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DETERMINATION OF THE OPTIMAL TECHNICAL SERVICING PERIODICITY OF SAMPLES OF AERODROME CONSTRUCTION EQUIPMENT

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The method for determining the optimal frequency of maintenance of individual samples of aerodrome construction equipment, which is operated outside the established resource, is presented. The developed methodology takes into account the frequency and duration of maintenance, routine maintenance, the reliability of equipment control, the probability of receiving signals about a failure, and the duration of the complete restoration of the product.

Also, the analytical dependence of the unit costs per hour of stay of a sample of aerodrome construction equipment in good condition on the scale factor and the shape of the diffusion-monotonic distribution law of random variables has been established, in turn, makes it possible to develop a methodology for assessing the technical and economic efficiency of the operation of aerodrome construction equipment.

Keywords: aerodrome alarm technology, the system of technical service, diffusion-monotonous law of distribution, optimal periodicity of technical services.

Introduction. Analysis of the operation of aerodrome construction equipment (ACE) in terms of performing various tasks related to the construction or restoration of destroyed airfields of the State Aviation of Ukraine (SAU) shows that the increase in the intensity of its use has led to an increase in the number of failures. A significant proportion of failures are due to non-compliance with the rules of retention of ACE samples in storage, incomplete implementation of the entire list and scope of work on their maintenance during removal from storage, as well as non-compliance with the rules of operation during its use.

In this paper, we will analyze the operation of ACE, which is used mainly for the construction of new and reconstruction of destroyed airfields in the Armed Forces of Ukraine, so the maintenance system (MS)will be considered the one adopted by the Armed Forces. Namely, planned and preventative maintenance system (PMS). Guiding documents governing the timing of regular maintenance operation on the base chassis set the following frequency: MO-1 – 1200-1600 km, MO-2 – 6000-8000 km, as well as periodic technical servicing (PTS) on special equipment (PTS-1 – 50 mh, and PTS-2 – 200 mh) At the same time, this frequency is recommended for all brands of cars.

The existing maintenance system does not fully ensure the implementation of the tasks assigned to it to maintain the ACE samples in a good condition. This issue is explained by the fact that the adopted planning and preventative strategy of ACE maintenance are designed mainly to maintain in working condition samples that are in operation for no more than the period specified by the manufacturers 18 – 20 years.

That is why, in the current difficult conditions of ensuring the operational readiness of the aerodromes of SAU, especially in the East of Ukraine, when the readiness of the airfield determines the crucial role of maintaining its troops in the Joint Forces operation. ACE operated for more than 20 years and finding ways to improve its efficiency.

One of the promising ways to increase the efficiency of ACE operation, which is in the maximum allowable operating condition, is to determine the required for each type of ACE frequency of its technical servicing.

The existing scientific and methodological apparatus for determining the frequency and scope of maintenance work does not take into account the impact of operating time and service life on the technical condition of ACE samples, so it is difficult to determine the optimal frequency and scope of maintenance for samples that are in operation more 20 years.

Analysis of the existing scientific and methodological apparatus for determining the frequency and scope of maintenance showed that improving the efficiency of ACE can be determined only in the presence of an adequate mathematical model of its operation, which will take into consideration both scheduled maintenance and periodic technical servicing.

When building a mathematical model of ACE operation, the physical nature of the object of operation must be taken into account. According to the failure model, modern foreign and domestic standards recommend the use of logarithmic-normal distribution law, Weibull distribution law, and diffusion-monotone (DM) distribution. The most promising of these laws is the DM-distribution as the most adequate description of the actual process of operation of mechanical products, which are the moving samples of ACE, but also the least used, primarily due to the complexity of the mathematical description.

Thus, today it is important to establish the optimal frequency of maintenance of individual samples of ACE, which is operated outside the installed resource, which, in turn, will increase the efficiency of its operation.

1. Methods for determining the optimal frequency of maintenance for a particular sample of ACE. Maintenance of samples in working order is carried out by carrying out maintenance work on the componentsand aggregates of the base chassis and periodic technical servicing on special ACE units. The proposed method is based on the optimization of the criterion of operational efficiency, namely the coefficient of technical use of $K_{тв}$ on the indicator – the specific cost of one hour of the sample in working condition C_{1num} at specific times of maintenance.

