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IMPROVING ENVIRONMENTAL COMPETITIVENESS OF AIR TRANSPORT ENTERPRISES

This article considers the directions of negative impact of air transport enterprises on the environment. The activities that can be used to reduce the negative effects of air transport enterprises on the environment are grounded. A concept of environmental competitiveness of an airline company is presented. A methodological approach to measure the environmental competitiveness of an airline company is offered.

Keywords: *environmental competitiveness; air transport enterprise; environmental security; environmental and economic damage; pollutant emissions.*
Peer-reviewed, approved and placed: *29.11.2016.*

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ПІДВИЩЕННЯ ЕКОЛОГІЧНОЇ КОНКУРЕНТОСПРОМОЖНОСТІ АВІАТРАНСПОРТНОГО ПІДПРИЄМСТВА

У статті розглянуто напрями негативного впливу діяльності авіатранспортних підприємств на навколишнє середовище. Обґрунтовано напрями зменшення негативного впливу авіатранспортного підприємства на навколишнє середовище. Визначено поняття екологічної конкурентоспроможності авіакомпанії. Запропоновано методичний підхід до вимірювання екологічної конкурентоспроможності авіакомпанії.

Ключові слова: *екологічна конкурентоспроможність; авіатранспортне підприємство; екологічна безпека; еколого-економічні збитки; емісія забруднюючих речовин.*
Форм. 2. Літ. 12.

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ПОВЫШЕНИЕ ЭКОЛОГИЧЕСКОЙ КОНКУРЕНТОСПОСОБНОСТИ АВИАТРАНСПОРТНОГО ПРЕДПРИЯТИЯ

В статье рассмотрены направления негативного воздействия деятельности авиатранспортных предприятий на окружающую среду. Обоснованы пути уменьшения негативного влияния авиатранспортного предприятия на окружающую среду. Дано определение понятия экологической конкурентоспособности авиакомпании. Предложен методический подход к измерению экологической конкурентоспособности авиакомпании.

Ключевые слова: *экологическая конкурентоспособность; авиатранспортное предприятие; экологическая безопасность; эколого-экономический ущерб; эмиссия загрязняющих веществ.*

Problem statement. Among the conditions to enhance the competitiveness of air transport enterprise, environmental security is paramont, it refers not only to the use of aviation services, but concerns the current and potential customers as well. The processes that occur during passenger and cargo air transportation contribute to negative environmental impacts. The negative effects of such impacts are: air pollution, both at the territory of an air transport enterprise, and around it; soil and water pollution by waste waters from the territory of an air transport enterprise; significant acoustical load on the environment (aircraft noise); powerful electromagnetic radiation from the facilities. Air pollution sources here are of two categories: stationary and non-stationary ones. The former includes the sources that emit pollutants to atmos-

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phere in the form of gas, vapor, dust and aerosols with constant coordinates of emission (point or plane coordinates). These are boiler rooms, fuel and lubricant depots, hangars, workshops, bases of special purpose vehicles, forecourts etc. Non-stationary sources are engine-on aircrafts, special purpose vehicles that move in the airport, and variety of mobile units that use fuel during their operations. On the part of airline company which acts as the owner of aircrafts, ground-based aircraft equipment (special purpose vehicles), the negative impact on environment is firstly made by engine emissions; and secondly – as electromagnetic pollution caused by overhead systems of electric transport (special purpose vehicles).

From this point of view, the actual problem is the least complicated transfer of domestic aircraft engines on Euro fuel that is recognized by the ICAO standards as environmentally friendly and safe for the environment, and the problem of partial or full replacement of land special purpose vehicles. Technically, upgrading engines "for Euro fuel" and other activities aimed to improve fixed assets condition requires not only significant technical intervention, but also significant financial costs and not every air transport enterprise can afford it. Note that only 20 of a 100 existing Ukrainian airline companies are profitable, that is, have own funds or are able to attract investments or loans to organize the aircraft transfer "for Euro fuel".

Environmental insecurity of airline companies does not promote the growth of their competitiveness, especially in international air transportation. Improving environmental competitiveness of airline companies based on the modernization of aircraft engines is impossible due to lack of funds, but airline companies may carry out partial replacement of land special purpose vehicles.

