterprises (Vnukovo, Domodedovo and Borispol') various mathematical methods, models and electronic computers have been successfully applied in the process of managing the technical maintenance and service of aircraft and planning the operations of apron teams, material and technical supply, the repair of aircraft and performance of other functions of management.

In the process of scientific management the laws of material dialectics, the theory of automatic control and probability, the methods of operation research and logical analysis are also used in practice.

The knowledge and use of the dialectical method make it possible for the manager to objectively evaluate the production situation, to understand the nature of events taking place, to establish the relationship between events and the production situation, and to analyze and forecast the direction events will take in their development.

Mathematical methods and the use of computers make it possible to mechanize and automate the process of working out a decision and, most important, to arrive at the optimum decision.

Neither an ordinary system nor a computerized system can take into account the psychophysiological attributes of members of the management staff such as psychological reaction, the interactions of the members of the collective, etc. But even here we should say that regardless of which system is making the decision, success ultimately depends on the supervisor, that is, a man. Only a supervisor who has a good knowledge of the various aspects of the production process, who possesses the necessary knowledge and skills, who knows how to use computers and to think creatively can successfully manage present-day production.

The decisionmaking process is a process of creative human thought based on the scientific foundations of management and intuition. This circumstance makes it more difficult to formalize the decisionmaking process. It is possible, then, to offer only an idealized representation (scheme), since the specific processes quite often depart from it (Figure 22).

The decisionmaking process consists of a great number of operations whereby an exploration is made for the best action among the alternatives. The principal and most widespread operations are as follows.

1. Identification of the problem situation. In order to discover the problem, to observe the deviation of the behavior of the system being managed from the planned flow of production, and the discrepancy within the system being managed and its external relations one must conduct a punctual analysis of the relevant information. Once the discrepancy has been

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detected, one undertakes to describe the problem and to determine the causes of this deviation. Such causes may be as follows: unproductive idle time of transportation equipment, insufficient capacity of the shops of the repair enterprise, tardy delivery of fuels and lubricants, etc.

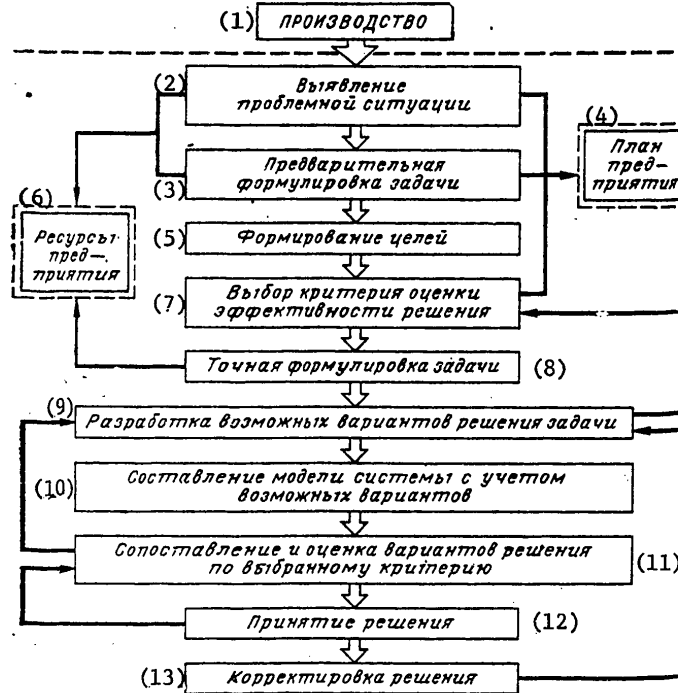


Figure 22. Block diagram of the decisionmaking process.

- Key:
1. Production
 2. Identification of the problem situation
 3. Preliminary statement of the problem
 4. Enterprise plan
 5. Statement of goals
 6. Resources of the enterprise
 7. Selection of criterion for evaluation of the effectiveness of the decision
 8. Precise statement of the problem
 9. Development of possible alternative solutions for the problem
 10. Compilation of a model of the system taking into account the possible alternatives
 11. Comparison of the alternatives and their evaluation with respect to the criterion chosen
 12. Decisionmaking
 13. Adjustment of the decision

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The problem may be stated in the form of the task of correcting the causes that have been discovered or of carrying out instructions of superior organizations. In identifying the problem the member of management must evaluate its importance on the basis of the particular strategy adopted for managing the industry, the association and the enterprise.

