MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY

Air Transportation Management Department

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Head of the Department
_____ D. O. Shevchuk
“_____” _____2020

MASTER THESIS
(EXPLANATORY NOTES)

Theme: “Organization and technology of vaccine delivery to Ukraine”

Done by: Mezei Vasyl, ОП- 202Ма

Supervisor: Ivannikova V.Yu., PhD, Associate professor

Standards Inspector: Shevchenko Yu.V., PhD, Associate professor

Kyiv 2020

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ АВІАЦІЙНИЙ УНІВЕРСИТЕТ

Кафедра організації авіаційних перевезень

ДОПУСТИТИ ДО ЗАХИСТУ
Завідувач кафедри
_____Д. О. Шевчук
«_____»_____2020 р.

ДИПЛОМНА РОБОТА
(ПОЯСНЮВАЛЬНА ЗАПИСКА)

ВИПУСКНИКА ОСВІТНЬОГО СТУПЕНЯ
«МАГІСТР»

Тема: «Організація і технологія доставки вакцини в Україну»

Виконавець: Мезей Василь, ОП-202Ма

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Київ 2020

NATIONAL AVIATION UNIVERSITY

Institute of Economics and Management

Faculty of Management and Logistics

Air Transportation Management Department

Major (specialty): 275 “Air Transportation Technology”

APPROVED BY
Head of the Department
_____D. O. Shevchuk
“_____”_____2020

TASK

of completion the master thesis

Mezei Vasyl Bohdanovich

1. Theme of the master thesis entitled “Organization and technology of vaccine delivery to Ukraine” was approved by a decree of the Rector order № 2026/st. of October 16, 2020.
2. Term performance of thesis: from October 05, 2020 to December 31, 2020.
3. Initial data required for writing the master thesis: general characteristics of special cargoes and their transportation; conditions for the creation of transport schemes for the delivery of special goods; features of transportation of biological cargoes; technology of delivery of biological materials and requirements for their packaging; countries where the vaccine is available, countries where it is being developed, their specifications (Covid-19 vaccine).
4. Content of the explanatory notes: introduction, theoretical part, analytical part, design part, conclusions and appendices.
5. List of mandatory graphic materials: the cost of the process itself, how much the airline will take, how much it will cost, I do not know there, a special "packaging" of biological materials for proper transportation, something like that.

Choosing aircraft in the airline, calculate 2-3 options for aircraft and choose the best for transportation. An airline is a system that has the same characteristics as any other system. One of the most important is integrity - each subsystem is controlled from the top. This is ensured by means of communication, which is also an important parameter of the system. On the other hand, the organization has its limits that limit it from the environment. For the aviation industry, there are the vast majority of factors that affect its performance, such as competitors, customers, rules, and so on.

6. Planning calendar

№	Assignment	Deadline for completion	Mark on completion
1.	Collection and processing of statistical data	05.10.2020	done
2.	Writing of the theoretical part	16.10.2020	done
3.	Writing of the analytical part	26.10.2020	done
4.	Writing of the design part	16.11.2020	done
5.	Writing of the introduction and summary	26.11.2020	done
6.	Execution of the explanatory note, graphic matters and the presentation	02.12.2020	done

7. Given date of the task: October 05, 2020.

Supervisor of the master thesis: Ivannikova V.Yu., PhD, Associate professor

Task was accepted for completion: Mezei V.B.

REPORT

Explanatory note to the diploma project “Organisation and technology of vaccine delivery to Ukraine” consists of 139 pages, 43 figures, 5 tables, 2 Appendix and 62 sources used.

Key words: AIRLINE, VACCINE, COVID-19, DELIVERY, STRATEGY, ADR, DANGEROUS GOODS, INVERSMENT ANALYSIS, COMPETITION, WIZZ AIR, UKRAINE INTERNATIONAL AIRLINES, COMPETITIVE FORCES, SWOT ANALYSIS, COVAX.

Object of study: organisation and technology of vaccine delivery to Ukraine.

Subject of study: calculation of the cost of delivery of the first batch of covid 19 vaccine to Ukraine.

Purpose of thesis: analysis for choosing an airline that has a good name in the aviation market that has experience in the transportation of dangerous goods and so that the delivery of the vaccine to Ukraine would be at the most favorable position for 2020.

The master’s thesis actuality: the relevance of robots for 2020-2021, taking into account the best airlines at the moment, as well as the aircraft that will be involved.

Recommendations: materials of the work can be used in further research on related topics. In case of using the materials of work, the source should be provided.

Projected assumptions about the object of study: an experienced airline in the transportation of dangerous goods, the optimal calculation of fuel for the aircraft, the choice of the vaccine against covid-19, the delivery of all this in the most optimal and profitable way for Ukraine.

CONTENTS

LIST OF SYMBOLS

ISO – International Organization for Standardization

NPAAC – National Pathology Accreditation Advisory Council

FTK – Freight Tonne-Kilometres

GDP – Gross Domestic Product

IAG – International Airlines Group

IOSA –IATA Operational Safety Audit

IRR – Internal Rate of Return

MBM – Market Based Measure

NPV – Net Present Value

PI – Profitability Index

GMO – Genetically Modified Organism

UIA – Ukraine International Airlines

US – United States

USD – United Stated dollars

VFR – Visiting friends and relatives

GM - Genetically Modified

UN - United Nations

EU - European Union

EU - European Union

IATA – International Aviation Transport Association

ICAO – International Civil Aviation Organization

INTRODUCTION

Air Transportation Management Department				NAU 20.05.50. 001 EN			
Researcher	Mezey V.				Letter	Sheet	Sheets
Supervisor	Ivannikova V.Yu.				D	10	2
Normative Supervisor	Shevchenko Yu.V.			INTRODUCTION	FTML 275 ОП- 202Ма		
Head of the Department	Shevchuk D.O.						

Relevance of the topic. The search for a viable COVID-19 vaccine continues around the world, but another pressing issue is already beginning to come to the fore: how to transport billions of doses from factories to hospitals. The European Union, as well as the United States, Britain, China and many other countries, have already entered into preliminary agreements with major pharmaceutical companies to ensure sufficient vaccine production capacity as soon as it becomes available.

While Europe boasts significant vaccine production potential and the block's new Vaccination Strategy aims to oblige companies to provide treatment in the EU, a logistical collapse could occur if politicians are not prepared properly.

Vaccines need to be transported according to strict regulations, under temperature-controlled conditions to ensure their quality, and they must arrive at their destination within a certain time frame to be effective.

According to IATA, it would take 8,000 Jumbo Jet 747 freighters to transport just one batch of vaccine to an estimated 7.8 billion people on the planet. Companies currently have just over 400 such planes in their fleet worldwide. In addition to the problems with air travel, there is also the issue of security.

The vaccine - which will be an extremely valuable commodity - will have to be shipped to every corner of the planet, and IATA warns that tampering and theft will become inherent problems.

Road transport will also be a critical factor in delivery, but the International Road Transport Union and the European Transport Workers' Federation continue to warn that Europe suffers from a lack of safe and secure parking spaces for trucks that could jeopardize delivery.

IATA recognizes that air cargo will only be part of the supply chain and other modes of transport will play a role in door-to-door delivery of vaccine, especially in developing countries. But current national government policies will limit distribution efforts, especially when it comes to border controls and quarantine measures for key workers such as ground crew, truck drivers, and sailors.

The European Commission has called on EU member states to sign a joint document on border measures to harmonize the bloc's approach to quarantine and travel criteria.

Object of study. Cargo transportation of dangerous goods to Ukraine.

Subject of study. Thesis is devoted to the study environment of International Airlines in order to define new strategy for the fastest and the chepest cost of delivery of COVID-19 vaccine to Ukraine.

Methods of study. During the thesis preparation, different sources of data have been used. The work is based primarily on secondary data, while it provides an extensive number of sources due to popularity of this target in the literature. Meanwhile, the primary data will be mainly used in the design part of the work, while it should be based on the case study, active research how much vaccines need to be bought, how much money will the state need, the calculation of the cost of flights by different aircraft, the cost of the process, how much will the airline, how much will it cost, special "packaging" of biological materials for proper transportation. Development of optimal vaccine delivery schemes.

As a result of this work it was proposed to create the most relevant way of COVID-19 vaccine delivery to Ukraine and this project can be updated with more related data and it can be presented more detailed plan.

The practical significance of the results. The following work can create new business model on Ukrainian aviation delivery market and give great influence on ways of delivery of vaccines to Ukraine. By the way of creation the cheapest and the fastest way of delivery.

1. THEORETICAL PART

1.1. General characteristics and transportation of special cargoes

The official definition is the following: “Articles or substances which are capable of posing a hazard to health, safety, property or the environment and which are shown in the list of dangerous goods [published] in the ICAO Technical Instructions, or which are classified according to these Instructions.”

There is a wide range of dangerous goods, some of them being familiar (detergents, lacquers, paints, gasoline, perfumes, aerosols, lithium cells or batteries, phones for instance). We carry them, store them or use them, often in our daily activity, in the personal or professional life. In flight, these items are subject to temperature, pressure, vibration, acceleration which can be very different than the conditions of storage or use at home.

In order to take into account this specific environment and ensure the safety of the flight, the regulation introduces limitations or prohibitions for the transport of these items.

The most widely applied regulatory scheme is that for the transportation of dangerous goods. The United Nations Economic and Social Council issues the UN Recommendations on the Transport of Dangerous Goods, which form the basis for most regional, national, and international regulatory schemes. For instance, the International Civil Aviation Organization has developed dangerous goods regulations for air transport of hazardous materials that are based upon the UN model but modified to accommodate unique aspects of air transport. Individual airline and governmental requirements are incorporated with this by the International Air Transport Association to produce the widely used IATA Dangerous Goods Regulations (DGR). Similarly, the International Maritime Organization (IMO) has developed the International Maritime Dangerous Goods Code ("IMDG Code", part of the International Convention for the Safety of Life at Sea) for transportation of dangerous goods by sea. IMO member countries have also developed the HNS Convention to provide compensation in case of dangerous goods spills in the sea.

The Intergovernmental Organisation for International Carriage by Rail has developed the regulations concerning the International Carriage of Dangerous Goods by Rail ("RID", part of the Convention concerning International Carriage by Rail). Many individual nations have also structured their dangerous goods transportation regulations to harmonize with the UN model in organization as well as in specific requirements.

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) is an internationally agreed upon system set to replace the various classification and labeling standards used in different countries. The GHS uses consistent criteria for classification and labeling on a global level.

Dangerous goods are divided into nine classes (in addition to several subcategories) on the basis of the specific chemical characteristics producing the risk.

Note: The graphics and text in this work representing the dangerous goods safety marks are derived from the United Nations-based system of identifying dangerous goods. Not all countries use precisely the same graphics (label, placard or text information) in their national regulations. Some use graphic symbols, but without English wording or with similar wording in their national language. Refer to the dangerous goods transportation regulations of the country of interest.

‘Dangerous goods’ are materials or items with hazardous properties which, if not properly controlled, present a potential hazard to human health and safety, infrastructure and/ or their means of transport.