Recent publications analysis. The issues of environmental security, efficiency of environmental and economic activities of air transport enterprises were discussed previously by H. Astapova (2004, 2008), L. Burychenko et al. (1992), J. Drachuk (2011), H. Franchuk et al. (2000). These authors elaborated the essence and directions of environmental and economic activities of enterprises, developed the criteria, indicators and methods for calculating efficiency (Hrebonkin et al., 2009), the features of funding – lending and investing in environmental activities and projects (Astapova, 2008). Specific measures of environmental protection for civil aviation enterprises are described in (Burychenko et al., 1992; Franchuk et al., 2000). Theoretical and practical principles of environmental security for companies are presented in (Drachuk, 2011; Franchuk et al., 2000; Hrebonkin et al., 2009).

However, the researchers have not defined the concept of ecological competitiveness of air transport enterprises, neither suggested the methodological approaches to its measurement.

The purpose of this article is grounding of ecological competitiveness of an airline company through minimizing pollutant emissions from non-stationary sources based on partial replacement of land special purpose vehicles.

The research is carried out on the basis of environmental management methodology, main provisions of economic theory and corporate control theory, theoretical provisions of air transport industry development. For this study the methods of economic analysis and synthesis, corporate investment expert assessment and logical generalization of results we employed. Information basis for the research includes ICAO materials, data of "Aero Express LLC", materials of author's precious scientific papers.

Key results. Environmental competitiveness of an air transport enterprise is characterized by its ability to provide ecological security of aviation services to the current and potential consumers. To understand the environmental hazards of an airline company we determine the emission sources and propagation paths of atmosphere pollution. This makes it possible to direct our efforts to reduce them. There may be several ways to reduce atmosphere pollution. For example, to make changes in the existing processes, to replace equipment with environmentally more friendly, to improve conditions of fuel combustion in engines and other engineering measures. Sometimes only organizational measures are required, such as reducing the number of simultaneously run engines. And sometimes, on the contrary, solving the problems of air pollution requires a more comprehensive approach. The real means to reduce pollution is specifying Maximum Permissible Emissions (MPE) of air pollutants per each unit (engine, vehicle, equipment etc.) per year. Processing units that do not meet these requirements are further prohibited for use.

Air transport enterprise has a small amount of solid emissions harmful to humans and biological objects. Therefore, they are recycled as secondary raw materials or exported to municipal landfills. If these wastes are toxic, then, before the removal, they are to be mandatory neutralized or detoxificated. Emissions and discharges of pollutants, waste disposal in the environment lead to degradation of lands, waters, minerals, flora and fauna, as well as reduction of human health indicators. As a result, it leads to damages. According to the Law of Ukraine "On Environmental Protection" (25.06.1991, No 1264-XII), one such mean of environmental protection is charging for pollution of environment and deterioration of natural resources, as well as compensation for the damage caused by violation of the applicable laws.

Environmental risk of an airline company is characterized by complex damage that is a consequence of aviation activities. Thus, for air pollution, in particular experts distinguish between economic, socioeconomic, social and environmental damages.

Economic damage that can be calculated in a monetary form includes:

- damage for the funds required to eliminate the consequences of pollution in industry and residential sector;
- damage due to reduced output of industrial and agricultural production;
- damage due to reduced productivity of natural biogeocenoses;
- damage arisen because of the emissions into the air include the part of materials and natural resources;
- costs required to support or adjust the necessary balance in natural ecosystems;
- costs caused by reduced lifetime of buildings and structures;
- damage arising from decreased productivity as a result of increased population morbidity rate.

Computable socioeconomic damage includes:

- costs for social security of population, when growth of morbidity rate is associated with environment pollution;
- constantly rising costs for preservation of natural recreational resources;
- additional costs required to provide proper rest for population;
- damage increasing as a result of environmental human migration.

Social damage which is almost incomputable includes:

- aesthetic damage from partial or full degradation of environmental landscapes;

- psychological damage accumulating as a result of people dissatisfaction with the quality of environment.