The initial data for calculations is:

– the scale parameter μ, which coincides for the DM-distribution with the statistics on the failure time of a particular sample;

– the parameter of the form v (for DM-distribution almost coincides with the coefficient of variation of the failure distribution);

– the intensity of false alarm signals λ;

– the intensity of the failure that occurred $\lambda_{ПР}$;

– duration of control by external tools of control $t_{ПР}$;

– period of periodic technical servicing T;

– duration of control by built-in tools of control $t_{П}^{*}$;

– duration of preventative maintenance t_P;

– recovery time in case of its failure t_B;

– reliability of control by external control systems$d_{НГ}$;

– reliability of correct definition of a faulty condition by the built-in tools of control $d_{НГ}^{*}$;

– reliability of correct definition of a serviceable condition by the built-in tools of control $d_Г$;

– the probability of receiving a signal about the failure of the object of control from the built-in control system ρ.

The technique can be used to determine the probability of failure-free operation, both samples of ACE and other types of automotive equipment if you know the value of the parameter of the flow of failures.

The main task of the method of determining the optimal frequency of maintenance for a particular sample of ACE is to ensure the maintenance of the coefficient of technical use at the maximum level in the process of using them for their intended purpose with minimal human and material resources. The method is intended for samples that are in operation beyond the deadlines set by the manufacturers, i.e., more than 20 years.

Determining the frequency of preventative work to prevent failures is based on the analysis of the dependence of the coefficient of technical use on changes in operating parameters.Such as the reliability of the built-in tools of monitoring the technical condition, the duration of the complete recovery of the failed sample, and the probability of a signal from the built-in control system of the failure of the sample ACE.Values of operating time, which correspond to the optimal periodicity of planned preventative measures, are set by the maximum level of the coefficient of technical use $K_{тв}$.

The minimum allowable level of $K_{тв}$ in determining the timing of planned preventative measures is set in the range of 0.8-0.75.

This level of $K_{тв}$ provides prevention of 75-80% of possible failures, and 20-25% of failures are eliminated as needed.

It is known that the performance of regular maintenance work on ACE samples increases the probability of their trouble-free operation. However, when applying the maintenance strategy according to the technical condition, it is proposed to carry out maintenance, in contrast to the planned and preventative strategy, not according to rigidly established deadlines for all equipment, but taking into account individual performance indicators of a particular sample. The value of the numerical value, which increases the probability of failure-free operation after maintenance work, depends on the type of maintenance. It is known that for samples that are in operation for up to 10 years, the performance of numbered technical servicing provides a certain probability of their trouble-free operation before the next numbered technical servicing.For specimens that have been in operation for more than 10 years, a certain number of ongoing repairs must be performed to maintain their serviceability between regular maintenance. The number of current repairs depends on the operating time and service life of the samples, and before performing maintenance work it is necessary to eliminate the identified deficiencies in the technical condition. The scope of work to eliminate the identified shortcomings also depends on the operating time and service life of the samples.

Based on the calculated values of the coefficient of technical use, a graph of $K_{тв}$ dependence on the frequency of maintenance and periodic technical servicing is built.

The design of the point of intersection of the curve of change of the coefficient of technical use with the line of the allowable value of $K_{тв}$ on the axis of the periodicity of maintenance shows the optimal frequency of planned preventative measures to improve the trouble-free operation of the ACE sample.

Analysis of the dependence of $K_{тв}$ on the frequency of maintenance and periodic technical servicingshowed that the permissible level of $K_{тв}$ does not coincide with the established frequency of maintenance for ACE that is in operation.

However, when analyzing the dependence of the unit cost of one hour of the sample in working order on the frequency of maintenance, it was found that with increasing frequency, its growth is observed. With the help of the method, it is possible to determine the timing of maintenance when achieving the minimum unit cost of maintaining the sample ACE in working order.

The decrease in the probability of failure-free operation of ACE samples is due to an increase in the specific number of failures with an increase in their service life.

The proposed method of determining the optimal periodicity of ACE maintenance is based on the following task: to ensure a trouble-free operation of the ACE sample within certain limits during a certain period of time by timely detection of the pre-failure condition of systems, components and aggregates of ACE, and preventative work to eliminate identified shortcomings.

The essence of the proposed method is to predict the probability and failure of ACE and on the basis of the results of the adoption and decision to take measures to maintain them in working order.

Prediction of the probability of failure-free operation of ACE is achieved by the fact that based on the analysis of the results of calculations obtained using known mathematical expressions, calculations of technical capabilities, which allows predicting failures in systems, components and aggregates depending on certain operating parameters.

The calculation of the specific number of failures is carried out on the basis of statistical data of failures in the operation of systems, components, and aggregates of ACE with different operating times and service life.

Maintaining ACE in working order using the proposed method shows that for some samples of ACE, the frequency of additional work and their volume will be different and does not coincide with the regulatory development of numbered periodic technical servicing.

To increase the efficiency of individual systems, components, and aggregates that have the greatest impact on increasing the specific number of failures, it is possible by timely detection of their pre-failure condition and measures to improve their efficiency.