Several problems may arise in analyzing the state of the system being managed. In this case it is indispensable to establish the order (priority) of their solution by performing the following operations: ranking the problems by importance and the urgency of dealing with them; definition of the specific tasks in solving each problem; identification of the general tasks covering several problems; determination of the criteria and constraints pertaining to the problem being solved; and organization of a team to work out the decision.

2. Preliminary statement of the problem. The search for the most rational ways of solving the problem is preceded by a stating of the problem. Revisions of the statement of the problem are made in the process of making the management decision. All problems are classified as either tactical or strategic depending on the causes giving rise to the discrepancy in the flow of production (between the plan and actuality) and making it necessary to solve the problem. Tactical problems arise because random departures have occurred (breakage, lack of replacement parts or materials of some kind, and so on). The time for solving such problems is limited.

Strategic problems are related to correction of shortcomings that exist in production (regular overconsumption of fuel, higher growth rates of the average wage than for labor productivity, etc.). If the problem is to be stated precisely, a proper study must be made of the situation and the reasons for its occurrence on the basis of information already available, and a determination must be made as to which of the workers was directly involved in the section where the undesirable situation came about, and the consequences of the impact which solving the problem will have on the flow of production must be determined.

3. Statement of goals. The purposiveness of the decisions being prepared for adoption must follow from a definite management strategy. In this connection the best results are achieved in the cases when the goal which has been set and also the problem ensure realization of the principle: what is advantageous to society must also be advantageous to the work collective and to the individual worker.

A multiple-objective problem may arise in the statement of the objective. Some of this set of objectives may be contradictory. For instance, in solving the problem of reducing production costs, it is not possible to omit such objectives as raising product quality, improving working conditions, etc. Thus there may be objectives which need to be achieved and objectives which need to be preserved (constraints). In such a situation one must first optimize decisions with respect to the several "main" objectives

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by stating definite constraints pertaining to them. For example, we might state improvement of the quality of the product of transportation as an objective, but the cost of the product cannot be allowed to rise without limit. In such cases a criterion of the effectiveness of attaining the goal has to be established.

4. Selection of criterion for evaluation of the effectiveness of the decision. One must have success criteria to objectively compare the different alternative decisions and to improve their quality. The main reason why it is a complicated matter to select a criterion for evaluation of the effectiveness of the decision is that a management decision is the product of creative work and is influenced by the following factors:

- a. the personal attributes of the person making the decision (professional training, general level of education and political ideology, and so on);
- b. organization of information support in the process of preparing the decision (for example, on the state of resources);
- c. organization of preparation of the decision (individual and group);
- d. adequacy of equipment and possibility of using and applying mathematical methods;
- e. period of time in which the decision must be prepared, and so on.

Even this list shows how complicated it is to work out a criterion for evaluating the variant of the decision that has been chosen. Aside from these factors, there are also a number of mandatory requirements which criteria must meet. They include the scientific soundness of the decision, compatibility of all the principal elements of management, punctuality of decisionmaking, completeness of content and form of expression. The requirement of scientific soundness presupposes that tendencies in development of economics will be taken into account in preparing the solution and that scientific methods of optimization and up-to-date equipment will be used. The requirement of strict consistency with the principal elements of management lies in the unity between the tasks stated in the decisions and the methods of carrying them out. The decision which is taken must be carried out in the initial stage of the discrepancy which has come about in the flow of production, which will make it possible to reduce the consequences of this undesirable occurrence. The essence of the requirement of punctuality of decisionmaking is manifested here. The completeness of content of the management decision is determined above all by the specific nature of the problem to be solved and by the level at which the decision is being taken. The need to solve the problem is substantiated in the content, and the specific actions are defined, those who are to take them are designated, and deadlines are fixed. The manner of expression of a decision is manifested in its form (order, command, verbal instruction, and so on).

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5. Precise statement of the problem. At length the problem is stated on the basis of additional data obtained as a result of the situation that has come about, an analysis of the possible methods of resolving it, the objectives which have been established and the criteria that have been adopted for evaluation of the effectiveness of the decision taken. The preliminary statement of the problem may be amended as a result of subsequent studies; in particular the statement and formalization of the problem may be revised in the process of stating the objectives. If the decisionmaking task is so complex that it cannot be formalized by any of the known and accessible methods, then the individual's heuristic abilities play a definite role in such a situation.

6. Development of possible alternative solutions for the problem. The search for the most rational ways of solving the problem is conducted by developing alternative decisions. The preliminary alternatives usually come into being even in the stage of selecting the criterion for evaluation of the effectiveness of decisions and in stating the problem. But when the problem has been definitively stated, all possible variants should be reexamined so as to take into account the fuller information description of the entity being managed and decisionmaking methods.