Environmental damage, which is also almost incomputable due to required huge amount of relevant information, knowledge and time, includes:

- disappearance of flora and fauna species;

- destruction of unique environmental ecosystems as a result of genetic errors in a new, younger generation of people.

Thus, environment pollution from non-stationary sources arising as a result of air transport enterprise activity creates economic, socioeconomic, social and environmental damages. Damage compensation is carried out in a regulatory manner by applying the environmental tax.

Special purpose vehicles and technological units are classified as non-stationary sources of fugitive emissions of pollutants into the air. These maintenance facilities are moving within significant airport territory, while being periodically near aircrafts (processes of refueling, loading and unloading etc.).

To calculate the pollutant emissions, all ground-based aircraft equipment is divided into the following groups:

I – facilities based on motor vehicle chassis, not used as drives for special equipment, as well as general purpose passenger and freight transport;

II – maintenance facilities based on motor vehicle chassis which are used as drives of special equipment and require relatively low power, and which engine mode of operation is close to idle;

III – maintenance facilities based on motor vehicle chassis which are used as drives of special equipment (or from additional or separate engine) and require relatively high power – more than 30–40% of the maximum value;

IV – fuel heaters of air and heating machine for ice removal from aircraft covering and artificial turf of airfield. It is possible to calculate engine emissions of ground-based aircraft equipment for major pollutants emitted with exhausted gases: carbon monoxide CO; unburned hydrocarbon compounds, C_xH_y; nitrogen oxides NO_x.

For such calculations we would need the following data: kilometrage of vehicle L_i (actual or reduced); the amount of fuel consumed Q_i; lifetime of a vehicle (year of manufacturing); technical condition of a product; mode of operation; conditions of operation; airport climatic conditions.

To calculate the pollutant emissions into the atmosphere from ground-based aircraft equipment the following formula is used (Franchuk et al., 2000):

$$M_j^{\tau} = \sum_{s=1}^{n} (K_{1j} K_{2j} K_{3j} K_{4j} K_{5j} m_j L_s) 10^{-3}, \quad (1)$$

where M^{τ}_j – the total emission of j-th harmful component (CO, C_xH_y, NO_x) by i-th vehicle per time τ, kg/year; n – the number of i-th vehicles at an aviation enterprise; m_j – the kilometrage of j-th vehicle per year; L_i – the actual (or reduced) kilometrage of i-th vehicle per year, km/year; K_{1j} – impact factor of vehicle age on emission of j-th pollutant; K_{2j} – impact factor of annual average temperature; K_{3j} – impact fac-

tor of average atmospheric pressure; K_{4j} – impact factor of average humidity; K_{5j} – impact factor of vehicle technical condition.

Important factors contributing to an increase of emissions from non-stationary sources are age and technical condition of fixed assets (vehicles). Thus, minimizing pollutant emissions is only possible through full modernization of engines and upgrading ground-based equipment of air transport enterprises.

As a result of implementing measures to reduce the negative impact of using the airline company's main resources on environment, environmental competitiveness of an aviation entity is increasing.

Quantitative measure of environmental competitiveness is the value of reduction of pollutant emissions (M^{τ}_{j}) resulting from upgraded ground-based equipment at the cost of an airline company. The first 3 indices do not contain economic meaning and their values are determined by the ICAO standards. Impact factor of vehicle technical condition (K_{5j}) can be calculated as a ratio of difference between the cost of vehicle upgrade activity and the total economic impact to the cost of upgrade:

$$K_{5j} = \frac{Vz - Ez}{Vz}, \quad (2)$$

where Vz is the cost of measures for ground special purpose vehicles renewal; Ez – the total economic impact due to implementation of measures for special purpose vehicles renewal.

If the cost of an upgrade is determined by the price of a new product manufacturer, the total economic impact can be calculated by the method of target profit planning. To address this situation, it is advisable to apply the methodology of corporate planning based on the use of technical and economic substantiation and calculation method of a company target profit, involving the following sequence in its practical implementation:

1. Development of short-term forecast of company's financial results for the coming year.
2. Development of a plan of company support with financial resources as at the beginning of year.
3. Substantiation of loan requirements for the enterprise.
4. Development of draft payment calendar for 12 years.