The transportation of dangerous goods is controlled and governed by a variety of different regulatory regimes, operating at both the national and international levels. Prominent regulatory frameworks for the transportation of dangerous goods include the United Nations Recommendations on the Transport of Dangerous Goods, ICAO’s Technical Instructions, IATA’s Dangerous Goods Regulations and the IMO’s International Maritime Dangerous Goods Code. Collectively, these regulatory regimes mandate the means by which dangerous goods are to be handled, packaged, labelled and transported.

Regulatory frameworks incorporate comprehensive classification systems of hazards to provide a taxonomy of dangerous goods. Classification of dangerous goods is broken down into nine classes according to the type of danger materials or items present:

Class 1 - Explosives

Explosives are materials or items which have the ability to rapidly conflagrate or detonate as a consequence of chemical reaction.

DGI are proficient in handling explosives, Class 1 Dangerous Goods. DGI have the ability to service all customer requests pertaining to the logistics of explosives; packing, packaging, compliance, freight forwarding and training.

Reason for Regulation

Explosives are capable by chemical reaction of producing gases at temperatures, pressures and speeds as to cause catastrophic damage through force and/or of producing otherwise hazardous amounts of heat, light, sound, gas or smoke

Sub-Divisions:

Division 1.1: Substances and articles which have a mass explosion hazard;

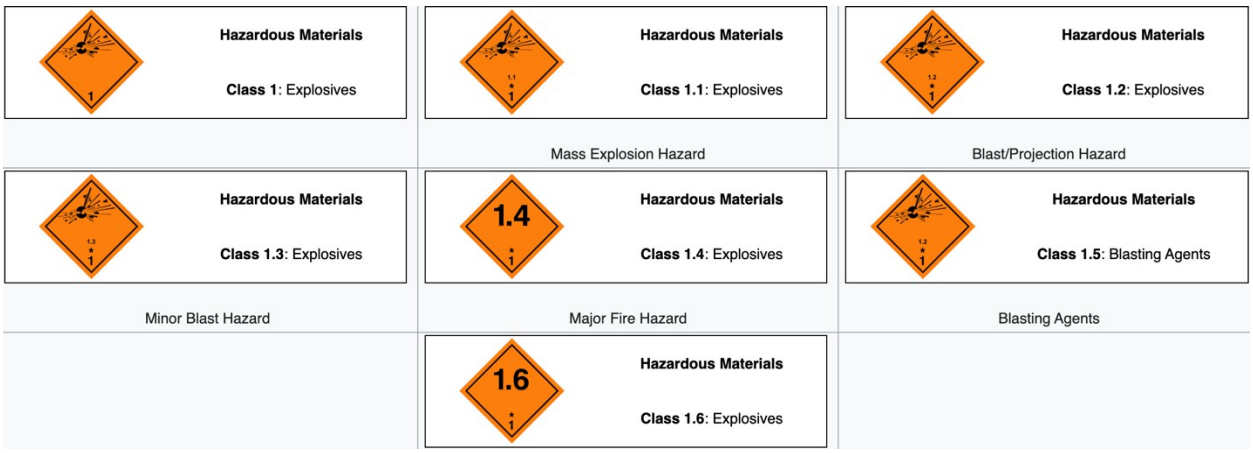
Division 1.2: Substances and articles which have a projection hazard but not a mass explosion hazard;

Division 1.3: Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both;

Division 1.4: Substances and articles which present no significant hazard; only a small hazard in the event of ignition or initiation during transport with any effects largely confined to the package;

Division 1.5: Very insensitive substances which have a mass explosion hazard;

Division 1.6: Extremely insensitive articles which do not have a mass explosion hazard.



Pic 1.1 Classification and labeling of dangerous goods

Commonly Transported Explosives

Ammunition/cartridges, Fireworks/pyrotechnics, Flares, Blasting caps / detonators, Fuse, Primers, Explosive charges (blasting, demolition etc), Detonating cord, Air bag inflators, Igniters, Rockets, TNT / TNT compositions, RDX / RDX compositions, PETN / PETN compositions.

Class 2: Gases

Gases which are compressed, liquefied or dissolved under pressure as detailed below. Some gases have subsidiary risk classes; poisonous or corrosive.

- Flammable Gas: Gases which ignite on contact with an ignition source, such as acetylene, hydrogen, and propane.

- Non-Flammable Gases: Gases which are neither flammable nor poisonous. Includes the cryogenic gases/liquids (temperatures of below -100 °C) used for cryopreservation and rocket fuels, such as nitrogen, neon, and carbon dioxide.

- Poisonous Gases: Gases liable to cause death or serious injury to human health if inhaled; examples are fluorine, chlorine, and hydrogen cyanide.

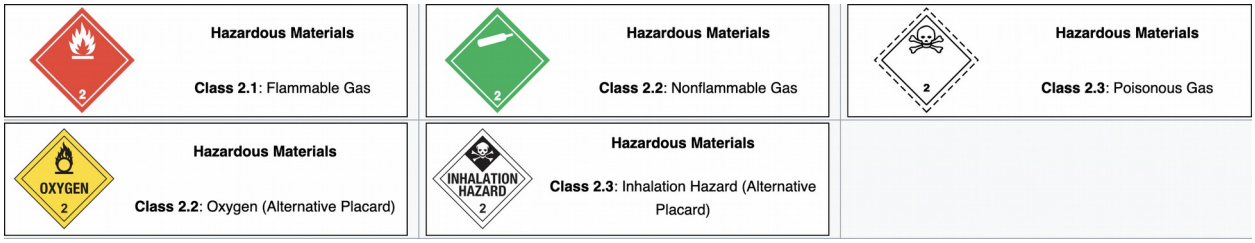


Fig.1.2 Classification and labeling of dangerous goods

Class 3: Flammable Liquids

Flammable liquids included in Class 3 are included in one of the following packing groups:

- Packing Group I, if they have an initial boiling point of 35°C or less at an absolute pressure of 101.3 kPa and any flash point, such as diethyl ether or carbon disulfide;
- Packing Group II, if they have an initial boiling point greater than 35°C at an absolute pressure of 101.3 kPa and a flash point less than 23°C, such as gasoline (petrol) and acetone;
- Packing Group III, if the criteria for inclusion in Packing Group I or II are not met, such as kerosene and diesel.

Note: For further details, check the Dangerous Goods Transportation Regulations of the country of interest.

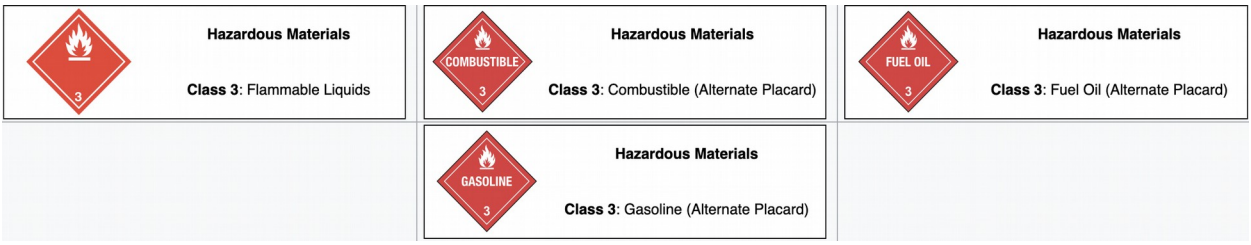


Fig. 1.3 Classification and labeling of dangerous goods

Class 4: Flammable Solids

- Flammable Solids: Solid substances that are easily ignited and readily combustible (nitrocellulose, magnesium, safety or strike-anywhere matches).

- Spontaneously Combustible: Solid substances that ignite spontaneously (aluminium alkyls, white phosphorus).

- Dangerous when Wet: Solid substances that emit a flammable gas when wet or react violently with water (sodium, calcium, potassium, calcium carbide).

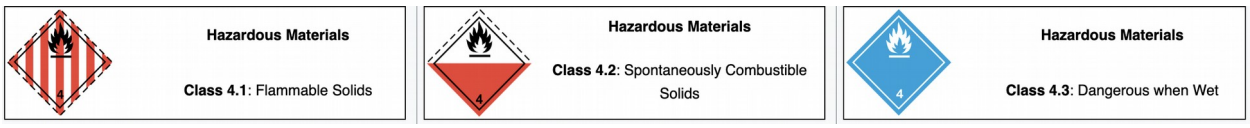


Fig. 1.4 Classification and labeling of dangerous goods

Class 5: Oxidizing Agents and Organic Peroxides

- Oxidizing agents other than organic peroxides (calcium hypochlorite, ammonium nitrate, hydrogen peroxide, potassium permanganate)

- Organic peroxides, either in liquid or solid form (benzoyl peroxides, cumene hydroperoxide).

Fig. 1.5 Classification and labeling of dangerous goods

Class 6: Toxic and Infectious Substances

Toxic substances which are liable to cause death or serious injury to human health if inhaled, swallowed or by skin absorption (potassium cyanide, mercuric chloride).

(Now PGIII) Toxic substances which are harmful to human health (N.B this symbol is no longer authorized by the United Nations) (pesticides, methylene chloride).

Biohazardous substances; the World Health Organization (WHO) divides this class into two categories: Category A: Infectious; and Category B: Samples (virus cultures, pathology specimens, used intravenous needles).

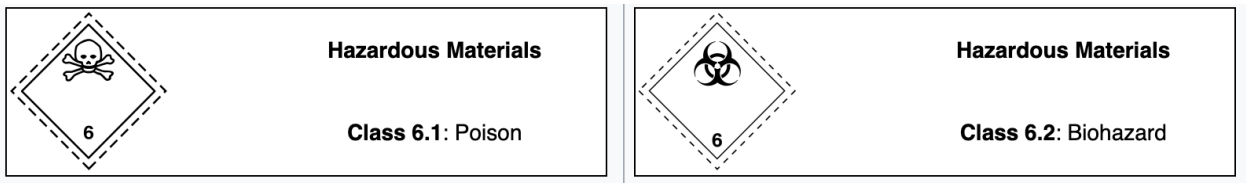


Fig. 1.6 Classification and labeling of dangerous goods

Class 7: Radioactive substances

Radioactive substances comprise substances or a combination of substances which emit ionizing radiation (uranium, plutonium).

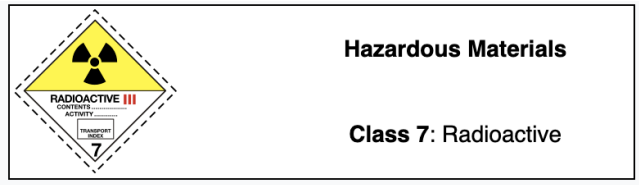


Fig. 1.7 Classification and labeling of dangerous goods

Class 8: Corrosive substances

Corrosive substances are substances that can dissolve organic tissue or severely corrode certain metals:

- Acids: sulfuric acid, hydrochloric acid;
- Alkalis: potassium hydroxide, sodium hydroxide.