Such methods as comparative analysis, forecasting, mathematical-economic modeling, the target-program approach, and so on, have a special place among these methods. In spite of the great capabilities of mathematical methods, their use is often restricted in working out alternative decisions in real economic practice. The primary reason for this is that management personnel have not had adequate mathematical training and the bodies of management do not have sufficient equipment.

From among the set of alternative variants which are possible one is left with several which are the most realistic both from the standpoint of technical and organizational realization and also in view of the outlays required.

7. Compilation of a model of the system taking into account the possible alternatives. The decision taken is checked on the actual system so as to take into account its characteristics. For example, a number of possible variants of deployment are analyzed when newly acquired aircraft are being distributed. Here the important characteristics of the system in which the aircraft is to be placed are the following: the traffic capacity of ground installations (the runways of the airport), specialization of the aviation equipment facility, and the qualifications of personnel.

When this approach is taken to composing the model, one is oriented toward a certain set of interrelated characteristics. In any case one models the possibility and consequences of the decision taken with respect to a specific variant. Mathematical models and computers are widely used in the process of modeling.

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Their use makes it possible to find the optimum variant of the decision in a sufficiently short period of time.

8. Comparison of the alternatives and their evaluation with respect to the criterion chosen. Each variant of the decision states the principal directions for achieving the goal, those who are to carry it out, the resources, incentives and completion dates. At the same time the possible results in the production and economic activity of the enterprise from carrying out the particular variant are substantiated and the benefit anticipated from its introduction is determined. The benefit is calculated with respect to the single criterion or set of criteria selected previously.

9. Decisionmaking. The decision is one of the alternatives of actions to attain the goal that has been set. Selection of the alternative--of a manner or method of attaining the goal that has been set--is determined by criteria, indicators or the conclusion of the manager. The manager bears personal responsibility for the effectiveness of the decision which is taken. The manager "passes" the entire set of possible variants of the decision one after the other through each specific criterion. The result is a decision that best suits the specific criterion.

When making a decision that is based on logical judgments and intuition the manager checks once again the correctness of the sequence of logical operations and makes certain that everything has been taken into account and provided for in the process of making the decision.

10. Adjustment of the decision. It should be remembered in modeling the decision that it is optimum for the model, but since the model is a representation of the real system with certain suppositions, the decision may prove not to be optimal for the system itself. This discrepancy between the model and the system means that in the process of the operation of the system being managed there may be a need to intervene in the flow of production, i.e., a need to correct the decision previously taken.

For a substantial portion of management processes the scheme expressing the sequence of decisionmaking (Figure 22) is applicable only in general form. Moreover, attention must be paid to the fact that in certain cases there will be little opportunity to apply the principle of selecting a variant of the decision from among several alternatives. For example, the lack of important information may exclude the possibility of setting up several alternatives, and in spite of his knowledge of the methods for scientific solution of the problem, the manager will be forced to resort to the method of trial and error or to use his own experience.

An important means of improving the effectiveness of the decisions taken is to optimize them, which complicates the management process, but at the same time makes it possible to seek out the most expedient decision.

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3. Optimization of Management Decisions

The essence of the optimization problem is to choose from among a certain set of variants those whose results best suit the objectives which have been set. The problem of selecting optimum solutions for any particular problem moreover has its specific peculiarities.

In most optimization problems it is an important organizing principle to take into account the dynamics of production processes, i.e., changes in time of a number of characteristics of the entity being managed as well as the impact of the solution chosen over a certain period after it is applied in the system being managed. The natural method of describing and solving optimization problems--mathematical-economic modeling--arises out of the very nature of these problems.

The following are among the most important principles for setting up and solving optimization problems:

- i. the national economic approach to evaluating the effectiveness of the various possible solutions. This means that in selecting a variant for solving a production problem one must take into account not only those costs and results achieved within the enterprise, but also those outside it;
- ii. arriving at the most efficient variant for utilization of limited resources, which gives rise to the problem of seeking an optimum solution;
- iii. use of a formalized description of the variants of the solutions by means of various kinds of mathematical-economic models.

