THE MONITORING OF OPERATING COSTS OF THE VEHICLES IN THE CZECH ARMY

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Abstract: *The paper deals with monitoring of operating costs of the vehicles in the Czech Army. The cost reduction is realized through the methods of controlling, improvement of field maintenance quality, modularization of the units, acquiring of new equipment, the options of reducing fuel consumption by additives, trends in the maintenance area and surveillance systems implemented for check of the vehicles operation. Significantly, we proceeded to the method of cost reduction by implementing new equipment. We have proved the method success. Especially with vehicles T 810 the demonstrated savings were about 12.7% of motor diesel in 2008. Similarly, it was also proved in 2009, when that the savings for the same vehicle T 810 in seven modifications were about 11.9% of diesel. The total contribution for the selected military facility of Czech Army was shown by significant overall saving. In 2009, the selected military facility used a total of 9 pieces of new vehicles T 810. The saving of the replaced equipment meant a total fuel savings of 1862 liters, which amounted to 2.34% of the total consumption of diesel.*

Keywords: saving costs, vehicles operating, reduction method, new equipment

1. Introduction

Amongst the current issues with the running of military equipment, inter alia, belongs a shortage of modern equipment. The shortage accompanies the Czech Army, as well as the most of the post-eastern armies. Associated issues are insufficient funds for spare parts, as well as for the services, maintenance of the new equipment, general repairs of the older military equipment, etc.

2. The current status of solved costs for running PVT

In the field of transport capacity of immobile equipment, the Czech Army faces the need to purchase a new capacitance flatbed truck of required load-carrying capacity and the corresponding quantity. Another deficiency is postponed purchase of mobile workshops and the need to buy recovery vehicles for armored

vehicles PANDUR II. The contract was canceled and it was decided by minister of defense to create and define new terms for the tender. In the end of the last year a critical shortage of tires for trucks T 815 became evident, caused by cancellation of acquisition. The new central contract of supply still has not been signed.

The current operation of military equipment and its solution is affected not only by the funds, but mainly by a shortage of spare parts. The main problem seems to be mainly administrative inability to purchase from companies the required material.

There are problems as a result of long-term neglect of keeping norms of technical maintenance (by mileage of km or once per year).

The problems with the non-existence of instruments for defectation of sophisticated equipment are being discussed. The most pressing problem is the already mentioned lack of central contracts with the possibility of concluding the necessary central contracts for maintenance and repair of military equipment (ME). This is about the covering of requirements for vehicles PANDUR II, chassis of BVP, T72M4CZ tanks, LRD vehicles, tank equipment, cranes and T-815. Some of the equipment necessary for land forces is in many cases, due to the absence of maintenance or general repairs, beyond the scope of use. As an example there are personnel off-road vehicles LRD in an amount 52% or the vehicle T 815 cargo of which 59% are immobile. Loaders of containers T 815 - loader KTN are 78% immobile and after their lifespan. If one takes problem to the detail, mainly there are not any transport capacities available. All semitrailers trucks P 50N are at end of their lifespan fully with its 100% [1].

The current novelty is an important experience in planning of the operation using primary specifications. This is an important issue for the realization of contracts for purchases of spare parts (SP) and material. It is the fuel, SP, preventive maintenance and repairs, general repairs and fees associated with the operation of a vehicle.

Experience with work during planning in LIS with the help of primary specifications and simultaneously affect opposing directions to planning in decisive period, increased effort of preparation and duplication requirements. Forward-looking plans for the use and maintenance, created already 79 units of 289, ie. 27.3%. From the planned ground military equipment, the most does not mean determined mid-repair norm [2]. As seen from evaluation and solving of fulfilled tasks, it is important to search and optimize the processes and to contribute to the reduction of costs in

frame of ground equipment operation in the Czech Army.

3. Used methods and object of research.

Aims and range of presented solution

To novelties related to control of invested costs in operation, ie. maintenance and repairs, belongs implemented method of controlling, currently applied in form of pilot project to Czech Army. Aims of controlling from the long-term are connected with permanent analysis of costs as well as with evaluating of efficiency, economy and purposfulness. It is necessary to permanently evaluate economical benefit and set system of economical indicators possible to evaluate. The effort is to reach the ability to plan costs and to process calculations with the use of data from the information systems.

In order to begin the implementation of the controlling it is necessary to acquire the database for the MoD. In the area of operation there are monitored vehicle costs. It could be in terms of monitoring costs of fuel consumption, spending of material for maintenance and repairs. Technical service of operation in total readiness to introduce the controlling has already taken preventive steps. There were created property cards in LIS at some vehicles, for instance for PANDUR II and T 810 vehicles.