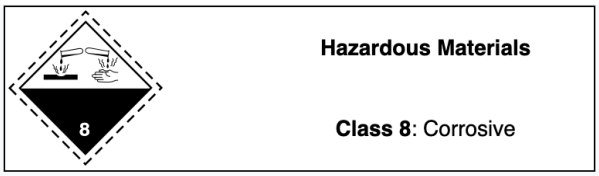


Fig. 1.8 Classification and labeling of dangerous goods

Class 9: Miscellaneous

Hazardous substances that do not fall into the other categories (asbestos, air-bag inflators, self inflating life rafts, dry ice).

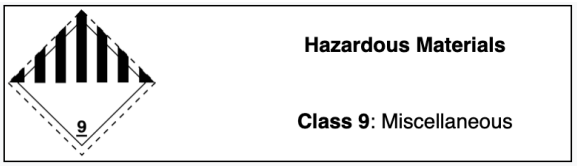


Fig. 1.9 Classification and labeling of dangerous goods

Miscellaneous dangerous goods are substances and articles which during transport present a danger or hazard not covered by other classes. This class encompasses, but is not limited to, environmentally hazardous substances, substances that are transported at elevated temperatures, miscellaneous articles and substances, genetically modified organisms and micro-organisms and (depending on the method of transport) magnetized materials and aviation regulated substances.

DGI are proficient in handling miscellaneous dangerous goods, Class 9 Dangerous Goods. DGI have the ability to service all customer requests pertaining to the logistics of miscellaneous dangerous goods; packing, packaging, compliance, freight forwarding and training.

Reason for Regulation

Miscellaneous dangerous goods present a wide array of potential hazards to human health and safety, infrastructure and/ or their means of transport.

Transport documents

One of the transport regulations is that, as an assistance during emergency situations, written instructions how to deal in such need to be carried and easily accessible in the driver’s cabin. A license or permit card for hazmat training must be presented when requested by officials.

Dangerous goods shipments also require a special declaration form prepared by the shipper. Among the information that is generally required includes the shipper's name and address; the consignee's name and address; descriptions of each of the dangerous goods, along with their quantity, classification, and packaging; and emergency contact information. Common formats include the one issued by the International Air Transport Association (IATA) for air shipments and the form by the International Maritime Organization (IMO) for sea cargo.

DANGEROUS GOODS TRANSPORTATION RULES

Dangerous goods are substances that are either not allowed for transportation at all or require a special permission for transportation. A permit can be obtained if the owner and the carrier have the correct documents, have special transport, have drawn up a detailed itinerary, and the delivery of dangerous goods is carried out by specially trained personnel. The main thing that needs to be taken care of is that the substances are safely and securely loaded into special containers or vehicles. Only in this case you can be sure that the dangerous cargo will not be damaged on the way and will not harm anyone.

The Rules for the Carriage of Dangerous Goods by Road (hereinafter referred to as the Rules) determine the procedure, as well as the basic requirements for ensuring the safety of these carriage by road throughout Ukraine and are mandatory for all Ukrainian carriers.

International road transport of dangerous goods is carried out in accordance with the European Agreement on the International Carriage of Dangerous Goods by Road (hereinafter - ADR) and other international agreements of Ukraine.

Dangerous goods are allowed to be transported by road only if they are admitted for carriage in accordance with the requirements of ADR and these Rules and if all requirements for the carriage of such goods are met.

Radioactive materials are transported by road within the territory of Ukraine in accordance with the Rules of Nuclear and Radiation Safety for the Carriage of Radioactive Materials approved by order of the State Committee for Nuclear Regulation of Ukraine No. 18 dated May 23, 2001, registered with the Ministry of Justice of Ukraine on July 13, 2001, No. 591/5782, and these Rules, in the part that is not regulated by the specified document.

The subjects of the transportation of dangerous goods are obliged to use the appropriate type and degree of hazard measures aimed at preventing accidents, and in the event of an accident that has taken place, measures that make it possible to limit the serious consequences of this accident as much as possible.

The TERMS that are used in these Rules have the following meaning:

A tank truck is a specialized vehicle that, due to its design and equipment, is intended for the transport of liquids, gases or powdery or granular substances and includes one or more built-in tanks.

Multi-element gas container - a container that consists of elements connected to each other by a manifold and installed in a frame. The elements of a multi-element gas container are: cylinders, tubes, cylinder connections, pressure drums, as well as tanks intended for the carriage of gases of hazard class 2 with a capacity of over 450 liters.

Large container - a container with an internal volume of over 3 cubic meters.

Built-in tank - a tank that has a capacity of over 1000 liters and is permanently installed on a vehicle (which in this case becomes a tank truck) or is an integral part of the frame of such a vehicle.

Large-sized packaging - a container that consists of an outer container that contains products or an inner container intended for mechanized processing, has a net weight of over 400 kg or a capacity of over 450 liters and its volume does not exceed 3 cubic meters.

Open container - an open top container or container based on a platform.

Open vehicle - a vehicle, the platform of which is equipped only with sides.

Responsible for filling - a legal or natural person who loads dangerous goods into a tank (tank truck, demountable tank, portable tank or tank container) and (or) a vehicle, large or small container for the carriage of dangerous goods in bulk (in bulk), as well as into a battery vehicle or multi-element gas container.

Consignor of dangerous goods - a legal or natural person specified in the shipping documents, who prepares and submits this cargo for transportation.

Waste - any substances, materials and objects that are obtained in the process of human activity and do not have further use at the place of formation or identification and which their owner must dispose of by recycling or disposal.

Packing group is a group to which some substances can be assigned depending on the degree of danger they are characterized by. Packing groups have the following meanings:

packing group I - substances with a high degree of danger;

packing group II - substances with medium hazard;

packing group III - substances with a low degree of danger.

Closed container - container with a solid shell, which has a rigid roof, rigid side and end walls and a bottom. This term includes a container with a roof that can be opened and that can be closed during transport. Closed vehicle means a vehicle with a body that can be closed.

Removable tank means any tank other than a built-in tank (portable tank, tank container or part of a vehicle - batteries or multi-element gas container) with a capacity of more than 450 liters, which is intended for the carriage of goods without reloading and is usually subject to handling only in an empty state. Container is an item of transport equipment (cage or other similar device) that:

a) intended for multiple use and has a permanent purpose;

b) specially designed to facilitate the carriage of goods by one or more modes of transport without intermediate reloading of goods;

c) equipped with devices that facilitate its securing and reloading from one vehicle to another;

d) designed for easy loading and unloading Intermediate bulk container - rigid or flexible portable packaging that has a capacity: not more than 3.0 m3 (3000 l) for solids and liquids of packing groups II and III:

- not more than 1.5 cubic meters for packing group I solids, if soft, rigid plastic, stacked, cardboard or wooden intermediate bulk containers are used;

- not more than 3.0 cubic meters for solids of packing group I, if medium-duty metal containers for bulk goods are used;

- no more than 3.0 cubic meters for radioactive material of the 7th hazard class.

United Nations Number is a four-digit identification number for a substance or article in accordance with the United Nations Recommendations on the Transport of Dangerous Goods. Model Regulations (ST / SG / AC.10 / 1 / Rev.13).

The nominal capacity of the vessel is the nominal volume of the hazardous substance that is placed in the vessel, expressed in liters. In the case of compressed gas cylinders, the nominal capacity of the cylinder is the capacity when filled with water.

Recipient of dangerous goods is a legal or natural person specified in the shipping documents who receives dangerous goods from the carrier.

A heating device is a device that directly uses liquid or gaseous fuel and does not use heat that is removed from the vehicle engine.

Tank container operator (portable tank) - a legal or natural person in whose name the registered tank container (portable tank).

Package - A casing that is used by a single shipper to combine one or more packages into a single unit in order to facilitate loading and unloading operations.

Bulk transportation - transportation of unpackaged solids and products in vehicles or containers. This term does not apply to packaged goods and substances that are transported in tanks.

Carrier of dangerous goods - a legal or natural person who carries out the transportation of dangerous goods in a certain way.

Portable tank - tank for combined transport, which has a capacity of over 450 liters and consists of a body with service equipment required for the transport of hazardous substances. This tank must be capable of loading and unloading without removing its structural equipment. It must ensure loading, reloading and unloading in a filled state.

Full load - any cargo of one shipper, during the transportation of which a vehicle or a large container is loaded only with this cargo and all loading or unloading operations of which are carried out in accordance with the instructions of the shipper or consignee.

1.2. Conditions of transport schemes creation for special cargo delivery

It is obvious that ensuring fast delivery of goods will require the use of faster modes of transport, such as air, which will increase the cost of delivery. Improving the quality of delivery also very often leads to an increase in the cost of transportation. There is an increase in the share of goods that require special conditions of carriage, as well as increasing requirements for the global transport system. Transportation of special cargo with the participation of air transport is currently of great importance, both for the transport complexes of countries and for the world economy as a whole. Using the speed of air transport, TEP has also significantly expanded the range of its services.

Offers for the transportation of special cargo are widely represented in the market of freight forwarding services. That is, the concept of special cargo is widely used in the practice of carriers and TEP in the organization of transportation of goods by different modes of transport

The specific properties of special cargo significantly affect the entire process of organization and technology of transportation, they can be aggressive towards other goods, vehicles and warehouses. Aggressive properties can damage other loads, damage vehicles and warehouses, and create hazards during transportation.

On the other hand, many categories of special loads are exposed to aggressive properties. The consequences of exposure to aggressive properties can be deterioration or loss of cargo.

The presence of specific properties in the cargo, in contrast to general cargo, contributes to the creation of risky situations in the process of transportation. When transporting them, it is necessary to comply with the requirements for acceptance of cargo for transportation, packaging, processing and loading, documentation, etc.

When performing TEP functions of the organizer of cargo delivery in a mixed connection, the components of the delivery cost and their ratio change greatly, and in the structure of the delivery cost it is the aviation tariffs that are the largest part of the costs. TEP, as the organizer of cargo delivery, becomes the generator of tariffs for delivery of cargoes in the mixed connection. The nature of the cargo also significantly affects the economic efficiency of forwarding and pricing.

When delivering special cargo, transport processes can have very serious consequences of exposure to risks - even to the complete loss of cargo properties, or negative impact on the environment, vehicles and other goods, and the probability of consequences higher than the delivery of general cargo.

Also, in calculating the economic results of ideal and optimal delivery, the author did not pay attention to the quantitative assessment of the impact of risks associated with the processes of transportation of goods. According to the author, the greatest impact on the economic results of supply have such stages of the supply chain as ordering, customs clearance and acceptance of goods. Therefore, the organization of the activities of TEP, engaged in the delivery of special goods, has certain differences, more diverse transport risks and requires a separate study.

The analysis of the freight market with air transport, the specific conditions of the movement and storage of different types of special cargo, particularly those that have perishable and hazardous properties, systematically sources of risk analysis made of the possible consequences of the occurrence of risk events and proved their effect economic financial and economic activities of the airport.