The conducted researches, and also a practice of operation of ACE have shown that owing to operational failures the repair fund can reach 3-5% of a regular number of samples for days of intensive operation. At the same time, most of the failures are hidden (errors of the second kind) and fall on the systems and units of the engine-transmission compartment. As the experience of maintenanceunits shows, the time to find such faults can be 50-80% of the total time to eliminate them.

The conducted researches also show that at the existing time standards it is impossible to control the technical condition of ACE at all types of technical servicing due to the lack of this time. Time for maintenance will be enough only for maintenance in the amount of daily technical servicing (DTS). The impossibility of control over types of maintenance does not allow to carry out all defined operations in full and with the necessary quality.

The frequency of additional work and the amount of additional work are determined for a single sample of ACE separately, depending on the operating time and duration of its operation and the specified operating parameters. This approach ensures the maintenance of their efficiency within certain limits with minimal human and material costs.

Attempts to perform the scope of numbered technical servicing in full before or during the implementation of the tasks were not provided with sufficient time, human and material resources, led to the unreasonable replacement of elements in the nodes, and aggregates of ACE. Therefore, this technique can significantly reduce time, human and material resources in the implementation of measures to maintain ACE in working order.

1.1. Determination of component costs for the technical operation of ACE samples. For the criterion «cost – efficiency» it was necessary to establish the dependence of the cost of operation on the main parameters of the mathematical model. This dependence has the form:

$$C_i(T) = C_{ii}(T)\cdot \eta_i(T) + \sum_{j=1}^{7} P_{ij}(T)\cdot C_{ij}(T), \qquad (1)$$

$C_{ii}(T)$– the cost of the product in the state of the process of technical operation, UAH/hour.

In further calculations it is considered that the $C_{ii}(T)$ represents the purchase price of the product intended for 20 years of operation, but are in operation for 25 and more years;

$C_{ij}(T)$– the cost of the product from the condition of technical operation, UAH;

$P_{ij}(T)$ – matrix of transition probabilities of the semi-Markov process from statei to state j.

To obtain the cost of operation of ACE in real units of value, it is necessary to know both the purchase price of a new product and the cost of its operation.The greatest practical interest is the cost of keeping each of the samples of ACE in good condition. For clarity of perception of information, it is necessary to construct graphic dependences of the criterion of efficiency of operation and cost of stay of a product in a serviceable condition on the periodicity of maintenance, reliability of control by external control systems, duration of recovery in case of failure, duration of performance of preventative works (maintenance). The presence of such schedules will allow the organizers of the operation to determine: at what price the maximum value of $K_{тв}$from the specified parameters is achieved.

The technical operation of ACE is associated with certain economic costs, which depend on the intensity of their operation, the intensity of failures, frequency, and duration of routine work and maintenance, duration of repairs, quality of built-in control systems, the purchase price of these products, and more.

As a criterion for the efficiency of technical operation of these products, we will use the coefficient of technical use of $K_{тв}$.

For the ACE failure model, we will use the diffusion-monotone distribution law, which is recommended by All-Union state standard (DSTU 2862-94) for mechanical type products.

As ACE samples we will use: the KS-4561 truck crane (on the basis of the KrAZ-257 chassis), the DZ-110 (T-130) bulldozer, the motor grader

DZ-143, excavator EOV-4421 (KrAZ-255B).

Table 1 shows the operating parameters of the studied ACE.

On each of the specified samples of ACE, there are certain built-in tools of control that control the current condition of work of the car and its special equipment. Under the external tools of control are those tools of control that are involved in the conduct of periodic technical servicing and maintenance.

To calculate the technical and economic efficiency of ACE operation, we will assume that the average cost of the product in the condition h_i and exit from the condition h_i is determined by the formula (1).

Table 1

Parameters of operation of the investigated samples of ACE

№	Samples of ACE Operating parameters	KS-4561 (KrAZ-257)	DZ-110 (T-130)	DZ-143	EOV-4421 (KrAZ-255B)
1	scale parameterμ,h	230	179	759	170
2	form parameter$v$	0,5	0,5	0,5	0,5
3	intensity of false alarm signalsλ, 1/h	10^{-3}	10^{-3}	10^{-3}	10^{-3}
4	the intensity of the failure that occurred in the sample of ACE $\lambda_{ПР}$, 1/h	10^{-2}	10^{-2}	10^{-2}	10^{-2}
5	duration of control by external tools of control $t_{пр}$, h	1	1	1	1
6	period of scheduled technical servicing T, h	100	100	100	100
7	duration of control by built-in tools of control $t^*_П$, h	0,5	0,5	0,5	0,5
8	duration of preventative maintenance$t_р$, h	5	4	2	4
9	duration of recovery of sample in case of its refusal $t_в$, h	10	8	4	8
10	reliability of sample control by external control system $d_{НГ}$	0,8	0,8	0,8	0,8
11	reliability of correct definition of a faulty condition by the built-in tools of control $d_{НГ}$	0,55	0,55	0,55	0,55
12	reliability of correct definition of a serviceable condition by the built-in tools of control $d_Г$	0,7	0,7	0,7	0,7
13	the probability of receiving a signal about the failure of the object of control from the built-in control system ρ	0,7	0,7	0,7	0,7

