The Role of the Psychological Factor in Increasing Production Efficiency in the Rocket and Space Industry

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Abstract. The article is devoted to improving the quality of the medium-range rocket and spacecraft manufactured by the «Joint Stock Company Rocket Space Centre Progress». The article reflects the results of studying the psychological and emotional profiles of the working staff for the assembly of rocket and spacecraft for remote sensing of the Earth, and its impact on the efficiency of the labor process. It has been established that an increased level of internal stress, unresolved internal conflicts in labor collectives, low communicative control and low stress tolerance among employees can lead to low performance. The recommendations proposed by the authors will stabilize the psychological status of employees.

1. Introduction
In our country the implementation of State policy in the field of space activities, including joint international programs and projects is carried out by the State Space Corporation "Roskosmos" which primary function is to ensure the coherence of the whole rocket and space industry.

At present the Corporation consists of 75 different organizations which include enterprises, agencies as well as joint stock companies of the «State Space Corporation Roskosmos» and their subsidiary companies [1].

In recent years, Russia has lost its primacy in the exercise of commercial launches. This fact has both external and internal causes such as the starts delay because of the need to eliminate defects in the production [2].

Despite the loss of leading positions in business, we continue to place great emphasis on the orders of the Defense Ministry and the needs of the national economy. In order to achieve not only the socio-economic but also scientific goals using communication satellites based on remote Earth sensing technology which development and improvement is of great importance currently. Satellites are also used for the prevention of emergency situations and liquidation of their effects [3].

2. Objectives and tasks of analysis
The object of the research is the process of managing the joint-stock company «Space Rocket Centre Progress» (JSC «SRC Progress»).
The subject of the study is the psychological profile of the shop employees who build satellites, reflecting the psychological component of the management process of the JSC «SRC Progress».

The research objectives that are to solve for creating psychological profile of the shop employees who build satellites are:

- to determine how far the shop employees control their emotions in the process of communication;
- to identify what mechanisms of psychological protection the employees use in order to reduce internal stress;
- to determine the level of employees’ stress tolerance;
- to determine the duration of their experiences in a stressful situation.

3. Fundamental research

Nowadays the demand for space communications [4–5], navigation [6], data transmission [7–8], broadcasting [9], Earth [10–11] and atmosphere observation [12] is constantly growing, in this regard, reusable launch vehicles and their production are of particular interest [13].

The manufacture of the space crafts for remote Earth’s sensing is carried out on the basis of the JSC «SRC Progress». They include the space crafts «Resource-P» and «Resource-P» № 2, the first of which is intended for observations of the Earth’s surface and transmitting received data via radio channel to the ground complex for planning, receiving, processing and distribution of information, and the second is for fine-grained, detailed widespread and hyper spectral optical-electronic observation [13–16] of the Earth's surface and the registration of high-energy cosmic rays in the energy range from 1012 to 1015 EV, which is carried out with the scientific equipment complex «NUCLON».

The data space system has been put into operation since November 10, 2015.

The competition in the field of artificial satellites launches is high enough. Currently, 55 countries have already launched satellites and 21 countries have it in their plans, so the product quality is of particular importance. Success in this endeavor depends largely on the effectiveness of the management process in this area. As it turned out, rationalism in managing, with all its virtues, is not the only and, in many cases, not the best way to improve the effectiveness of organizations and leaders. Usage of modern innovative technologies in the production has led to some complication of management science and contributed to dynamic use of system approach in the management [14] which allows managers to see the entire organization as a unity and interrelation of its constituent parts, one of which is the human factor in the organization of the management process. The effectiveness of employment depends largely on the professional qualifications of employees, as well as their resilience and socio-psychological adaptation to production conditions.