Effectively manage these risks cannot be transmission or ignoring risks, as it can lead to disastrous consequences (complete loss of consumer product quality, damage to vehicles and other goods, etc.). Defined risk group requires management decisions aimed at preventing risk events guaranteed at all times due to increased shipping costs for organizations of all delivery processes. On the other hand, these costs may not exceed, as a client opportunities and market price of delivery.

Highlight traffic parameters, factors that affect the costs and revenues of airport in the delivery of special goods that have both dangerous and perishable properties. It was found that the most significant impact on the efficiency of delivery are characteristics of loading units, the size and quantity of cargo parties, tariff rates, which largely operates freight forwarding company.

That was proposed the system of special categories of cargo delivery performance management, that is formed the subsystem of expanses performance, risk performance and fees and tariffs performance. In sum all these performances allow to control the process of delivery by each stage and providing the given level of profitability.

The paper detailed data components and subsystems of the content delivery options special cargo in car and aircraft traffic. Management options loading units in the organization of special cargo delivery enables on the one hand to manage risks on the other hand the cost of shipping cargo that will determine the thrust of calculating the cost of delivery and affordable prices and thereby ensure the economic efficiency of the airport during the planning period. The ability to design cost of airport in the chain of delivery of special cargo by selecting combinations of traffic makes it possible to increase the yield of special cargo delivery and flexibility to change the price of FCC services, depending on the competitive situation and fluctuations in demand.

The study of international experience of civil aviation in terms of legal transport of dangerous goods allowed to identify legislation needed for priority entry to Ukraine in order to regulate the transport complex of the country on the

Transport of special cargo: the law on transportation of special cargo and insurance law transport of special cargo, developed taking into account the recent recommendations of the United Nations, ICAO and other international organizations. The convergence of national transport legislation with special cargo transportation with the relevant international legal instruments must, above all, to integrate the transport system of Ukraine in the global improvement of the operational efficiency of international transport routes on time, cost and level of service.

Analysis of regulations governing the transport processes of special categories of goods in the country, found that in civil aviation are mostly outdated standards, designed for processes organization of special categories of cargo of aircraft using imperfect types of ground equipment. To improve traffic safety in air transport it is proposed to carry out the development and implementation of scientifically based standards on procedures related to the transport of specific categories of goods, in the form of manuals, instructions and guidance on the technical characteristics of the types of aircraft operated, machinery, equipment, modern requirements safety in air transport and training of aviation personnel

Currently, the issue of control of the organization of transportation of special categories of goods and their impact on the safety of air transport are at the junction of the two administrative structures Civil Aviation Committee, Office of Aviation Security and Safety Inspectorate. As a result, the problem of transportation of special categories of goods are overlooked. To streamline the organization of transportation of special categories of goods in the thesis work the creation of a separate structural unit of the Committee of civil aviation and air transport is proposed.

The introduction of these structures will provide:

- permanent control over special categories of cargo transportation in the form of specialized inspection;
- development of compliance and regulatory framework;

– coordination for training and licensing of aviation professionals and shippers;
– analysis of factors influencing the transport of special categories of goods on the safety of air transport;
– guidelines for production activities;
– provide information to cargo shippers, agents, air passengers;
– recording of special categories of traffic loads.

1.3. Features of biological cargo transportation

The transport of biological materials, including infectious substances, is covered by international, regional or national regulations that are updated on a regular basis and are widely accessible via the internet, or through commercial and regulatory transportation affiliates.

The international regulations for the transport of infectious substances by any mode of transport are based upon the Recommendations on the Transport of Dangerous Goods made by the Subcommittee of Experts on the Transport of Dangerous Goods (UN SCETDG), a subcommittee of the United Nations Economic and Social Council. The Recommendations are presented in the form of Model Regulations covering air, rail, road, sea and also include international mail. The World Health Organization (WHO) guidance document on "Transport of Infectious Substances" summarising the different transport regulations is regularly updated. Countries, other international organisations, international treaties and conventions such as the International Air Transport Association (IATA), the World Customs Organization (WCO), the Convention on International Trade in Endangered Species (CITES), and the Convention on Biodiversity (CBD), especially the Nagoya Protocol, provide additional guidance and regulations that should be considered in planning the transportation of biological materials.

All personnel involved in the packaging, labelling and shipping of biological materials must be appropriately trained, certified, competent and knowledgeable of the relevant national, regional and international regulations. Biological materials

should be transported to ensure a rapid and reliable system for delivery to the recipient using individuals such as professional logistics service providers that are trained and competent in the shipping and transportation process.

The efficient transport and transfer of biological materials requires co-ordination between the sender (shipper, consignor), the logistic providers, the carrier and the recipient (consignee) to ensure safe transport and arrival on time and in proper condition.

Classifiacation and categorisations

When transporting biological materials, the sender must determine whether the material should be classified as dangerous goods or not. Dangerous goods (hazardous materials, HAZMAT) are materials that can harm humans, animals and other living organisms, property, or the environment, and their transport is regulated by United Nations (UN) regulations.

Table1.1

Classification of packing of biological dangerous goods

Dangerous goods classifications	**Categorisation**	**Proper shipping name**	**UN number**	**Packing instruction/packaging requirements**
Class 6, Division 6.2	Category A	Substance, affecting humans	UN 2814	P620
		Substance, affecting animals	UN 2900	
Class 6, Division 6.2	Category B	Biological substance, Category B	UN 3373	P650
Class 6, Division 6.2	Exempt human/animal specimens	Exempt human/animal specimens	N/A	Triple packaging
not subject to dangerous goods regulations(DGR)	Biological materials not subject to DGR	N/A	N/A	N/A
Class 9	GMMOs and GMOs not classified as Category A or B	Genetically modified organisms/ microorganisms;	UN 3245	P904 (ICAO/IATA PI 959), IBC99

The sender (shipper, consignor) is responsible for providing the applicable documentation (e.g. certifications, permits) required by the national authorities of the countries of export, transhipment and import as well as ensuring that the shipment also complies with all other applicable regulations.

Dangerous goods are assigned a UN number and proper shipping name based on the classification of the dangerous goods. The transport regulations assign a packing instruction against the UN number and proper shipping name, to specify the packaging/packing method to ensure that the dangerous goods do not pose a hazard in transport. Of the biological materials are classified as dangerous goods and are assigned to UN 2814, UN 2900, UN 3373, or UN 3291, as appropriate. In addition, Genetically Modified Microorganisms (GMMOs) and Genetically Modified Organisms (GMOs) are classified as Class 9 and assigned to UN 3245 if they are not classified as Category A or Category B.

Category A

Substance is an infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals. Assignment to UN 2814 or UN 2900 (see Table 1) must be based on the known medical history of the animal(s), signs and individual circumstances of the specimen source, and endemic local disease conditions, or professional judgement concerning individual circumstances of the source, human or animal. Some organisms are considered Category A only when in culture form (e.g. Bacillus anthracis, foot and mouth disease virus). Indicative examples of substances that meet these criteria. The table is not exhaustive. Infectious substances, including new or emerging pathogens, which do not appear in the Table but which meet the same criteria must be assigned to Category A. In addition, if there is doubt as to whether or not a substance meets the criteria it must be assigned to Category A.

Some infectious substances may have a high economic or trade impact on specific countries should there be release to the environment. Therefore, other

infectious substances may be added to the list by individual countries (e.g. cultures of Newcastle disease virus where the virus is exotic to the country or region).

Medical or clinical waste containing Category A infectious substances shall be assigned to UN 2814 or UN 2900 as appropriate. Solid medical waste containing Category A infectious substances generated from the medical treatment of humans or veterinary treatment of animals may be assigned to UN 3549. It should be noted that Medical or clinical waste from bio-research or liquid waste must not be assigned to UN3549.

Category B

Biological materials containing pathogens which do not meet the criteria for Category A (i.e. do not cause lifethreatening disease to humans or animals) shall be assigned to Category B (UN 3373)

Typically a specimen with a high likelihood to contain pathogenic organisms shipped for disease diagnosis (e.g. confirmatory diagnosis of suspected or clinical cases, specimens for differential diagnosis, such as blood samples for classical swine fever or sheep pox diagnostics or throat samples from chickens for avian influenza) can be assigned to Category B.

It is important to note that unlike cultures, patient specimens which may contain infectious microorganisms listed as „cultures only" in Table 3 (Category A infectious substances) do not require Category A transport practices. For these specimens Category B transport practice should be applied. In this case, although directly collected specimens (e.g. serum) can be shipped as Category B, pure cultures of the same pathogens must follow the requirements of Category A due to the characteristics of the specific organism. Some examples are classical swine fever virus isolates or sheep pox virus isolates (see Table 3). Specimens from animals intentionally infected with Category A pathogens must be sent as Category A, even if they are assigned to Category A (cultures only). Shipments of cultures of non-category A agents can be assigned to Category B.

Medical or clinical waste containing Category B infectious substances shall be assigned to UN 3291.

Animal specimens for which there is minimal likelihood that pathogens are present can be transported as Exempt Specimens. Examples of specimens in the veterinary field which may be transported as exempt include specimens from surveillance studies, export controls of healthy animals (e.g. certification of freedom from classical swine fever) or determination of immune status of individual animals or populations (post-vaccination). These specimens are not subject to dangerous goods regulations if the specimen is transported in a packaging that will prevent any leakage and that is marked appropriately.

Biological materiarls not subject to Dangerous Good Regulations (DGR).

Based on the known medical history of the animal(s), signs and individual circumstances of the source of the biological materials, and endemic local disease conditions, the following are not subject to dangerous goods regulations, unless they meet the criteria for inclusion in another class (such as Class 9):

- biological materials that do not contain infectious substances
- biological materials containing microorganisms that are non-pathogenic to humans or animals;
- biological materials in a form in which any pathogens present have been neutralised or inactivated such that they no longer pose a health risk;
- environmental specimens (including food and water specimens) that are not considered to pose a significant risk of infection;
- dried blood spots, collected by applying a drop of blood onto absorbent material.

There may be specific regulations in place in some countries for the shipment, export or import of nucleic acids.

A Category A substance is an infectious substance that is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, or a life-threatening or fatal disease in otherwise healthy humans or animals. Infectious substances meeting these criteria that cause disease in humans or both in humans and animals must be assigned to UN 2814. Infectious substances that

cause disease only in animals must be assigned to UN 2900. These are classified under IATA Hazard Class 6.2 and IATA Packing Instruction 602.

Assignment to Category A and the proper shipping name, 'Infectious substances, affecting humans' or 'Infectious substances, affecting animals', must be based on the known medical history and symptoms of the source human or animal, endemic local conditions, or professional judgment concerning individual circumstances of the source human or animal. Indicative examples of substances that meet these criteria are given in Appendix A.

A Category B substance is an infectious substance that does not meet the criteria for inclusion in Category A. Infectious substances in Category B must be assigned to UN 3373, and their proper shipping name is 'Biological Substances, Category B'. Human or animal material including but not limited to excreta, secreta, blood and its components, tissue and tissue fluids, and body parts, being transported for purposes such as research, diagnosis, investigational activities, disease treatment and prevention, are assigned to UN 3373. These are classified under IATA Hazard Class 6.2 and IATA Packing Instruction 650.

