Estimation of Efficiency of Metrological Support Management for Weapon Samples and Military Equipment

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***Abstract* — The method for estimation of efficiency of metrological maintenance management of weapon samples and military equipment of military units (sections) is offered, based on the comparison of the number of maintained weapons and military equipment, taking into consideration their importance, state and intensity of using with time and cost resources spending.**

***Index Terms* — armament and military technics, metrological support, estimation of efficiency**

I. INTRODUCTION

RESEARCH objective. One of the most important components of weapons and military equipment (WME) samples technical support of the Armed Forces of Ukraine is metrological one. We can not underestimate the role and significance of the metrological support of the troops (forces) in solving the tasks of maintenance the WME in readiness for use, under condition of providing high-degree alert of troops (forces) due to increasing of quality indicators of weapons and military equipment samples and combat training of the personnel assets.

Regional metrological military units and apparent laboratories carry out metrological maintenance of troops in places of their permanent dispositions using outgoing metrological groups (OMG) from the staff of regional metrological military units or military metrological laboratories of the Armed Forces of Ukraine [1].

Since existing methods of metrological maintenance planning for WME samples provided by mobile metrological teams don't fully meet requirements of metrological support and ongoing repair, it is necessary to have a method for estimation of efficiency for this kind of works.

Issues of mobile laboratory of measuring equipment using as a component of OMG are presented in works [2-4]. Articles [5-8] propose mathematical models and methods for solving the problems of determining the optimal distribution plan and optimal routes of the OMG transportation according to the criteria of the minimum total time or the total cost of metrological maintenance of WME samples by specialized or general OMG.

At the same time, there is no method for estimation of efficiency of the metrological maintenance of WME samples of military units (sections).

Purpose of the article is to justify the method for estimation of efficiency of metrological support management of weapons and military equipment samples of military units (sections), based on the comparison of the number of maintained weapons and military equipment, taking into consideration their importance, state and intensity of using with time and cost resources spending.

Manuscript received November 8, 2016.
Yu.I. Sheviakov is with Kharkiv National Air Force University named after Ivan Kozhedub, Kharkiv.

II. MAIN PART

In accordance with the systemic approach, the efficiency of any operation is characterized by two main indicators, which are related to the final result of the operation and the resources spending for its implementation [9-11].

These indicators allow to determine performance indicator of the operation. In [8] author proposed to use time of metrological maintenance and spending for OMG transportation to estimate the efficiency of metrological suppot management in case when we can neglect number of implemented orders and importance of WME samples. And he also proposed to find performance indicator in the form of intersection of relative meaning of spending time to the relative decreasing of the path length in comparison with the maximum possible length of the routes, which corresponds to the radial variant of transportation:

$$\text{ПЕ} = \frac{\frac{1}{K}}{\frac{T_{MO}}{T_{\Sigma}}} \cdot \frac{l_{\max} - l_{nep}}{l_{\max}}, \qquad (1)$$

where T_{MM} – time spending for metrological maintenance of WME samples in case of simultaneous execution of work by several OMG; T_{Σ} – total time spending for metrological maintenance, which are equal to time spending on metrological maintenance of WME samples in the case of successive work without taking into account the possibility of simultaneous execution by several VMG; l_{max} – maximum length of all OMG transpositions that corresponds to the possibility of service each military unit (section) with the obligatory return to the place of OMG disposition; l_{nep} – the length of the transportation of all OMG according to the selected routes; K – number OMG.

At the same time, the given efficiency indicator completely doesn't take into account both the achieved effect of the operation and the total cost of metrological maintenance. It is usually to think that the effect of metrological maintenance management of WME samples is determined by their number, taking into account their importance and the state of metrological support. In addition, the effect of the operation can be achieved through greater or lesser resources spending. That's why it is more appropriate to characterize the management efficiency indicator of metrological support of armament by comparing the number of maintained WME, taking into account their importance and level of their metrological support with time and cost resources spending. Moreover, we will consider cost of resources as relative values, because usually they have quite bigger meaning in comparison with the number of maintained WME samples. Thus, the management efficiency indicator of metrological support of armament is proposed to determine as the ratio of the number of maintained WME samples, taking into account their importance, and the level of their metrological support to the intersection of relative time spending for the metrological maintenance of WME samples to the relative total cost spendings:

$$E = \frac{E1}{E2 \cdot E3}, \qquad (2)$$

where *E1* – number of maintained, according the plan, WME samples with estimation of their metrological support condition no less than "satisfactory" and taking into account their importance; *E2* – value, which characterizes the relative time spending for the metrological maintenance of WME samples; *E3* – value, which characterizes relative total cost spending for metrological maintenance according the plan.

That's why indicator *E1* is determined by the ratio

$$\mathrm{E1} = \sum_{u=1}^{|U|} w_u x_u, \qquad (3)$$

where U – multiplier of kind of WME samples; $w_u; \mathrm{u}=\overline{1,|U|}$ – coefficient of WME sample importance of u – type; $x_u; u=\overline{1,|U|}$ – number of served WME samples of u – type in region with estimation of their metrological support condition no less than "satisfactory".

Indicator E2 is:

$$\mathrm{E2} = \frac{T_{MO}}{T_0}.$$

Indicator E3 is determined by the ratio:

$$\mathrm{E3} = \frac{C_{заг}}{C_0},$$

where C_0 – total given funds for metrological support of WME samples and transposition of OMG; C_t – total cost spending for WME works.

Thus, the management efficiency indicator of metrological support is:

$$\mathrm{E} = \frac{\sum_{u=1}^{|U|} w_u x_u}{\frac{T_{MO}}{T_0} \cdot \frac{C_{заг}}{C_0}}. \qquad (4)$$

III. Conclusion

1. The article proposes the method for estimation of efficiency of metrological support management of WME samples.

2. The indicator of efficiency of metrological support management for WME samples is proposed, based on the comparison of the number of maintained weapons and military equipment, taking into consideration their importance, state and intensity of using with time and cost resources spending.

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