The tools for strategic controlling are ad-hoc analysis, financial analysis, SWOT analysis, strategic budgeting, GAP analysis (gap analysis), Pareto ABC analysis and Target costing (targeted costs). Next to them are recommended instruments of operative controlling, which are mainly Benchmarking, ad-hoc analysis, SWOT analysis, Pareto ABC analysis, as well as Target costing (calculation of target costs) [3], [4].

3.1 Used methods

There are number of methods which are applicable for reduction of operational costs. These can include the methods of modularization units, purchase of new

equipment, the possibility of reducing fuel consumption by additives. They may be new trends in the field of maintenance and use of surveillance systems classified for operation check.

3.1.1 Reduction of costs by modularization method

Reducing of costs by modularization method means intensification of processes and their implementation in practice. This is about creating a new, modular, artificially assembled unit from the best and most powerful elements of the previous arrangement. The modular unit in running of military vehicles shows some benefits, but also shortcomings. They should be considered in implementation in favor of the operation.

Pros are seen in the fact that on modularization will share best sub-units, thus will theoretically create a powerful complex. This reduces the number of used vehicles, drivers and reduce the number of fully unused equipment. It will contribute to the prevention of unnecessary costs issued for short term storage of technology, vehicles. Reducing the number of drivers creates a competitive environment, which should bring the quality to their performance. Furthermore, it reduces the cost of unnecessarily performed annual maintenance on vehicles, which were not much in use. It will increase the mileage per year per vehicle and disposal of unnecessary and obsolete equipment will pass.

3.1.2 Method of costs reduction by using fuel additives

Another possible method is to reduce the cost of operation by using fuel additives. It is known that it is carried out with additives in the production stage but also in after-expedition phase (e.g. for reduction of freezing, improving startup etc.). Trends in use of additives are as for lubricating oils as for fuels. The state of additives can be solid, liquid or gaseous.

Previously solved defense research project [6] examined the additive with the trademark name ENVIROX. The composition is based on cerium oxide. The properties affecting the reduction of fuel consumption, reduce engine smoke, cleaning additive effect and a positive effect on engine building were being verified.

The additive has been verified in operation and under laboratory conditions. The measurements and the tests resulted in useful measurement methodology. Verifying of the effects of additives passed, inter alia, by tribological analysis of oil samples. To evaluate the effect on the activity of crank mechanism and on fuel system parts. Micrometer trials of engine motor measurements to verify the changes in geometry and functionality of the engine. Numerous positive and useful outcomes in operation of the vehicles were achieved [6, 7].

3.1.3 Method of cost reduction by the increased efficiency of the maintenance

Method of costs reduction by the increased efficiency of the maintenance, where the considered area of maintenance is technical maintenance in the field [5]. Trends in maintenance costs are high in the Czech Army, as well as the civilian life. The maintenance system is preventive in nature. Maintenance system in the Czech Army has characteristics based on 3 P. It is characterized as a system plan-based, preventive and periodic. There are known different stages of development of preventive maintenance in the world. Dependency in development in the last decades of the last and this century can be seen from the Figure 1. The Czech Armed Forces developmentally stand in the 80's of the last century. The development in maintenance within the Czech Army slows down due to obsolete technology. *Best in the world are the US, Japan and Germany.*

Figure no. 1: The development of maintenance

3.1.4 Method of costs reduction in operation by the use of monitoring systems

The ways of operational costs reduction with the use of tracking systems incorporated for control of the factors affecting operation, primarily to control undesirable decreases of fuel and monitoring the drivers [6].

The solution can be used for different types of military vehicles as are- combat vehicles, trucks, special vehicles for maintenance, handling equipment, containers, aggregates etc.

To prevent and control adverse decreases of fuel used, a fuel measurement electromagnetic probe method is used. It is being measured directly in a tank with high accuracy; as seen on Figure 2. The checks are focused on refueling, notice of any

abnormality and loss with the graphical, tabular, textual and individual on-line reports completed afterwards. The tracking devices are installed in the vehicle and monitored remotely via a computer system GPS.

Fuel monitoring is provided by a probe installed in the fuel tank, wherein the level meter serves simultaneously as the lock of the tank, to seen from Fig. 2. The measuring accuracy is quite sturdy, and $\pm 3\%$. The benefits are quantified and elimination of losses is given to 200 l per month in the civilian sector transport companies [8], [9]. [10].

Another important saving of still rising costs seems to be the solution through the purchase of new technology, seen in part 4.

Figure no. 2: The fuel monitoring

3.2. Material used for research

The material used for this article and the considerations are focused on modular units created for the time as a study. Material for use by fuel additives is focused on the tested fuel additive with the trade name Envirox, used by vehicles with diesel

engines.

The modernization of the fleet, which is the main subject of this paper was applied by of one military battalion, where was being shown the possibility of savings in operation after replacing obsolete vehicles P V3S by T 810 vehicles. It can be applied

generally throughout the ACR.