In the process of management optimum decisions should not be chosen by using experience or intuitive conceptions of the manager, but on the basis of strict scientific calculation. For this purpose the initial problem must be appropriately formalized, i.e., described by means of mathematical equations. This is done by building a model of the problem in which connections reflecting the management process being described are set up and expressed quantitatively. In building a model one takes into account the influence of external factors, which take the form of constraints in the formalization. Thus the mathematical model of a real management process is an abstract entity which has been formally described. The complexity and diversity of functioning of real processes do not allow an absolutely adequate model to be built for them or for any one method to be used.

The method of linear programming has become widespread in civil aviation. The essence of this method of optimizing the variant of the decision can be explained in the following example. Let us suppose that an enterprise repairs two products, two models of aircraft. Four groups of production equipment (capacities of production shops) are used to repair the product. The output of one unit of product A assures the enterprise a profit of

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2,000 rubles, and one unit of product B 3,000 rubles. The operating time of each group of equipment and the labor intensiveness of manufacturing each type of product are characterized by the figures given in Table 2.

Table 2. Distribution of Product Manufacturing Among Groups of Equipment

Group of Production Equipment	Labor Intensiveness of Manufacturing Product, hrs		Operating Time of Equipment, hrs
	A	B	
I	72	72	360
II	48	96	432
III	96	0	384
IV	24	48	192

We have to prepare that variant of the solution for manufacturing the products A and B which would ensure maximum profit Z.

Denoting the amount of the products A and B manufactured as X_1 and X_2 , respectively, we can write in mathematical equations the conditions reflecting the maximum operating capacity of the equipment of each group:

$$\left. \begin{aligned} 72X_1 + 72X_2 &\leq 360; \\ 48X_1 + 96X_2 &\leq 432. \\ 96X_1 &\leq 384; \\ 24X_1 + 48X_2 &\leq 192. \end{aligned} \right\} \quad (1)$$

In real conditions the actual total time to manufacture products of both types on any group of equipment may be greater than the available operating time of that equipment. It is quite permissible, then, to write the inequality:

$$X_1 \geq 0 \quad \text{and} \quad X_2 \geq 0. \quad (2)$$

Moreover, it is natural to assume that the amount of the product manufactured (prepared) may not be a negative number. It follows from these assumptions that no variant of the decisions we make may be negative. A certain profit expressed by the inequality below corresponds to each possible solution for organizing manufacture of the products X_1 and X_2

$$2X_1 + 3X_2 \geq Z. \quad (3)$$

Thus the problem of composing a variant of the decision for organizing manufacture of the products has come down to the following linear programming problem, to maximize the linear form (1) in the context of the linear constraint (2) and (3). In any case we need to find that solution of a system of $m + n + 1$ linear equalities (1), (2), (3), at which the linear form (3) takes the greatest value. Here m is the number of groups of equipment; n —the number of different products being manufactured.

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In our example the greatest possible profit is

$$Z = 288,000 \text{ rubles.}$$

In general form the mathematical model of the problem for optimizing management solutions aimed at improving utilization of production capacities can be formulated as follows. Let us assume that the enterprise or shop repairing (manufacturing) n products has m groups of manufacturing equipment. We know the standard times for repairing (manufacturing) each product on each group of processing equipment and the available operating time of each group of equipment. Assume that we also know that of all n products to be repaired l products are in the greatest demand. We need to make a decision (compile a plan) whereby the output of the product in demand will be as large as possible. We adopt the following notation: i --number designating the group of equipment: $k = 1, n$; j --number designating the product: $j = 1, n$; a_{ij} --standard repair time of the j -th product on the i -th group of equipment; b_i --actual time available for operation of the i -th group of equipment; X_j --planned number of units of the j -th product in the variant of the decision we are seeking.

The time required to repair all X_1, X_2, \dots, X_n products on the i -th group of equipment will be equal to the sum

$$a_{i1} X_1 + a_{i2} X_2 + \dots + a_{in} X_n,$$

which must not exceed the available operating time of the i -th group of equipment, i.e., must be $\leq b_i$. Having composed analogous conditions for all the groups of equipment, we obtain a system of linear inequalities:

$$\left. \begin{aligned} a_{11} X_1 + a_{12} X_2 + \dots + a_{1n} X_n &\leq b_{1i} \\ a_{21} X_1 + a_{22} X_2 + \dots + a_{2n} X_n &\leq b_{2i} \\ a_{m1} X_1 + a_{m2} X_2 + \dots + a_{mn} X_n &\leq b_{mi} \end{aligned} \right\} \quad (4)$$