Predictive calculations are based on the results of analysis of the company's financial condition. Data received as a result of financial analysis are used for substantiation of loan requirement for this enterprise. Specifically, such requirement arises under the condition of deficient amount of company working capital required to realize the upgrade of ground-based equipment. Internal source for covering this shortcoming is capitalized net income, its receipt is expected at the end of the current period (expected or projected value). If this income is not enough for resource provision, then extra amount is attracted as credit resources.

Based on the approved procedure of perspective distribution we can calculate the net profit for a planning period (year). At this point we determine the amount of one of special funds – the material incentive fund. The calculation is based on the value of average premium bonus, which is regulated by employment contract and equals 15% of salary (according to the data of "Aero-Express LLC", internal audit annual

report for 2015) Applying this percentage to predictive value of direct labor costs we obtain the amount of material incentive fund. According to the procedure of profit distribution the share of this fund in the total amount of net profit is 30%. Using simple mathematical proportion, we can determine the planned net profit. More obviously, the process of payback of own funds or repayment of credit resources is reflected in the payment calendar of company. The structure of payment schedule consists of 3 parts – the balance "Start-up costs", the table "Forecast for profits and losses" and the table "Forecast for flow of funds". The latter table shows the performance of using own and borrowed funds measured by the rate of increase of the air company's own funds at end of the period (12 years) as compared with the initial amount.

Attraction of credit funds, including environmental credit associated with the renewal of vehicles (according to "Aero-Express LLC", the renewal cost – Vz is 397,631.00 UAH) guarantees the increase of own funds for "Aero-Express LLC" to the amount of 39,474.00 UAH. This is regarded as a result of measures of vehicles renewal in the last 12 years. Taking into account part of the credit for environmental purposes, the calculated effect due to measures implementation on ground vehicles renewal for the last 12 years equals to 1,268,438.00 UAH. The annual amount due to the effect is 115,313.00 UAH (according to the internal audit annual report of "Aero-Express LLC" for 2015). Using the formula (2), the calculated value of K_{5j} is 0.71. In case of unperformed measures for vehicles renewal (the effect is absent, assuming 0), the value of K_{5j} is 1. Thus, the lower is the value of K_{5j}, the lower would be the emissions of contaminants by ground technical facilities of the airline company. In order to obtain the value of the environmental competitiveness index, it is proposed to calculate two values of the index Mτj by the formula (1). The first calculation takes into account the value of K_{5j} = 0.71. The second one uses the value K_{5j} = 1. The calculation of both values of Mτj and their comparison enable identifying emission reduction of contaminants due to renewal of ground vehicles as the rise in environmental competitiveness of the airline company. The experimental value of the environmental competitiveness index, calculated using the "Aero-Express LCC" data (reduction of total emissions of CO harmful component) as the difference of M^{τ}_{j} upon the results of two calculations ($M^{\tau}_{j2} - M^{\tau}_{j1}$), equals to 125697 kg/year. Using the results of comparison between the values of environmental competitiveness indices for several airline companies, it is possible to determine the level of ecological security of aviation services as high, medium, low and non-available (N/A).

In the process of our research, data on "Aero-Express LLC" were obtained on the basis of scientific government programs of the Department of Finance and Accounting, National Aviation University on the topics: "Financial planning and institutional security of quality management at airlines in response to globalization" (the number of state registration 0113U000584, 2012–2015), "Financial security for integration development and property quality of airlines in response to globalization" (2015–2018).

Conclusions. Environmental pollution from non-stationary sources produced as a result of air transport enterprise activity leads to economic, socioeconomic, social and environmental damages. The ability of an airline company to prevent these damages demonstrates its environmental competitiveness. Environmental competitive-

ness is determined by the value of reduced emissions of pollutants as a result of upgrading ground-based equipment at the expense of an airline company.

Features of the proposed methodological approach to calculating the environmental competitiveness index of an airline company are the following: firstly, the methods of corporate planning and ecological-economic forecasting for determining the environmental factor of influence on vehicle technical conditions; secondly, environmental competitiveness index can be interpreted as a natural value; thirdly, the dependence of the level of ecological security from environmental competitiveness of an airline company can be established.

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