Biological products

Biological products are those products derived from living organisms which are manufactured and distributed in accordance with the requirements of appropriate national authorities, which may have special licensing requirements, and are used either for prevention, treatment, or diagnosis of disease in humans or animals, or for development, experimental or investigational purposes related thereto. They include, but are not limited to, finished or unfinished products such as vaccines.

Genetically modified microorganisms and organisms

Genetically modified microorganisms and organisms are microorganisms and organisms in which genetic material has been purposely altered through genetic engineering in a way that does not occur naturally. Those genetically modified microorganisms and organisms that do not meet the definition of an infectious substance shall be assigned to UN 3245 and shipped following Packing Instruction

P904 (ICAO/IATA PI913) – this is not considered further in these guidelines.

Medical or clinical wastes

Medical or clinical wastes are wastes derived from the medical treatment of animals or humans or from bio-research. Medical or clinical wastes containing Category A infectious substances shall be assigned to UN 2814 or UN 2900 as appropriate. Medical or clinical wastes containing Category B infectious substances, or which are reasonably believed to have a low probability of containing infectious substances, shall be assigned to UN 3291 and shipped following Packing Instruction P621 (ICAO/IATA PI622) – this is not considered further in these guidelines.

Patient specimens

These are human or animal materials, collected directly from humans or animals, including, but not limited to, excreta, secreta, blood and its components, tissue and tissue fluid swabs, and body parts being transported for purposes such as research, diagnosis, investigational activities, disease treatment and prevention.

Cultures (laboratory stocks)

Cultures are the result of a process by which pathogens are amplified and propagated in order to generate high concentration, thereby increasing the risk of infection when exposure to them occurs. This definition refers to cultures prepared for the intentional generation of pathogens and does not include cultures intended for diagnostic and clinical purposes.

Cultures are the result of a process by which pathogens are intentionally propagated. This definition does not include human or animal patient specimens as defined below. Cultures may be classified as Category A or Category B, depending on the microorganism concerned.

The following additional definition has been adopted for the 14th edition of the United Nations Model Regulations. ICAO has approved the application of this new text for air transport from 2005, as described in the Addendum No.2 to Doc 9284-AN/905, published in May 2005.

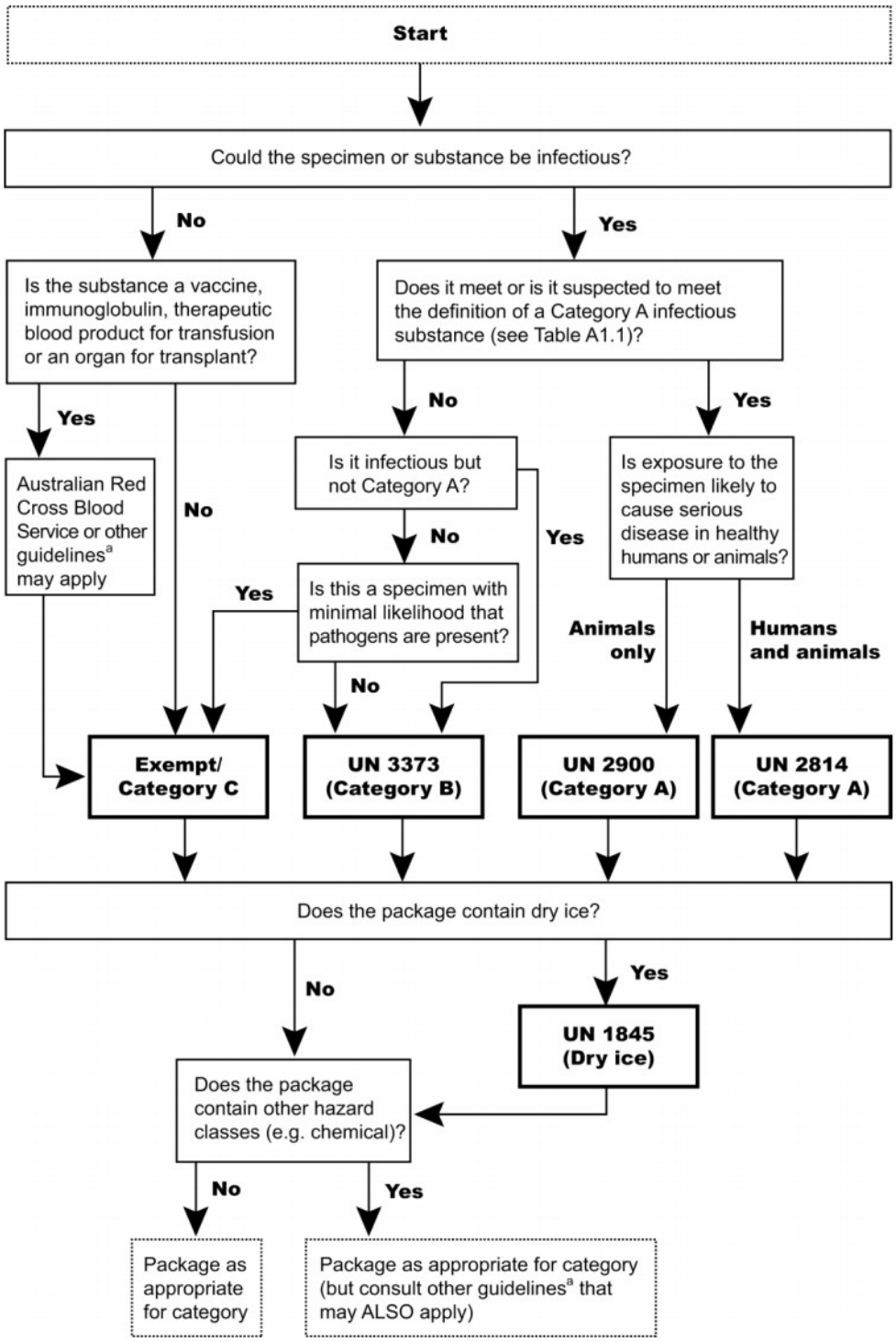


Fig 1.10 Hazard classification flow chart

*Refer to ISBT 128 (November 2006) and NPAAC's Requirements for Procedures Related to the Collection, Processing, Storage and Issue of Human Haemopoietic Progenitor Cel.

1.4. Technology of biological materials delivery and requirements for their packaging

1.4.1 Requirements for biological materials packaging

All biological materials should be packaged and transported in accordance with local, national and international regulations. The procedures should minimise the risk of exposure for those engaged in transportation and should protect the environment and susceptible animal populations from potential exposures. Additionally, ineffective packaging that does not protect specimens or preservatives (e.g. ice) from damage or prevent leakage will likely delay the delivery of the shipment to the laboratory, delaying or preventing critical laboratory analyses from being performed. Biological materials should always be packaged and transported to protect the integrity of the specimens, as well as to avoid cross-contaminating other specimens and environmental contamination. Minimum requirements for the transport of specimens follow the principle of triple packaging, consisting of three layers as described below:

- a primary receptacle;
- a secondary packaging;
- an outer packaging;

of which either the secondary or the outer packaging must be rigid.

A primary receptacle

A primary receptacle, leak-proof for liquids or sift-proof for solids containing the specimen. Primary receptacle(s) must be packed into the secondary packaging with enough absorbent material (e.g. cellulose wadding, paper towels, house hold paper, cotton balls) to absorb all fluid in case of breakage.

Even though the regulations do not prohibit glass, primary receptacles should preferably be nonbreakable. In addition, they must not contain any sharps (e.g. vacutainer with needle), particularly when using soft secondary or outer containers. If screw cap vials are used, they shall be secured by e.g. tape. A flip-top vial must

not be used. Biological materials should always be packaged and transported to protect the integrity of the specimens, as well as to avoid cross-contaminating other specimens and environmental contamination.

A Secondary receptacle

A second durable, leak-proof packaging to enclose and protect the primary receptacle(s) (e.g. sealed plastic bag, plastic container, screw-cap can).

The primary receptacle or the secondary packaging shall be capable of withstanding, without leakage, an internal pressure of 95 kPa (0.95 bar) in the range of –40°C to +55°C (–40°F to +130°F).

Secondary packaging is placed in outer shipping packaging (e.g. sturdy insulated fibre board box) with suitable cushioning material. Outer packaging protects the contents from outside influences, such as physical damage, while in transit.

Due to the highly hazardous nature of the Category A samples the packaging must meet special requirements. The principle of triple packaging applies here, and the transport containers and outer packaging must meet the criteria defined in the relevant regulations. Category A must only be transported in packaging that meets the United Nations class 6.2 specifications, complies with Packing Instruction P620 and have passed specific tests and with UN specification marking as P620. This ensures that strict performance criteria are met; tests for compliance with these criteria include a 9-metre (29.5 feet) drop test, a puncture test, a pressure test and a stacking test. The packages are labelled to provide information about the contents of the package, the nature of the hazard and the packaging standards applied.

- the delivery address (consignee) and sender’s details (shipper), as well as 24/7 emergency contact details including named persons with telephone numbers to guarantee safe delivery;
- the proper shipping name and the UN number;

Proper shipping name	*UN number*
INFECTIOUS SUBSTANCE, AFFECTING HUMANS	*UN2814*
INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only	*UN2900*

Fig 1.11 Proper shipping name

- the Infectious Substance label;

Marking and labelling is as follows (see Appendix B):

This label is only for Category A. This label must not be used when shipping Category B.

Fig 1.12 The Infectious Substance label for Category A

UN specification marking for P620 packaging (printed on the box).

Orientation label, Cargo only label, if required (depending on the Net Weight [kg] of the infectious substance in a P620 box).

The exact details can be found in P620 Packing Instruction

For air transport:

The primary receptacle or secondary packaging must be capable of withstanding, without leakage, an internal pressure of 95 kPa. The primary

receptacle or secondary packaging must also be capable of withstanding temperatures in the range of –40°C to +55°C;

For liquids: the net quantity of infectious substances per one P620 box shall not exceed 50 ml for transport in cargo space of a passenger aircraft; and must not contain more than 4 litres (contain multiple primary receptacles totalling more than 4 litres) for transport on a cargo only aircraft;

For solids: the net quantity of infectious substances per one P620 box shall not exceed 50 g for transport in cargo space of a passenger aircraft, and must not contain more than 4 kg (even if containing multiple primary receptacles totalling more than 4 kg) for transport on a cargo only aircraft. This quantity limit doesn‟t apply for animal parts, organs and whole carcasses.

The three triple packaging principle has to be adopted accordingly using appropriate packaging systems;

The entire package must have been tested and complies with Packing Instruction P620. For further information on marking and labelling of the Category A shipment package, see P620 Packing Instruction for UN Nos 2814 and 2900.

Category B must be transported in a packaging that complies with the requirements of packing instruction P650. The approval of the box by the government is not required, thus UN specification marking is not required.