In recent years there has been a significant evolution of the concept of social and psychological adaptation. If earlier it meant a passive device, now they consider the system construction of productive interaction of personality and milieu (K.A. Abulhanova-Slavskaya, B.D. Parygin, A.A. Rean, A.A. Nachaldzhian). This position is associated with the shift from a biological and physiological adaptation to a mental and social one. Health maintaining and sense of well-being is possible only with sufficient adaptation to social and natural environment, however, for successful adaptation passive acceptance of value orientations is not enough, it involves an active personal self-modification (the mechanism of subjective activities aimed at individual's adaptation to different norms, standards, rates) [15]. The essence of the adaptation process is that a body comes to inner balance and equilibrium with milieu through disorder again. Psychological adaptation mechanisms underlie individual types of respond to balance violation in the system “human-milieu”, there is strengthening or weakening of those or other personality traits and behavioral reactions. The normal functioning of an individual always presupposes the harmonization of external and internal. J Piaget pointed out that mental development occurs during the process of balancing the organism and milieu [16].

A. Adler allocates types on the basis of how a person solves three major problems (job, friendship, love). The classification is based on the principle of two-dimensional scheme where one dimension is
represented by «social interest» and the other – by «activity level». In his opinion, life style develops spontaneously as a result of the interaction of individual characteristics and social conditions of human life. To achieve mental health is to adjust internal stress and simultaneously the relationship with the world [17].

There are some interaction situations of milieu and a person:

The first situation. Milieu prevails over the capacity of the organism and its adaptive action is little effective, though it is fraught with maximum costs. Behavior is colored energized and excited [18]. According to A. Adler, this corresponds to the taking type who perceives the world around us as an aggressor. These people have not developed nor desire for supremacy, neither social interest. Such people work without initiative and aim minimizing all their efforts.

The second situation. The superiority of the organism on milieu. Human behavior flows without any internal delay and implements optimal adaptation with the smallest amount of energy and strength, emotional background in this scenario is positive. According to A. Adler, this corresponds to the ruling type. These people have aspiration to excellence, but social interest is negligible. They aim dominating while manipulating other people. They do not learn to be stronger, more adequate but they learn to appear stronger in their own eyes.

The third situation. It is when in some situations the organism succumbs to milieu and in some others prevails over it. These people do not have developed pursuit of excellence, but they have developed social interest. Such people do not develop their abilities, do not compensate for their weaknesses and therefore their attempt to do something good for people can turn in evil.

And the fourth situation is homeostatic (balanced relationship of the organism and milieu accompanied by emotionally neutral behavior. These are people with high desire for excellence and developed social interest. They successfully cope with all three tasks of life.

Summing up, it may be noted that every time the emotion being the result of one of the above named relations with milieu defines the subsequent forms of human behavior [19].

For verification how far at the management of the JSC «SRC Progress» the psychological component is taken into account we undertook the study of psychological profile of workshop employees who makes satellites.

In the research 39 employees of JSC «SRC Progress», working in the workshop on assembling satellites. In this workshop employees use nanotechnologies, there is an automatic transfer line of soldering and welding, the production conditions are modern and very comfortable.

For the creation of psychological profile of employees we used such methodologies as:
- methodology of self-control estimation in communication (M Snider’s test);
- questionnaire of Plutchik-Kellerman-Conte by means of that we studied the mechanisms of psychological defense;
- test «Analysis of lifestyle» (Bostonian test on stress tolerance);
- test for determination of experience duration in a stress situation.

M Snider’s test (methodology of self-control estimation in communication) gave such results:
- 8 employees have got subzero communicative control (they differ in straightness, conservatism and absence of flexibility);
- 61,5% employees (24 persons) have got middle communicative control (they are sincere, but oriented on surrounding people, do not restrain their emotions);
- 7 employees only have got high communicative control (they easily play any role, flexibly react on the change of the situation, can even foresee the impression that is produced on surrounding people).

Plutchik-Kellerman-Conte’s questionnaire (Index of vital style) allows to identify the employees’ mechanisms of psychological defense. Psychological defense is the system of mechanisms by means of that a man aims to get rid (or to take to the minimum) negative, injuring the personality experience (that roots in internal or external conflicts), causing the state of anxiety and discomfort [20].

The mechanisms of psychological defense protect the human mind from painful feelings and remembrances due to the change (overvalue) of the factors that are perceived as a threat as well as
own negative traits and values. The aim is to bring down anxiety (psychic discomfort) or to promote self-appraisal on the basis of distortion of selection process and transformation of information [21]. These mechanisms allow to a person to save the idea about himself and about surrounding world.