We take into account that in compiling a repair program one usually knows the need for each product. If q_j is the required number of units of the j -th product, then this requirement is written in the form of a system of inequalities:

$$\left. \begin{aligned} X_1 &\geq q_{1i} \\ X_2 &\geq q_{2i} \\ &\vdots \\ X_n &\geq q_{ni} \end{aligned} \right\} \quad (5)$$

If we denote the products in the greatest demand by the numbers j_1, j_2, \dots, j_n , the total number of the product can be expressed by the sum

$$f = X_{j_1} + X_{j_2} + \dots = X_{j_n}. \quad (6)$$

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Our objective is to compile a production program so that the sum (6) has the greatest value while fulfilling all other conditions. Then we need to solve the system of linear inequalities (4), (5) and (6) and to find that variant at which expression (6) will have the greatest value. We should note that in planning output in money terms an analogous problem arises, but one in which an additional condition is taken into account, a condition written in this form

$$P_1 X_1 + P_2 X_2 + \dots + P_n X_n \geq B, \quad (7)$$

in which P_j is the wholesale price of the j -th product; $j = \overline{1, n}$ is the product.

Ultimately we find the solution to the systems of linear equations (4), (5) and (7) at which the linear form (6) takes its greatest value.

In the practical operation of the operations enterprises of civil aviation one must frequently solve the problem of optimizing the volume of traffic and operating costs, or, as it is referred to, the transportation problem. From the standpoint of its mathematical description it differs little from the linear programming problem examined above. In essence the transportation problem is a special linear programming problem.

By contrast with optimization of solutions described by linear expressions, the problems of nonlinear programming contain objective functions and a system of constraints written in nonlinear expressions. In this case the general variant of the management decision can be formulated as a problem of minimizing the function

$$f(X_1, X_2, \dots, X_n) \quad (8)$$

under the conditions:

$$\left. \begin{aligned} \varphi_1(X_1, X_2, \dots, X_n) &\leq 0; \\ \varphi_2(X_1, X_2, \dots, X_n) &\leq 0; \\ \varphi_m(X_1, X_2, \dots, X_n) &\leq 0. \end{aligned} \right\} \quad (9)$$

and $X_j \geq 0; j = \overline{1, n}$.

As in linear programming any nonnegative solution of the system of inequalities (9) will be a permissible variant of the solution, but the optimum variant will be when the objective function (8) assumes its minimum possible value.

In various aspects of the practical activity of bodies for management of enterprises it is frequently advisable not to make management decisions immediately, but to make them gradually, step by step. Multistep solutions of this kind can be optimized using the method of dynamic programming.

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One of the typical problems of dynamic programming which has come into use in air transport is the problem of resource allocation, and it is that we shall take up.

There is a given amount of resources X which we must allocate between two enterprises. The amount of Y invested in the first enterprise makes it possible to obtain the income $A(Y)$ in 1 year (or some other period of time), and at the same time the capital invested decreases by the end of the year to the quantity $C(Y)$. Correspondingly, the share of $X - Y$ invested in the second enterprise yields the income $B(X - Y)$ and decreases the value $D(X - Y)$. At the end of every year the remaining capital is again allocated between the enterprises. There is no new capital coming in. We need to find the solution whereby the greatest total income over the period N years is obtained in each stage through appropriate allocation of the resources.

The process of optimizing the management decision consists of the following. In the first stage (year) the initial amount of resources X is divided into Y and $(X - Y)$, and the income is computed

$$A(Y) + B(X - Y).$$

In accordance with the principle of optimality,* whatever the first allocation Y , in the remaining $N - 1$ stages the remainder of capital

$$C(Y) + D(X - Y)$$

must be put to the best use, and over $N - 1$ year income will be

$$F_{N-1}[C(Y) + D(X - Y)].$$

Then the income over the N years from the initial allocation of resources can be expressed by the sum

$$A(Y) + B(X - Y) + F_{N-1}[C(Y) + D(X - Y)].$$

We still have to select the allocation Y , which may vary from zero to X so that this sum takes its greatest value. Thus we get the functional equation

$$F_N(X) = \max \{A(Y) + B(X - Y) + F_{N-1}[C(Y) + D(X - Y)]\} \quad \text{for } N = 2, 3, \dots \\ \text{years.}$$

We will clarify these principles of the method of dynamic programming with a practical example. We need to find the optimum variant of a decision on

* Optimum behavior has the characteristic that whatever the original state and solution at the initial moment, the subsequent solution must be optimum with respect to the results of the decision.