Marking is as follows:

- packages should be clearly labelled with the delivery address and sender‟s details to guarantee safe delivery in time at the correct destination;

- label with the proper shipping name in letters at least 6 mm high: “BIOLOGICAL SUBSTANCE, CATEGORY B” (Figure 1.13)

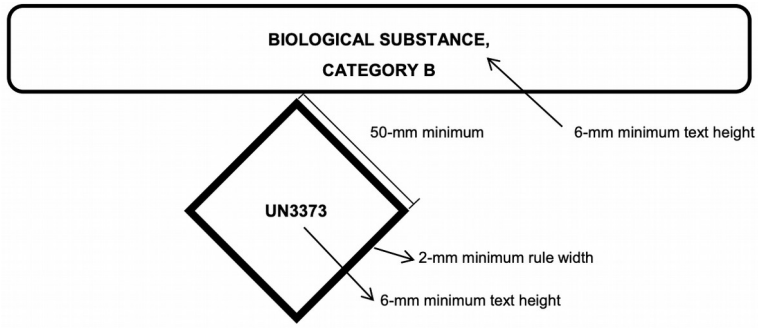


Fig 1.13 UN3373 Mark for category B substances.

- in addition to the proper shipping name, the mark shown below (UN3373 in diamond) is used for shipments of Category B substances. The UN3373 mark must always be visible on the outer packaging.

Additional requirements do apply as for category A for international shipment and air transport. One of the main differences between P650 and P620 is the reduced drop-test to 1.2 meters (4 feet).

For air transport:

- the primary receptacle or secondary packaging must be capable of withstanding, without leakage, an internal pressure of 95 kPa. The primary receptacle or secondary packaging must also be capable of withstanding temperatures in the range of –40°C to +55°C;

- for liquids: no primary receptacle shall exceed 1 litre and the outer packaging must not contain more than 4 litres (contain multiple primary receptacles totalling more than 4 litres);

- for solids: the outer packaging must not contain more than 4 kg. This restriction doesn‟t apply for animal parts, organs and whole carcasses.

The exact details can be found in P650 Packing Instruction for UN No. 3373

Biological materials for which there is a minimal likelihood that pathogens are present are not subject to regulation if the specimen is carried in a packaging which will prevent any leakage and which is marked with the words “Exempt animal specimens”, as appropriate. The triple packaging system must still be applied.

This exemption refers to biological materials that do not contain infectious substances and are therefore not subject to dangerous goods regulations (such as class 6.2) and any packaging requirements, unless they meet the criteria for inclusion in another class (such as class 9).

Note: There may be specific regulations in place in some countries for the shipment, export or import of nucleic acids.

“Overpack” is the term used when one or more packages are combined to form one unit and sent to the same destination by a single shipper. When

refrigerants are used to protect contents, the overpacks may comprise insulated vessels or flasks. Whenever an overpack is used, the required marks and labels shown on the outer packaging must be repeated on the outermost layer of the overpack, except for the UN specification marking on P620. This requirement applies to all infectious substances including Categories A and B. Overpacks are also required to be marked with the word “overpack”.

Combining different categories of infectious substance in a same overpack is permissible however in this case outer labelling should indicate the highest category included in the package.

Refrigerants may be used to stabilise specimens during transport.

Ice, ice packs or dry ice shall be placed outside the secondary receptacle. Wet ice shall be placed in a leak-proof container; the outer packaging or overpack shall also be leak-proof. Dry ice (solid carbon dioxide) must not be placed inside the primary or secondary receptacle because of the risk of explosion. A specially designed insulated packaging may be used to contain dry ice, typically a polystyrene or waxed-treated cardboard box to prevent leakage and maintain temperature. The packaging must permit the release of carbon dioxide gas if dry ice is used and the package (the outer packaging or the overpack) shall be marked “UN 1845” and “Carbon dioxide, solid as coolant” or “Dry ice as coolant” and the weight of the dry ice in Kilograms should also be indicated on the labelling. The package must also bear the Class 9 – Miscellaneous hazard label.

The secondary receptacle shall be secured within the outer package to maintain the original orientation of the inner packages after the refrigerant has melted or dissipated.

If liquid nitrogen is used as a refrigerant, additional requirements have to be followed according to the relevant regulations for dangerous goods (Division 2.2, UN 1977). Information on Dry Shipper is available in p19 of WHO Guidance on regulations for the transport of infectious substances 2017–2018.

1.4.2 Packaging, labelling and documentation requirements for infectious substances in Category B

The triple packaging system continues to apply, including for local surface transport. Testing documents are not required, however. It may be possible to source packagings locally rather than finding an authorized supplier, provided that the packaging manufacturer and the shipper can comply fully with the requirements of P650 (see Figure 1.14).

As for P620, there is no comprehensive list of suppliers of packagings that comply with Packing Instruction P650.

However, an Internet search using a suitable international or national search engine usually provides appropriate information, as well as access to national regulations.

Search phrases such as “UN packaging” and “UN infectious substance packaging” produce extensive results.

Carriers and forwarding agents should also be able to supply details of local suppliers or local companies that can provide such information.

To ensure correct preparation for transport, packaging manufacturers and subsequent distributors shall provide clear instructions to the consignor or persons preparing packages (e.g. patients) on how the packaging should be filled and closed.

For surface transport there is no maximum quantity per package.

For air transport:

• no primary receptacle shall exceed 1 l (for liquids) or 1 kg (for solids)

• the volume shipped per package shall not exceed 4 l or 4 kg.

Provided all the requirements of P650 are met, there are no other transport requirements. P650 incorporates all that is needed to make a shipment for Category B infectious substances.

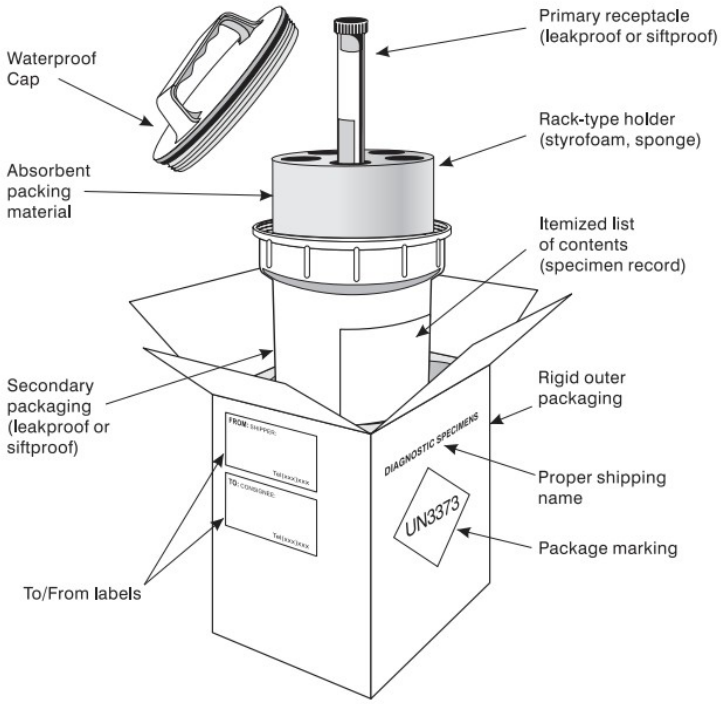


Fig 1.14 Example of the triple packaging system for the packing and labelling of Category B infectious substances

(Kindly provided by IATA, Montreal, Canada)

Marking

Each package shall display the following information:

• for air: the shipper's (sender's, consignor's) name, address and telephone number;

• for air: the telephone number of a responsible person, knowledgeable about the shipment;

• the receiver's (consignee's) name, address and telephone number;

• for air: the proper shipping name ("DIAGNOSTIC SPECIMENS" or "CLINICAL SPECIMENS" or "BIOLOGICAL SUBSTANCE, CATEGORY B");

• temperature storage requirements (optional).

The marking shown in Figure 1.15 is used for shipments of Category B infectious substances.

Minimum dimension: the width of the line forming the square shall be at least 2 mm, and the letters and numbers shall be at least 6 mm high. For air transport, each side of the square shall have a length of at least 50 mm.

Colour: none specified, provided the mark is displayed on the external surface of the outer packaging on a background of contrasting colour and that it is clearly visible and legible.

For surface transport (by road, rail and sea): no other mark is required.

For air transport: the mark shall be shown but with the following additional information: The words “DIAGNOSTIC SPECIMENS” or “CLINICAL SPECIMENS” in letters at least 6 mm high shall be displayed adjacent to the mark From 2007 the name will be “BIOLOGICAL SUBSTANCE, CATEGORY B” for all modes of transport, but this shipping name can be used immediately without contravening the regulations.

Fig 1.15 Marking for infectious substances of Category B

"Overpack" is the term used when several packages are combined to form one unit and sent to the same destination by a single shipper. When refrigerants are used to protect contents, the overpacks may comprise insulated vessels or flasks. Whenever an overpack is used, the required marks and labels shown on the outer packaging must be repeated on the outermost layer of the overpack. This requirement applies to infectious substances in Categories A and B. Overpacks are also required to be marked with the word “overpack”.

Refrigerants

Refrigerants may be used to stabilize infectious substances in Categories A and B during transit. Ice or dry ice shall be placed outside the secondary

receptacle. Wet ice shall be placed in a leak-proof container; the outer packaging or overpack shall also be leak-proof. Dry ice must not be placed inside the primary or secondary receptacle because of the risk of explosions.