To determine the average cost of the product in condition, it is necessary to know the recoverable amount of the sample. The recoverable amount is calculated using the formula:

$$B_B = П_B \cdot K_I, \tag{2}$$

where $П_B$– the initial cost (purchase price) of ACE before 1991, K_I– indexation coefficient, which as of January 1, 2019, was 3.4277.

The cost per unit of calendar time of the product is equal to

$$C_{ПИТ} = \frac{\sum_{i=1}^{7} C_i(T)\cdot\pi_i(T)}{\pi_i(T)\cdot\eta_i(T)}, \tag{3}$$

where $\pi_i(T)$ –the average frequency of Markov chain to hit stateh_i; $\eta_i(T)$–

the average length of stay of the product in any state h_i; $C_i(T)$– the average cost of the product and exit from the state h_i.

Next, we calculate the sample cost per unit of calendar time of ACE in good condition according to formula (3).

For clarity, these characteristics are listed in Table 2.

Table 2

Characteristics of costs and average duration of the Semi-Markov process in the state of the model

№	Samples of ACE / Cost characteristics and average length of stay semi-Markov process in the states of the model		KS-4561 (KrAZ-257)	DZ-110 (T-130)	DZ-143	EOV-4421 (KrAZ-255B)
1	Expenses for stay and exit from the state, UAH	C_1	70	136	152	26
2		C_2	19796	21324	8505	17251
3		C_3	19793	21320	8502	17251
4		C_4	65980	71069	28339	57502
5		C_5	6598	7106	2834	5750
6		C_6	6598	7106	2834	5750
7		C_7	47	92	101	18
8	The average duration of stay in the states of the semi-Markov process $\eta_{сер}$, h	$\eta_{сер1}$	94,7	93,7	95,2	93,4
9		$\eta_{сер2}$	6	5	3	5
10		$\eta_{сер3}$	2	1,8	1,4	1,8
11		$\eta_{сер4}$	10	8	4	8
12		$\eta_{сер5}$	0,5	0,5	0,5	0,5
13		$\eta_{сер6}$	0,5	0,5	0,5	0,5
14		$\eta_{сер7}$	63,2	63,2	63,2	63,2
15	Specific costs per unit of calendar time $C_{пит}$, UAH.		225	287	91	242
16	Specific cost per unit time in good condition $C_{1пит}$, UAH/h		243	318	94	270

According to formulas (1) and (3) calculations of the coefficient of technical use and specific costs for maintaining ACE in working conditions are performed.

The results of the calculations are shown in Fig. 1-5, where the axis of the ordinates on the left are the values $K_{тв}$, and on the right, the unit cost per unit time of the samples of ACE in good condition.

The abscissa axis in Fig. 1 deferred values of the frequency of periodic technical servicing, in Fig. 2 – the reliability of the control of the technical condition of ACE by external tools of control, in Fig. 3 - duration of recovery, in fig. 4 – duration of control of a technical condition of ACE by external tools of control, on fig. 5 – duration of maintenance work.

All calculations are performed at constant values of the parameters listed in Table 1, except for those that vary along the abscissa. From fig. 1 shows that for all samples of ACE there is an optimal period of maintenance work, which provides the maximum value $K_{тв}$. At the same time, there is a pattern: that the larger $\mu$the more $K_{тв}$ and less often you need to carry out maintenance work. From fig. 2 shows that with increasing $d_{нг}$ increases $K_{тв}$. From fig. 3 shows that with increasing duration of recovery $t_в$ decreases $K_{тв}$, and the unit cost per unit time of the product in good condition $t_в$ does not depend on the conditions set out in the Table 1.