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allocation of X resources between two enterprises of an association over 3 years ($N = 3$). The initial data are these:

$$A(Y) = 0,8Y; B(X - Y) = 0,5(X - Y); C(Y) = 0,3Y;$$

$$D(X - Y) = 0,6(X - Y).$$

At the outset of the process we have X resources. In the first stage a certain allocation Y determines the income $A(Y) + B(X - Y)$ and the amount of resources $X_1 = C(Y) + D(X - Y)$ at the beginning of the second year. The resources X_1 are again allocated, i.e., divided into the parts Y_1 and $X_1 - Y_1$, which determines the income $A(Y_1) + B(X_1 - Y_1)$ for the second year and the amount of resources $X_2 = C(Y_1) + D(X_1 - Y_1)$. At the beginning of the third year the amount X_2 is again divided into Y_2 and $X_2 - Y_2$ and we get the income $A(Y_2) + B(X_2 - Y_2)$ for the third year. We need to indicate the optimum decisionmaking strategy for the successive allocation Y, Y_1 , Y_2 that brings about the best result.

The process of dynamic programming unfolds from the end toward the beginning, i.e., we first find the choice Y_2 , and then Y_1 and thereafter Y.

In accordance with the principle of optimality, whatever decisions are made with respect to Y and Y_1 in the first two stages, and whatever amount of resources X_2 is obtained as a consequence by the beginning of the third stage, we must use them in the best way and obtain the largest possible income for the last year:

$$F_1(X_2) = \max\{A(Y_2) + B(X_2 - Y_2)\} \quad \text{when } 0 \leq Y_2 \leq X_2 \quad \text{or}$$

$$F_1(X_2) = \max\{0,8Y_2 + 0,5(X_2 - Y_2)\} = \max\{0,5X_2 + 0,3Y_2\} \quad \text{when } 0 \leq Y_2 \leq X_2.$$

The expression in braces attains its maximum value when $Y_2 = X_2$:

$$F_1(X_2) = 0,8X_2.$$

Consequently, to obtain the maximum possible income in the last stage we must commit all resources to develop the first enterprise.

Now we will find a maximum total income for the last two stages:

$$F_2(X_1) = \max\{A(Y_1) + B(X_1 - Y_1) + F_1[C(Y_1) + D(X_1 - Y_1)]\} \quad \text{when } 0 \leq Y_1 \leq X_1; \quad \text{or}$$

$$F_2(X_1) = \max\{0,8Y_1 + 0,5(X_1 - Y_1) + F_1[0,3Y_1 + 0,6(X_1 - Y_1)]\} = \max\{0,5X_1 + 0,3Y_1 +$$

$$0,8[0,6X_1 - 0,3Y_1]\} = \max\{0,98X_1 + 0,06Y_1\} \quad \text{when } 0 \leq Y_1 \leq X_1;$$

$$F_2(X_1) = 1,04X_1 \quad \text{when } Y_1 = X_1.$$

i.e., in the next to the last stage all resources are again committed to develop the first enterprise.

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We move on to examining the first stage and we find Y so as to take into account all actions in the previous stages:

$$F_3(X) = \max \{A(Y) + B(X - Y) + F_2[C(Y) + D(X - Y)]\} = \max \{0,8Y + 0,5(X - Y) + 1,04[0,3Y + 0,6(X - Y)]\} = \max \{1,124X - 0,012Y\} \text{ when } 0 \leq Y \leq X;$$

$$F_3(X) = 1,124X.$$

In the first stage all resources are committed to development of the second enterprise.

Thus we obtain the optimum strategy for the management decision: $Y = 0$; $Y_1 = X_1$; $Y_2 = X_2$.

The resulting income will be obtained in accordance with this sequence. In the first stage all resources are committed to development of the second enterprise, and we accordingly obtain the income:

$$B(X) = 0.5X.$$

Then the remainder of resources for the beginning of the second year is

$$D(X) = 0.6X.$$

In the second stage we commit the remainder of the resources to development of the first enterprise. As a result we get the income:

$$A(0.6X) = 0.8 \cdot 0.6X + 0.42X.$$

Then the remainder of resources for the beginning of the third year is

$$C(0.6X) = 0.3 \cdot 0.6X = 0.18X.$$

In the final stage the resources remaining are committed to development of the first enterprise. Here the income is

$$A(0.18X) = 0.8 \cdot 0.18X = 0.144X.$$

As a result of the optimized solution our total income will be

$$1.124X(0.5X + 0.48X + 0.144X).$$

Table 3 surveys the entire course of the strategy governing the taking of the decisions.