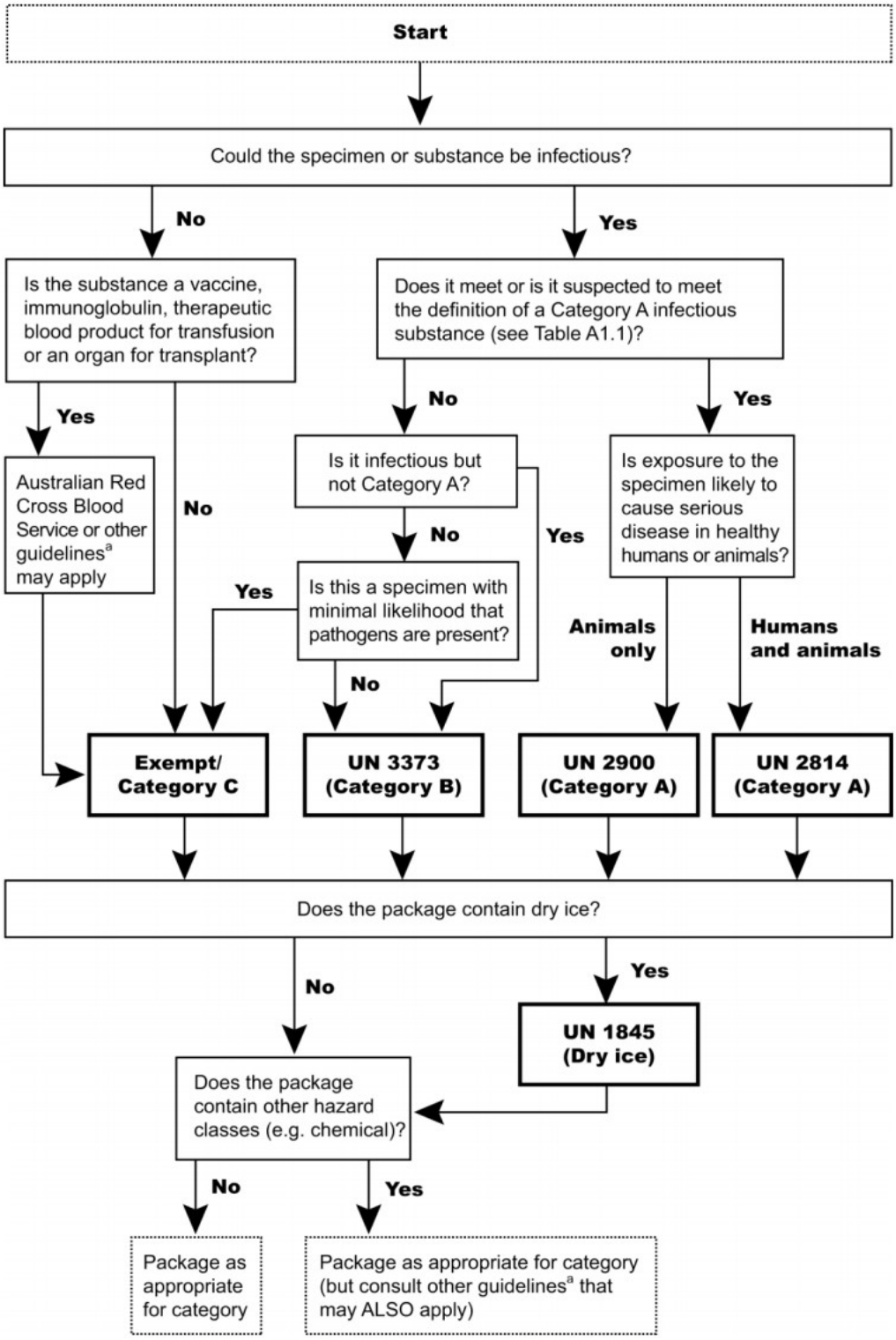


Fig 1.16 Requirements for the Packaging and Transportation

A specially designed insulated packaging may be used to contain dry ice. The packaging must permit the release of carbon dioxide gas if dry ice is used. ICAO/IATA Packing Instruction 904 shall be observed.

The secondary receptacle shall be secured within the outer package to maintain the original orientation of the inner packages after the refrigerant has melted or dissipated. If dry ice is used to ship infectious substances in Category A, the details shall appear on the shipper's Declaration for Dangerous Goods. In addition, the outermost packaging shall carry the hazard label for dry ice and the appropriate marking. If dry ice is used to ship infectious substances in Category B, the package shall be marked "Carbon dioxide, solid" or "Dry ice" - this is not considered further in these guidelines.

If liquid nitrogen is used as a refrigerant, special arrangements shall be made in advance with the carrier. Primary receptacles shall be capable of withstanding extremely low temperatures, and packaging and documentation requirements for liquid nitrogen shall be observed. In particular, the outermost packaging shall carry the hazard label for liquid nitrogen. For air transport, the handling label for cryogenic liquids shall also be affixed (see Figure 6) – this is not considered further in these guidelines.

1.4.3 Documentation

Dangerous goods documentation (including a shipper's declaration) is not required for Category B infectious substances. The following shipping documents are required. To be prepared and signed by the shipper (sender, consignor):

• for international shipments: a packing list/proforma invoice that includes the shipper's and the receiver's address, the number of packages, detail of contents, weight, value (Note: the statement "no commercial value" shall appear if the items are supplied free of charge);

• an import and/or export permit and/or declaration if required.

Documentation required by a transporter or operator should be accessible without opening the package.

Packages for or from overseas destinations must be accompanied by the necessary documentation, including customs and/or quarantine permits. A check of the Australian Quarantine and Inspection Service website4 may be necessary to review the latest relevant information.

When transporting dangerous goods internationally under the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), you must ensure your consignments are always accompanied by a transport document. This sets out detailed information on the load being carried, including full classification of the substance(s) carried and how it is packaged. You must present the required information in a certain order and follow certain rules on language.

In addition to documents required under other regulations, under ADR you must ensure that the following documents are carried on the transport unit:

• transport document(s) containing prescribed information for each dangerous substance, material or article being carried - eg their UN number, their technical name in brackets in addition to the name under which they are being shipped;

• emergency instructions in writing;

• means of identification, including a photograph for each member of the vehicle crew.

Some exceptions, or 'derogations' from the provisions of ADR are allowed under certain multilateral agreements. These allow goods to be transported - usually for a fixed period - between or through any of the countries that have signed up to the multilateral agreement. If you are carrying dangerous goods under such an agreement, you must carry a copy of that agreement.

You should also check whether other legislation beyond the ADR applies to the dangerous goods you carry - for example, load restrictions on the carriage of petrol.

Before ship dangerous goods, you need to properly complete the required transport documents: the air waybill and the Shipper's Declaration for Dangerous Goods.

The main purpose of the Dangerous Goods Declaration (DGD) is for the shipper to provide critical information to the aircraft operator or carrier in a format that is consistent throughout the transportation industry. This standard is part of the International Air Transport Association (IATA) Dangerous Goods Regulations (DGR).

Section 8 of the IATA DGR begins with the statement: "A Shipper's Declaration must be completed by the shipper for each consignment of dangerous goods."

There are nine materials that have a low risk and are excepted from this requirement. These are:

UN 3164, Articles, pressurized, hydraulic;

UN 3164, Articles, pressurized, pneumatic;

UN 3373, Biological substance, Category B;

UN 1845, Carbon dioxide, solid (Dry ice) when used as a refrigerant for other than dangerous goods;

Dangerous goods in excepted quantities;

UN 3245, Genetically modified organisms and Genetically modified microorganisms;

Lithium ion or lithium metal cells or batteries meeting the provisions of Section II of Packing Instructions 965–970;

UN 2807, Magnetized material; and

Radioactive material, excepted packages.

For each consignment of dangerous goods as defined and regulated by the DGR, the shipper is required to:

Use only the correct form in the correct manner;

Ensure the information is accurate, easy to identify, legible and durable; and

Ensure that the shipment has been prepared in accordance with the DGR.

These requirements are essentially what the dangerous goods shipper is declaring when they complete the IATA Dangerous Goods form and what appears in bold type in the bottom left-hand corner of the form:

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked, labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national government regulations. I declare that all of the applicable air transport requirements have been met.

The Dangerous Goods Declaration must be signed and dated by the shipper. Other persons employed to act on behalf of the shipper such as consolidators, freight forwarders, and cargo agents may sign the DGD on behalf of the shipper.

Even though the IATA specifies retention of the transport documents for a minimum of three months, the U.S. Department of Transportation (DOT) requires 24 months. Electronic versions may be used if they can be reproduced in printed form.

1.5. COVID-19 vaccine specifications and countries which create vaccine

The COVID-19 vaccine is a vaccine that can protect against the COVID-19 coronavirus infection. The development of a vaccine is a critical health system challenge as the disease pandemic began in late 2019. As of September 2020, more than 200 potential vaccines are being developed by various medical institutions and pharmaceutical companies, and human trials have begun for 40 drugs. Currently, seven candidate vaccines are in phase III clinical trials, 4 of which are of Chinese origin.

At the end of February 2020, the World Health Organization (WHO) announced the hope that a vaccine against the SARS-CoV-2 virus that causes COVID-19 will become available in 18 months. Vaccine development is complicated by the constant mutation of the virus and the difficulty of studying it.

Its effectiveness depends on the ability to induce an immune response in the human body and on its safety for it.

Strains of the SARS-CoV-2 virus, which causes a dangerous infectious disease, COVID-19, were first detected in December 2019. The genome of the virus was the first to be completely deciphered by the Chinese health services; on January 10, it was made publicly available. On January 20, 2020, human-to-human transmission was confirmed in Guangdong, China. On January 30, 2020, in response to the outbreak, WHO declared an international health emergency, and on February 28, 2020, WHO raised its global risk assessment from high to very high. On March 11, 2020, the epidemic was recognized as a disease with signs of a pandemic.

Many organizations are using published genomes to develop possible vaccines against SARS-CoV-2. About 35 companies and academic institutions are involved, three of which receive support from the Coalition for Epidemic Preparedness Innovation (CEPI), including projects from biotech companies Moderna and Inovio Pharmaceuticals, and University of Queensland.

As of March 2020, about 300 studies were in progress. Until April 23, 2020, 83 drugs were included in the WHO list of promising developments, of which 77 are at the stage of preclinical studies and six are undergoing clinical trials in humans.

The example of the British pharmaceutical concern AstraZeneca shows the intense competition between countries in the pursuit of a vaccine. The company has already developed a promising drug. "In September, we will know if we have an effective vaccine or not," AstraZeneca chief Pascal Soriot told the BBC.

But already now, many millions of doses of the drug not yet approved for use have been staked out by the governments of the UK, the United States, the Global Alliance for Vaccines and Immunization (GAVI), as well as Germany, France, Italy and the Netherlands together. But it is not clear who will get this vaccine first, if it really turns out to be effective.

Therefore, the governments of different countries are betting on several promising "horses" at once. And that's the right strategy, says Alexander Nuyken of the consulting firm EY. “It is still completely unclear who will come first,” he told DW, “so it’s good that government subsidies are distributed in a wide fan.” EY analysts believe that of the more than 160 vaccine projects currently underway in different countries, 97 percent will not be brought to the certification stage.

In the United States, the vaccine race takes on the characteristics of a military operation. Leadership is entrusted to four-star General Gustav Pern, a military logistics specialist and chief of the United States Army Logistics Command. The general received $ 10 billion from the Washington administration so that by January there would be enough doses in the country to vaccinate all Americans.

The German government went even further - for 300 million euros, it entered the share of a potential vaccine manufacturer CureVac, which was allowed to conduct clinical trials of its new drug ten days ago. When creating it, the so-called RNA technology (ribonucleic acid, RNA) was used, in which the vaccine contains parts of the genetic material of the virus.

CureVac from Tübingen, Germany, is among the 16 companies that, according to the WHO, are already officially testing their vaccines in humans. It is believed that the German government spent the aforementioned 300 million in order to get ahead of foreign competitors, who also have their eyes on this biotechnology company.

The COVID-19 vaccines that scientists around the world are working on are being developed on different technology platforms, each with advantages and disadvantages.

Inactivated vaccines are produced by growing SARS-CoV-2 in cell culture, usually on Vero cells, followed by chemical inactivation of the virus. They can be produced relatively easily, but their yield can be limited by the productivity of the virus in cell culture and the need for production facilities with a high level of biosafety. These vaccines are usually given intramuscularly and may contain alum (aluminum hydroxide) or other adjuvants. Since the entire virus is presented to the

immune system, immune responses are likely to target not only the SARS-CoV-2 spike protein, but also the matrix, envelope and nucleoprotein. Examples of inactivated vaccine candidates are CoronaVac from Sinovac Biotech, vaccines from the Wuhan and Beijing Institutes, QazCovid-in Research Institute of Biosafety Problems of Kazakhstan, etc.