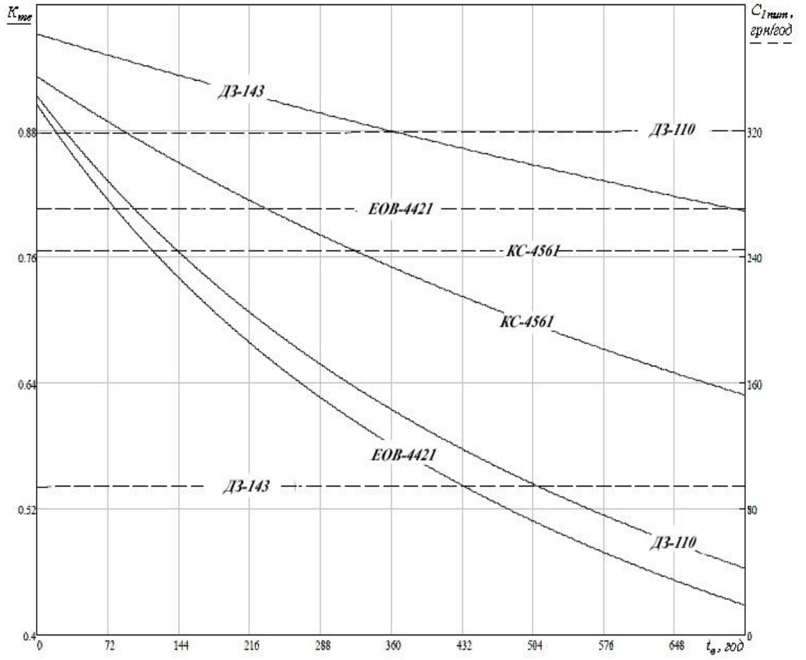

Fig. 1

From fig. 4 it is seen that the increase in the duration of preventative work t_p leads to a decrease $K_{тв}$ in the linear law, and the unit costs are almost unchanged for the conditions of table 1. The nature of such dependencies are shown in Fig. 5 is similar to the curve of Fig. 4. The unit cost per unit time of products in good condition $C_{1пит}$ varies approximately according to the law of function $y = \frac{1}{x}$. The lowest costs are observed for the product DZ-143. At $T_{опт} \approx 240$ h, the specific costs for DZ-143 are approximately 50UAH/h. For other products, the unit cost per unit time in good condition varies insignificantly.

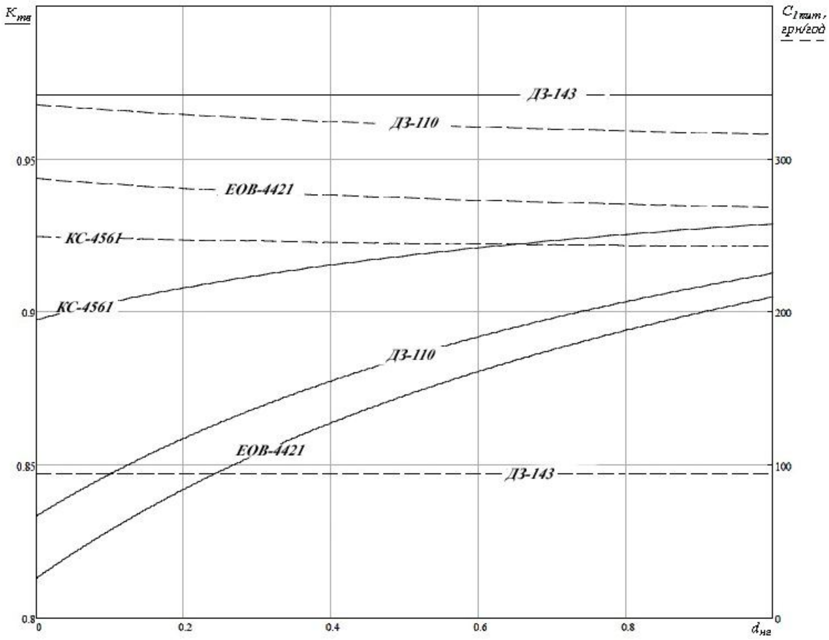
Kтв
C1 пит, грн/год
0.8
0.85
0.9
0.95
0
100
200
300
0
0.2
0.4
0.6
0.8
dнв
ДЗ-143
ДЗ-110
ЕОВ-4421
КС-4561
КС-4561
ДЗ-110
ЕОВ-4421
ДЗ-143