At present it is unthinkable to optimize management decisions not only without extensive use of mathematical methods, but also without computer equipment.

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Table 3. Sequence for Adoption of Decisions

Stage	Resources To Be Allocated To Develop Enterprises		Income Obtained From Enterprises	Remainder of Resources
	I	II		
1	0.00	X	0.500X	0.60X
2	0.60X	0	0.480X	0.18X
3	0.18X	0	0.144X	0.00

4. Use of Computers in the Process of Managing Civil Aviation Enterprises

Along with improvement of the organizational structure of management and the use of mathematical-economic methods to optimize management decisions, the use of electronic computers is becoming more and more widespread at civil aviation enterprises. Computers are mainly used within ASU's [computerized management system or automatic control system]. For example, there were more than 40 ASU subsystems in operation in the industry by the beginning of 1975. The rate at which ASU's are being put into operation in the national economy as a whole shows a steady tendency to increase (Table 4).

Table 4. Number of ASU's by Levels of Administration of the USSR National Economy*

Type of ASU	Introduced in			
	1966-1977 Period	1966-1970 Period	1971-1975 Period	1976-1977 Period
For enterprise management	1,142	151	838	153
For process control	1,064	170	564	330
For management of regional organizations	839	61	631	147
For administration of ministries and departments	219	19	168	32
For data processing	162	13	108	41
Total	3,426	414	2,309	703

* "Narodnoye khozyaystvo SSSR za 1977 g." [The USSR National Economy in 1977], Moscow, Statistika, 1978, 100 pages.

The widespread use of computers as part of ASU's makes it possible to solve the problems of further improvement of the organization of management of the sectors of the economy more quickly and thereby to promote successful fulfillment of their planned assignments. According to data of the Central Mathematical Economics Institute of the USSR Academy of Sciences, ASU's for enterprise management raise the load coefficient and production capacity 7-8 percent, reduce time required to fill orders 25-30 percent, and the outlays involved in setting them up are returned in 2-3 years.

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The basic feature distinguishing the ASU from simple use of a computer is that it computerizes all the technological stages in the functioning of the management system (collection, transmission, processing and analysis of data) and also creates the precondition for working out the management system. In this case the management represented by a particular individual only makes the decision and delivers it to the entity being managed.

For all the diversity of the computerized management systems (Figure 23), they all must solve the problem of collecting data and then (depending on the class) process the data and issue the influences which are to be exerted for management or control.

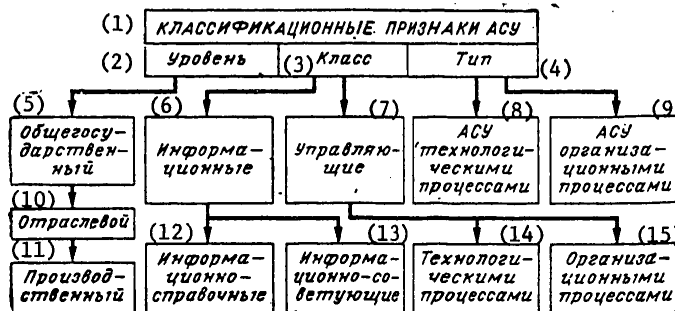


Figure 23. Classification of ASU's [computerized management system and automatic control system].

- Key:
- 1. Classification features of ASU's
 - 2. Level
 - 3. Class
 - 4. Type
 - 5. Nationwide
 - 6. Date processing
 - 7. Management
 - 8. Process control ASU's
 - 9. ASU's for organizational processes
 - 10. Sectorwide
 - 11. Within the production unit
 - 12. Data and reference
 - 13. Data and advice
 - 14. Manufacturing processes
 - 15. Organizational processes

In all stages of development of civil aviation much attention has been paid to improvement of the organization of the processes of management and control. For instance, up until the fifties the improvement of management or control took place through mechanization and automation of the influences exerted on the flow of the process being managed or controlled, and in

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subsequent years functional connections in the very system of control or management were also improved.

The further development of computer control through development of a certain sequence of actions in accordance with a given program resulted in creation of program control and the emergence of ASU's. The present stage of development of the country's unified transportation system is now typified by attempts to set up ASU's to manage and control all production and economic processes.

Depending on the extent of the problems to be solved, the industrywide ASU Aeroflot (highest level of management) and within it several computerized systems at the middle and lower levels of management are operative in civil aviation enterprises and organizations (Figure 24).