The material used relates to the area of influence of the new technology purchase. Obsolete vehicles P V3S, were replaced gradually between years 2007 and 2009 by the new vehicles T 810. The vehicles were assigned according to the schedule to Czech Army units. For the modernization of the fleet and the cost savings possibilities are taken into account vehicles Tatra T-810.

3.3 Limiting conditions of the considered case

Limiting consideration of proposed solution is the implementation of a new modern technology and demonstration of its impact on reducing operating costs. The vehicle T 810 was selected and then has been in recent years (2007-2009) implemented into the army. The solution has been focused on a selected military facility, where after change instead of the vehicles P V3S were proved the benefits - reduced operating costs. From sample, it can be inferred that the reduction could be generalized to a nationwide modernization of that vehicle type in the Czech Army.

4. The operating costs reduction by implementation of the new technology

Prior to year 2007 it was decided to realize the purchase of the new technology. The reason for the modernization was the increasing costs of maintenance and their constant escalation. It also multiplies repair costs and on top of that there is a low reliability of operating technology. The planned modernization of the Czech army fleet seems to be a necessity for ongoing modernization in the Army as a whole. In addition, older versions of the technology do not have sufficient combat parameters. The cause of decommissioning of older technology is undoubtedly the

principle of protection of ecology, noise, high engine smoke (of the standards EURO) and leakage of fuel. Significant, however, is the pressure of partners in NATO and in the PfP because of the reasons of interoperability in the field.

4.1 The change of outdated fleet

These operated 553 vehicles had the annual mileage of 1,935,730 km, fuel consumption was 627 459 liters F-54. If the original vehicles P V3S were operated, then by the same mileage, consumption would be 712 349 liters of diesel. Savings of diesel by new vehicles T 810 were 84 890 liters, which represents the amount of 2 088 294, - CZK.

As a practical illustration may be taken the situation at the logistics company of one mechanized battalion. The original 9 vehicles Praga P V3S fulfilled tasks in service in 2008 and the following year were replaced with new vehicles T 810. Here was demonstrated by measuring and with the comparative method a reduced fuel consumption by 1 861.8 liters F-54 and the amount of money saved is 45 800, - CZK. In addition to the savings on fuel, there were secondary savings on the environment. Reduction of emission components produced 105.8 kg CO₄ 907.5 kg and 223.3 kg of CO₂ NO_x [7].

Replacement of the old technology with the new T 810 total savings amounting to 1,862 liters of fuel, which is 2.34% of the total consumption of F-54.

The situation is shown on Figure 3, it is possible to see the impact of the modernization on fuel consumption and in Figures 4 and 5 there are the other monitored parameters of cost savings and emission components.

Figure no. 3: Impact of modernization on the fuel consumption

4.2. Discussion and nationwide generalization within the Czech army

Reducing the costs of operation by car fleet change for 553 vehicles with an annual

mileage in the year 2009, which was detected 1,935,730 km, fuel consumption was 627 459 liters of diesel.

Figure no. 4: Impact of the modernization on the fuel cost [CZ]

Figure no. 5: The influence of equipment modernization on the amount of emissions load

If the original vehicles Praga V3S were operated, then by the same number of kilometers traveled, the consumption would be at least 712 349 liters of diesel. Due to the modernization the fuel savings were achieved, which were calculated as follows: Savings of diesel caused by operating the new T 810 vehicles were 84 890 liters, which in the then charged price amounts to 2 088 294, - CZK.

The purchase of the modern technology will

result in reduced fuel consumption, emissions and maintenance costs by about 10%.

From the statistical evaluation of the operation of logistics companies observed results reflect the real situation of the individual battalions. They are consistent with the short and long term planning of funds and fuel inventories. Efficiency of operation is summarized into a relationship, which determines the financial

expensiveness operation [7].

5. Conclusions

The modernization of technology is one of the possible ways to increase the efficiency of vehicles in the evaluated operation. It was shown what savings were achieved in 2008 and 2009 with the realized modernization in the Army as a whole. In 2008, when the total modernization put into operation 337 vehicles, T 810 and replaced obsolete vehicles P V3S, the fuel savings amounted to 12.7% of engine diesel.

In 2009, all 553 newly supplied vehicles T 810 in seven modifications were in operation, and fuel saving was 11.9% F-54. The benefits of modernization were documented on the example of a logistics company of one mechanized battalion.

There was a total of 9 new vehicles T 810

put into the operation, which replaced older vehicles PV3S in 2009. The replacement of the old technology represented a total fuel savings of 1 862 liters, which is 2.34% of the total consumption of F-54.

The overall results also highlight the savings in favor of the environmental protection, which is evident in [7]:

- Fuel savings are dependent on the number of vehicles used, can be substantial.
- Protecting the environment and addressing the consequences of the operation, such as emissions, dust and noise. There is a high risk of environmental accidents because of the leakage of fuel and lubricants from the vehicle systems.

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