Fig. 2

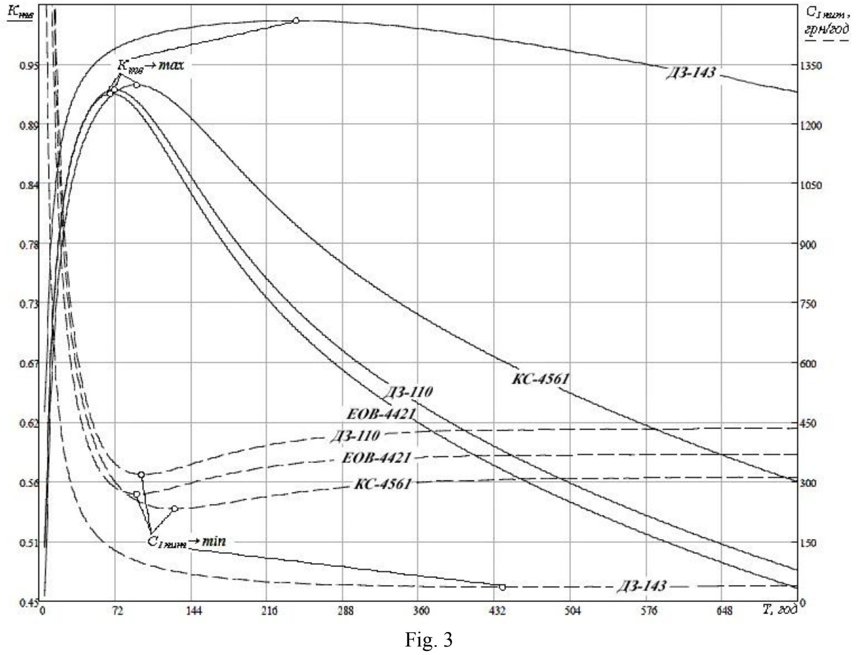
Kтв
C1 пит, грн/год
Kтв → max
0.45
0.51
0.56
0.62
0.67
0.73
0.78
0.84
0.89
0.95
0
150
300
450
600
750
900
1050
1200
1350
0
72
144
216
288
360
432
504
576
648
T, год
ДЗ-143
КС-4561
ДЗ-110
ЕОВ-4421
ДЗ-110
ЕОВ-4421
КС-4561
C1 пит → min
ДЗ-143

Fig. 3

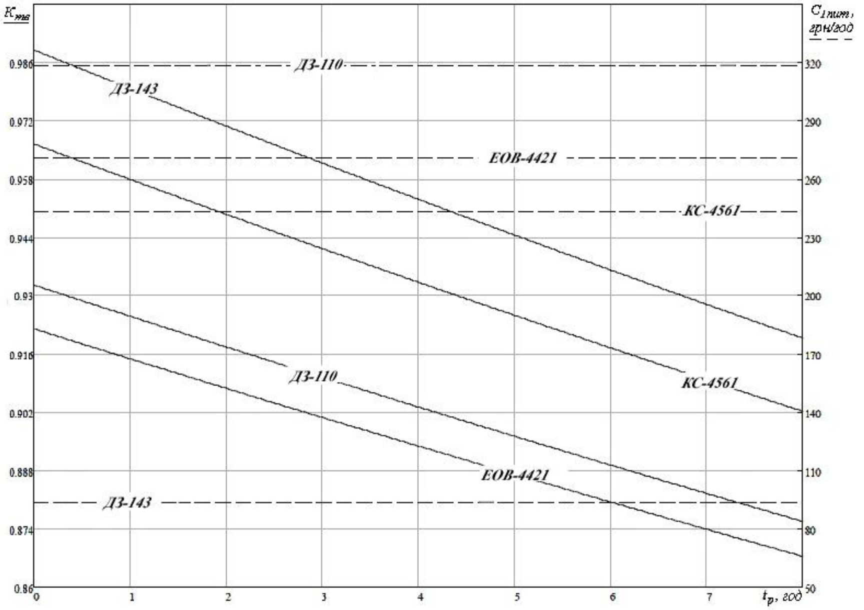
$K_{тв}$
$C_{1пит}$, грн/год
0.986
0.972
0.958
0.944
0.93
0.916
0.902
0.888
0.874
0.86
320
290
260
230
200
170
140
110
80
50
0
1
2
3
4
5
6
7
t_p, год
Д3-110
Д3-143
ЕОВ-4421
КС-4561
КС-4561
Д3-110
ЕОВ-4421
Д3-143