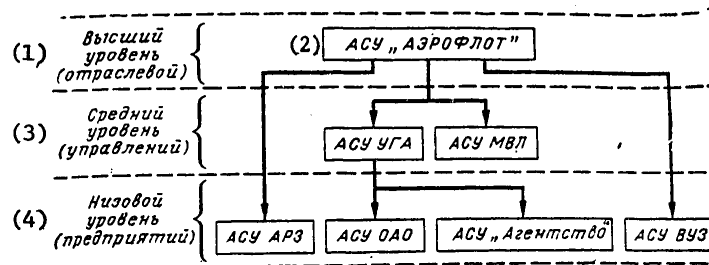


Figure 24. Structure of the ASU for civil aviation: АСУ УГА--computerized system for management of civil aviation administrations; АСУ МВЛ--computerized system for management of international air routes; АСУ АРЗ--computerized system for management of aircraft repair plant; АСУ ОАО--computerized system for management of the associated flight group; АСУ "Агентство"--computerized system for management of the air travel agency; АСУ ВУЗ--computerized system for management of the higher educational institution.

- Key:
1. Highest level (sectorwide)
 2. ASU Aeroflot
 3. Middle level (administrations)
 4. Lower level (enterprises)

The three-level structure of ASU's being developed in civil aviation reflect the three-tier system of management of the industry: the ministry--the civil aviation administration--and the enterprise.

The ASU Aeroflot is an integral part of the nationwide computerized management system (OGAS) and interacts in its functioning with the ASU's at the middle and lower levels of the industry. The principal purpose of setting up the ASU Aeroflot was to increase the level of efficiency of production and economic activity in the industry and to ensure flight safety.

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Along with these other problems are also solved in creating a unified complex of subsystems for multiannual and current planning, of improving comprehensive planning, of creating a single data bank for the industry, and of improving utilization of resources.

The ASU UGA [computerized system for management of civil aviation administrations] and ASU MVL [computerized system for management of international air routes] are being developed for the middle hierarchical level of management within the complex of the computerized system for management of the industry. The principal potential that exists for increasing the efficiency of activity of entities being managed at the middle level are augmentation of the volume of operations, improved use of fixed productive capital, optimum allocation of resources, and assurance of unhampered interaction among subordinate enterprises.

Introduction of the ASU UGA (in six administrations) has had a beneficial effect on the processes of operational planning and recordkeeping of the use of the airplane fleet and management of inventories of materials and equipment. Operation of the first phase of the ASU MVL has made it possible to increase the inflow of foreign exchange from the commercial activity of aircraft on international routes.

The ASU OAO [computerized system for management of the associated flight group], the ASU ARZ [computerized system for management of aircraft repair plant], ASU "Agentstvo" [computerized system for management of the air travel agency] and ASU VUZ [computerized system for management of the higher educational institution] are integral parts of the ASU at the lower level. For instance, in 1977 the ASU OAO was functioning as a part of separate subsystems at five operations enterprises. Their use contributed to a 2-percent rise in the commercial load on aircraft making flights, a 10-percent reduction of standing time on the apron, and a 30-percent reduction of takeoff delays.

Introduction of the ASU ARZ has contributed to an average 3-5-percent reduction of aircraft repair time, a 2-4-percent reduction of outlays for raw materials and supplies, and a 1-2-percent reduction of shopwide and plant-wide costs.

According to the data of the Main Air Travel Agency, where one of the systems of the ASU "Agentstvo" has been in full-scale operation since 1974, the labor productivity of cashiers has increased approximately 3 percent.

The first phase of the computerized system for management of the higher educational institution is planned for pilot operation in 1980.

The principal purpose of setting up the ASU OAO, ASU ARZ, and ASU "Agentstvo" was to increase the efficiency of production and economic activity of these enterprises thanks to improvement of the processes of management and the methods and procedures for organizing the system of information support.

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All ASU's within a particular level utilize the potential of the computers located in computer centers, which is sizable in capacity and is dispersed. This has resulted in a drop in the rate of development of such centers, whose construction and operation are not efficient for one enterprise, even the largest one. The task accordingly arose of setting up consolidated centers so that they would become a computer facility to solve the complicated economic and scientific problems of enterprises of one or several civil aviation administrations. This kind of problem has also arisen in other sectors of the economy. To be specific, such centers have already been set up in air transportation and are referred to as cluster data processing and computer centers (KIVTs).

Plans call for further development of KIVTs. Designs are being developed for KIVTs which would be used collectively, which will make it possible to make the transition to integration of the lower level ASU into a unified ASU of the civil aviation region.

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