The questionnaire allows to identify eight base defenses: expulsing, regression, substitution, denial, projection, compensation, overcompensation (reactive formations), rationalization which use testifies to the presence of internal conflict.

In this methodology such two concepts (of the mechanism of psychological defense) as rationalization and intellectualization are incorporated although they differ from each other. Intellectualization is a mechanism when experience caused by an unpleasant or subjectively unacceptable situation is transformed by means of logical options and manipulations (even in case when there are proofs of reverse). And in case of rationalization there is an attempt to bring down the value of inaccessible for personal experience (when somebody justifies his failure in front of others or himself) [22].

During rationalization a person creates logical (pseudo reasonable), but plausible justifications for his or one’s behavior, actions or experience caused by reasons that this person cannot confess because of threat to lose his self-esteem.

In the scale of «rationalization» sublimation as the mechanism of psychological defense was also included when forced out desires and feelings are hypertrophied compensated by other ones corresponding to higher social values which are confessed by the person. General for all those mechanisms of psychological defense is that a person tries either to bring down importance or to escape or to explain why it is so thus reducing intensity of experience.

It is necessary to add that psychological defense can be both successful and failure. In first case, impulses and impact of those factors that have caused a conflict, the state of anxiety, fear and neurosis disappear. When psychological defense is not successful nothing of the kind takes place.

Due to this methodology we got such results (figure 1) if general tension of all defenses exceeds the threshold in 30%, it testifies to the presence of internal stress, in case of 40%, it testifies to the presence of unsolved external and internal conflicts.

![Figure 1](image-url)
The 38% respondents have high level of internal tension, and 18% have psychological, emotional problems that in turn can affect general condition of a worker and also his work or quality of performance of his objective.

Due to the test «Analysis of lifestyle» [23, 24] we have had such results: only 10% respondents are marked with high level of stress resistance (to 10 points); stress situations greatly influence 23% employees (environment prevails above possibilities of organism); for the other 67% stress corresponds to the extent tense life of an active person.

The results got by means of Test for determination of experience duration in a stress situation (figure 2) are: only one person of failure and misses are in-process caused sense of extreme vexation, however he can do simultaneously a few businesses without special tension and prefers work requiring large exactness of motions, that answers requirements, efficiency of activity in the workshop that produces satellites.

![Figure 2. The results got by means of Test for determination of experience duration in a stress situation.](image)

For 33% respondents failures, quarrels and conflicts, experience badly, but after some time restored and able with new forces to begin work. At this category good adaptability is to that, how other work, however they need frequent changing character of work, that in case of work on a conveyer at assembling of companions that differs in monotonous character can result in the increase of internal tension and origin of sense of tiredness and formal attitude to work.

62% employees in spite of visible good bearableness of stress sharply react at experiencing of failure, however due to the analysis of situation there is adaptation to the new terms, therefore they find the necessary decision at the unexpected change of situation at once.

4. Aspects of rational material choice

The research results showed that most employees of the workshop did not restrain the emotions, but are oriented on surrounding people, and approximately 21% respondents differ in straightness, conservatism and absence of flexibility, and 17,5% flexibly react on the change of situation and easily play any role.

For 38% respondents the high level of internal tension is marked and 18% have psychological, emotional problems.

For 23% employees the low level of stress resistance is marked, though 33% respondents dispose quickly to forgive, but they experience failures, quarrels and conflicts badly, therefore they need frequent changing character of work.
5. Conclusion
Thus, it is possible to conclude that workshop staff that produces satellites is effective enough in realization of its activity. However, in stress situations there can be failures in-process because the high level of internal tension and unsolved internal conflicts in the situations related to the strained work at the shortage of time can result in off-grade implementation of the duties that will influence general results.

Subzero communicative control and bad stress bearableness for some employees in this situation also can negatively effect on the results of productive activity.

For warning of possible failures in the production it is necessary to conduct a rotary of the staff working on certain operations that will promote labor productivity, provide interchangeability and bring down the stress loading by decision of productive tasks which have high degree of tension.

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