Fig. 4

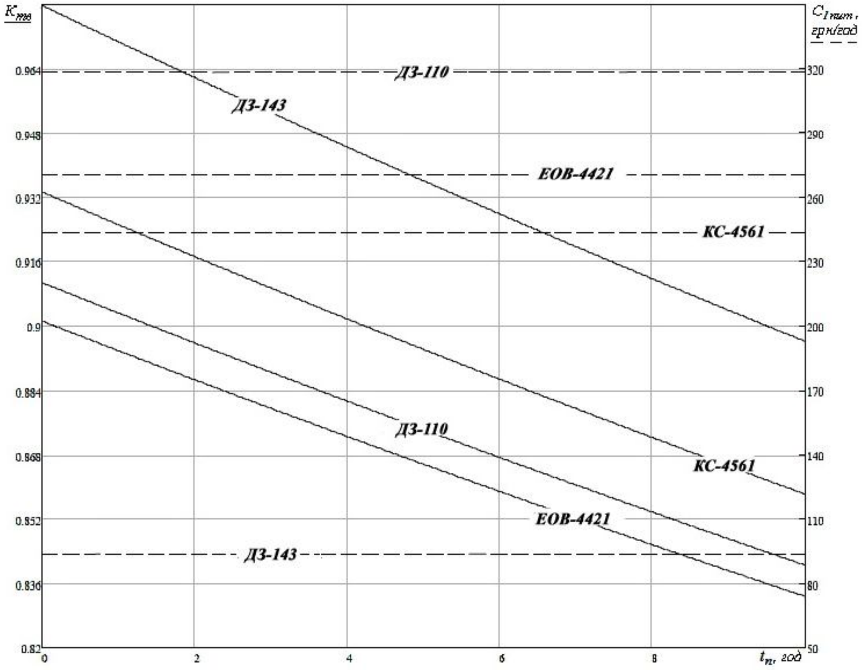
$K_{тв}$
$C_{1пит}$, грн/год
0.964
0.948
0.932
0.916
0.9
0.884
0.868
0.852
0.836
0.82
320
290
260
230
200
170
140
110
80
50
0
2
4
6
8
$t_п$, год
Д3-110
Д3-143
ЕОВ-4421
КС-4561
Д3-110
КС-4561
ЕОВ-4421
Д3-143

Fig. 5

2.Methods for assessing the technical and economic efficiency of ACE operation. The developed technique is designed to establish the cost of unit costs per unit time of the product in good condition to achieve the maximum value $K_{тв}$. The values of operating time, which correspond to the optimal periodicity of planned preventative measures, are set by the maximum level of the coefficient of technical use $K_{тв}$ and the minimum value of the unit cost of one hour of product in good condition C_{1num}.

According to the results of calculations made in section 1.2 and construction of the dependence of $K_{тв}$ and *min* C_{1num} the periodicity of technical servicing (Fig. 1), using the graph-analytical method of optimization

As mentioned above, the determination of the frequency of maintenance is based on the analysis of the dependence of the coefficient of technical use on changes in operating parameters, namely the reliability of built-in tools of monitoring the technical condition, the duration of complete recovery of the failed sample and the probability of signal failure control systems. For example, for the investigated sample DZ-143 the maximum value of $K_{тв}$ = 0.98 is reached at an optimum periodicity of carrying out PTS $T_{опт}$= 240 h. At the same time, the specific costs per unit of time spent in good condition are equal to C_{1num}=50 UAH/hour.

Similarly, the assessment of technical and economic efficiency of operation for the rest of the investigated samples.

For KS-4561 the maximum value of $K_{тв}$=0,94 is reached at optimum periodicity of carrying out PTS$T_{оптКС\text{-}4561}$=90 h thus specific expenses for unit of time of stay in a serviceable condition are equal to $C_{1numKS\text{-}4561}$= 250 UAH/h, for DZ-110 – $K_{тв}$= 0,93 at $T_{оптDZ\text{-}110}$=72 h at the same time $C_{1numDZ\text{-}110}$ =350 UAH/h, for EOV-4421 –$K_{тв}$=0,92 at $T_{оптEOV}$=70 h at the same time $C_{1numEOV}$=290 UAH/h.

Table 3

The proposed timing of maintenance of ACE

Name of equipment	The average speed of ACE at the aerodrome, km / h	Periodicity, h.	Frequency of maintenance, km		The value of $K_{тв}$	
			According to the guiding documents	Suggested	Set	Received
KS-4561 (KrAZ-257)	5	90	1200 – 1600	450	0,7	0,94
EOV-4421 (KrAZ-255Б)	5	70	1200 – 1600	350	0,7	0,92
DZ-110(T-130)	5	72	1200 – 1600	360	0,7	0,93
DZ-143	5	240	1200 – 1600	1200	0,7	0,98

Given the fact that the average speed of ACE at the aerodrome is 5 km/h, by multiplying the obtained values of $T_{опт}$ in hours by speed, we obtain the value of $T_{опт}$ in kilometers. The results of the calculations are shown in Tab. 3.

Thus, using the method of assessing the technical and economic efficiency of operation, the determined optimal periodicity of maintenance was assessed by the criterion of «efficiency-cost». Using certain $T_{опт}$ values, the $K_{тв}$ was increased to 0.92… 0.98 in contrast to the set 0.7.

Conclusions. Thus, the article describes the method of determining the optimal frequency of maintenance. The values of operating time, which correspond to the optimal frequency of planned preventative measures, are set at the maximum level of the coefficient of technical use of $K_{тв}$. The developed technique takes into account the frequency and duration of maintenance, routine work, the reliability of equipment control, the probability of failure signals, the duration of complete recovery of the product.

The analytical dependence of unit costs per hour of the ACE sample in good condition on the coefficient of scale and form of diffusion-monotone distribution law, periodicity, and duration of routine works, probability of information on failures of ACE samples, reliability of control, and duration of preventative maintenance, etc.

The method of estimation of technical and economic efficiency of operation of aerodrome construction equipment is offered. The level of $K_{тв}$ and specific costs per unit time of the product in good condition for the actual operating parameters of the studied samples are determined.

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ВИЗНАЧЕННЯ ОПТИМАЛЬНОЇ ПЕРІОДИЧНОСТІ ПРОВЕДЕННЯ ТЕХНІЧНИХ ОБСЛУГОВУВАНЬ ЗРАЗКІВ АЕРОДРОМНОЇ БУДІВЕЛЬНОЇ ТЕХНІКИ

Наведено методику визначення оптимальної періодичності проведення технічних обслуговувань окремих зразків аеродромної будівельної техніки, яка експлуатується поза межами встановленого ресурсу. Розроблена методика враховує періодичність і тривалість проведення технічних обслуговувань, регламентних робіт, достовірність контролю обладнання, ймовірність надходження сигналів про відмову, тривалість повного відновлення виробу.

Також встановлено аналітичну залежність питомих витрат на годину перебування зразка аеродромної будівельної техніки у справному стані від коефіцієнту масштабу і форми дифузійно-монотонного закону розподілу випадкових величин, що в свою чергу надає можливість розробити методику оцінювання техніко-економічної ефективності експлуатації аеродромної будівельної техніки.

Ключові слова: аеродромна будівельна техніка, система технічного обслуговування, дифузійно-монотонний закон розподілу, оптимальна періодичність проведення технічного обслуговування.

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ОПРЕДЕЛЕНИЕ ОПТИМАЛЬНОЙ ПЕРИОДИЧНОСТИ ПРОВЕДЕНИЯ ТЕХНИЧЕСКИХ ОБСЛУЖИВАНИЙ ОБРАЗЦОВ АЭРОДРОМНОЙ СТРОИТЕЛЬНОЙ ТЕХНИКИ

Приведена методикаопределения оптимальной периодичности проведения технических обслуживанийотдельныхобразцоваэродромнойстроительной техники, котораяэксплуатируется за пределамиустановленного ресурса. Разработаная методика учитываетпериодичность идлительность проведения техническихобслуживаний, регламентных работ, правдивость контроляоборудования, вероятность сигналов наотказ, длительность полного восстановления изделия.

Ключевые слова:аэродромнаястроительная техника, система технического обслуживания, диффузионно-монотонный закон распределения, оптимальная периодичность проведения технического обслуживания.

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Наведено методику визначення оптимальної періодичності проведення технічних обслуговувань окремих зразків аеродромної будівельної техніки, яка експлуатується поза межами встановленого ресурсу.

Табл. 3. Іл. 5. Бібліогр. 6 назв.

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Avramenko O.V., Matsko O.Y., Polishchuk V.V., Pidhorodetskyi M.M., Salii A.H., Salii O.Y. Korshets O.A., *Duzhyi R.V.* **Determination of the optimal technical servicing periodicity of samples of aerodrome construction equipment** // Strength of Materials and Theory of Structures: Scientific-&-Technical collected articles – Kyiv: KNUBA, 2021. – Issue 107. – P. 265-280.

The method for determining the optimal frequency of maintenance of individual samples of aerodrome construction equipment, which is operated outside the established resource, is presented.

Tabl.3. Fig. 5.Ref. 6.

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Авраменко А.В., Мацько А.Й., Полищук В.В., Подгородецький Н.Н., Салий А.Г., Салий А.Я. **Определение оптимальной периодичности проведения технических обслуживаний образцов аэродромной строительной техники**//Сопротивление материалов и теория сооружений: науч.-тех. сборн.– К.: КНУСА, 2021. – Вып. 107. – С. 265-280.

Приведена методика определения оптимальной периодичностипроведения технических обслуживаний отдельных образцов аэродромной строительной техники, которая эксплуатируется за пределами установленного ресурса.
Табл. 3. Ил. 5. Библиогр. 6 назв.

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