Live attenuated vaccines are produced by creating a genetically attenuated version of the virus that replicates to a limited extent without causing disease but eliciting immune responses similar to those caused by natural infection. Attenuation can be achieved by adapting the virus to adverse conditions (for example, growing at a lower temperature, growing in non-human cells) or through rational modification of the virus (for example, deoptimizing codons or removing genes responsible for counteracting innate immunity recognition). An important advantage of these vaccines is that they can be administered intranasally, after which they induce immune responses in the mucous membranes that can protect the upper respiratory tract, the main portal of entry for the virus.

In addition, since the virus replicates in the vaccinated individual, the immune response is likely to affect both structural and non-structural viral proteins through antibodies and cellular immune responses. However, the disadvantages of these vaccines include safety concerns and the need to modify the virus, which is time-consuming if carried out using traditional methods, and technical complexity if reverse genetics is used. An example of a live attenuated vaccine is the SpyBiotech Alliance UK and Serum Institute of India candidate vaccine.

Vector, non-replicating vaccines represent a large group of vaccines in development. Such vaccines are usually based on another virus that has been engineered to express the spike protein and has been disabled from replication in vivo due to the deletion of portions of its genome. Most of these approaches are based on adenoviral vectors (AdVs), although modified Ankara [de] viruses (MVA), human parainfluenza virus vectors, influenza virus, adeno-associated virus and Sendai virus are also used.

Most of these vectors are injected intramuscularly, enter the cells of the vaccinated person, and then express a spike protein to which the host's immune system responds. These approaches have many benefits. There is no need to deal with live SARS-CoV-2 during production, there is considerable experience in the production of large quantities of some of these vectors (the primary boost vaccine based on Ad26-MVA against the Ebola virus was created many years ago), and the vectors show good stimulation of responses both B cells and T cells. The disadvantage is that some of these vectors are affected and partially neutralized by preexisting vector immunity.

This can be avoided by using vector types that are either rare in humans, derived from animal viruses, or by using viruses that do not induce particular immunity by themselves (eg, adeno-associated viruses). In addition, immunity to vectors can be problematic when using prime-boost schemes, although this can be avoided by using priming with one vector and boosting with another. An example of a non-replicating vector vaccine is the Gam-COVID-Vac of the N.F. Gamaleya Research Center (AdV5 / AdV26), CanSino (AdV5), Oxford / AstraZeneca ChAdOx1 nCoV-19 (Chimpanzee AdV), GRAd-COV2 (Gorilla AdV), etc.

The vectors that replicate usually come from attenuated or vaccine virus strains that have been engineered to express a transgene, in this case a spike protein. In some cases, animal viruses are also used, which do not replicate efficiently and do not cause disease in humans. This approach can lead to a more sustained induction of immunity, since the vector spreads to some extent in the vaccinated person and often also induces a strong innate immune response. Some of these vectors can also be injected across mucosal surfaces, which can elicit an immune response in the latter.

An example is a vector based on the influenza virus being developed by the Beijing Institute of Biological Products. vectors based on vesicular stomatitis virus, equine pox and Newcastle disease virus are currently under development.

Vector, inactivated. Some SARS-CoV-2 vaccine candidates currently under development are based on viral vectors that display a spike protein on their surface,

but are then inactivated before use. The advantage of this approach is that the inactivation process makes the vectors safer, as they cannot replicate even in an immunocompromised host. Using standard viral vectors, it is not easy to control the amount of antigen that is presented to the immune system, but in vaccines with inactivated vectors, it can be easily standardized, as in the case of vaccines with inactivated or recombinant proteins. These technologies are currently in the preclinical stage.

DNA vaccines are based on plasmid DNA, which can be produced in large quantities in bacteria. Typically, these plasmids contain mammalian expression promoters and a gene encoding a spike protein that is expressed in the vaccinated individual upon delivery. The great advantage of these technologies is the possibility of large-scale production in E. coli, as well as the high stability of plasmid DNA. However, DNA vaccines often show low immunogenicity and must be delivered via delivery devices to be effective. This requirement for delivery devices such as electroporators limits their use.

RNA vaccines are relatively recent. Like DNA vaccines, genetic information about an antigen is delivered in place of the antigen itself, and then the antigen is expressed in the cells of the vaccinated person. Either mRNA (modified) or self-replicating RNA can be used. Higher doses are required for mRNA than for self-replicating RNA, which amplifies itself, and RNA is usually delivered via lipid nanoparticles. RNA vaccines have shown great promise in recent years, and many are under development, for example against Zika virus or cytomegalovirus. Promising preclinical test results have been published as potential vaccines against SARS-CoV-2.

The advantages of this technology are that the vaccine can be produced entirely in vitro. However, the technology is new and it is not clear what problems will be faced in terms of large-scale production and long-term storage stability as ultra-low temperature is required. In addition, these vaccines are given by injection and are therefore unlikely to induce strong mucosal immunity. An example is the

vaccine candidate BNT162b2 of the German pharmaceutical concern BioNTech, the storage temperature of which is -70 ° C.

Recombinant protein vaccines can be divided into recombinant spike protein vaccines, RBD (Receptor-binding domain) recombinant vaccines, and virus-like particle (VLP) vaccines. These recombinant proteins can be expressed in a variety of expression systems, including insect cells, mammalian cells, yeast and plants; it is likely that RBD vaccines can also be expressed in Escherichia coli. The outputs, as well as the type and degree of post-translational modifications, vary depending on the expression system. In particular, for recombinant vaccines based on spiked proteins, modifications such as deletion of a polybasic cleavage site, inclusion of two (or more) stabilizing mutations and inclusion of trimerization domains, as well as a purification method (soluble protein versus membrane extraction) - can affect the evoked immune answer.

The advantage of these vaccines is that they can be produced without handling live virus. In addition, some recombinant protein vaccines, such as the FluBlok influenza vaccine, have been licensed and have significant manufacturing experience. There are also disadvantages. Spike protein is relatively difficult to express and this is likely to affect productivity and how many doses can be obtained. RBD is easier to express; however, it is a relatively small protein when expressed on its own, and although strong neutralizing antibodies bind to RBD, it lacks the other neutralizing epitopes that are present on the full spine.

This could make RBD vaccines more susceptible to antigenic drift than vaccines containing full length spike protein. Like inactivated vaccines, these candidates are usually given by injection and are not expected to result in sustained mucosal immunity. An example of a candidate recombinant protein vaccine - NVX - CoV2373 from Novavax.

Financial risks of pharmaceutical firms

There are also doubts about the interest of the pharmaceutical and biotechnology firms themselves in international cooperation. WHO’s Act

Accelerator or GAVI's Covax platform to bring a vaccine ever invented to the world and to limit patent rights is unlikely to inspire much enthusiasm.

On the one hand, says Alexander Nuiken of EY, the pharmaceutical industry is aware of its responsibility, it makes remarkable efforts, but on the other, in the end, the invention and production of a vaccine should be profitable for such enterprises. And the financial risk is great, because many enterprises have already started producing their drugs in the hope that if clinical trials are successful and they are approved for use, they will be able to quickly start selling their unique vaccine to different countries of the world.

Large pharmaceutical companies with experience in making vaccines at scale, including Johnson & Johnson, AstraZeneca, and GlaxoSmithKline (GSK), are forming alliances with biotechnology companies, national governments, and universities to accelerate progression to an effective vaccine.

To combine financial and manufacturing capabilities for a pandemic adjuvanted vaccine technology, GSK joined with Sanofi in an uncommon partnership of multinational companies to support accelerated vaccine development.

During a pandemic on the rapid timeline and scale of COVID-19 infections during 2020, international organizations like the WHO and CEPI, vaccine developers, governments, and industry are evaluating distribution of the eventual vaccine(s). Individual countries producing a vaccine may be persuaded to favor the highest bidder for manufacturing or provide first-service to their own country. Experts emphasize that licensed vaccines should be available and affordable for people at the frontline of healthcare and having the greatest need.

Under their agreement with AstraZeneca, the University of Oxford vaccine development team and UK government agreed that UK citizens would not get preferential access to a new COVID-19 vaccine developed by the taxpayer-funded university, but rather consented to having a licensed vaccine distributed multinationally in cooperation with the WHO. Several companies plan to initially

manufacture a vaccine at low cost, then increase costs for profitability later if annual vaccinations are needed and as countries build stock for future needs.

The WHO and CEPI are developing financial resources and guidelines for global deployment of several safe, effective COVID-19 vaccines, recognizing the need is different across countries and population segments.

For example, successful COVID-19 vaccines would likely be allocated first to healthcare personnel and populations at greatest risk of severe illness and death from COVID-19 infection, such as the elderly or densely-populated impoverished people. The WHO, CEPI, and GAVI have expressed concerns that affluent countries should not receive priority access to the global supply of eventual COVID-19 vaccines, but rather protecting healthcare personnel and people at high risk of infection are needed to address public health concerns and reduce economic impact of the pandemic

1.6. Conclusions for theoretical part

Infectious substances in Category A will not be accepted for shipment through postal services.

Infectious substances in Category B may be shipped by registered air mail, and the Universal Postal Union recommends the following procedure.

The basic triple packaging system is used with the same requirements as for other means of transport. The address label shall display the word “Lettre” or “Letter” and the green Customs Declaration WHO/CDS/CSR/LYO/2005.22 Guidance on regulations for the transport of infectious substances. Label for Postal Mail is required for international mailing. “DIAGNOSTIC SPECIMENS”, “CLINICAL SPECIMENS” or “BIOLOGICAL SUBSTANCE, CATEGORY B” shall be identified with the white diamond label with black letters “UN 3373”.

Local/international restrictions may be in force. Prior contact should therefore be made with thenational public operator to ascertain whether the packaged material will be accepted by the postal service in question.

Statistical data collected by a group of central laboratories showed the efficacy of packaging compliant with P650 and P620 in assuring that infectious substances are transported without leakage and loss of materials. For the 4.92 million primary containers shipped in 2003 to any of the worldwide regional offices of these central laboratories, just 106 breakages, 0.002% of the total number, were recorded. Moreover, the leakages that did occur were all contained by the absorbent material, and no damage to secondary containers or outer packagings was reported.

CEPI classifies development stages for vaccines as "exploratory" (planning and designing a candidate, having no evaluation in vivo), "preclinical" (in vivo evaluation with preparation for manufacturing a compound to test in humans), or initiation of Phase I safety studies in healthy people. Some 321 total vaccine candidates are in development as either confirmed projects in clinical trials or in early-stage "exploratory" or "preclinical" development, as of September.

Phase I trials test primarily for safety and preliminary dosing in a few dozen healthy subjects, while Phase II trials – following success in Phase I – evaluate immunogenicity, dose levels (efficacy based on biomarkers) and adverse effects of the candidate vaccine, typically in hundreds of people.

A Phase I–II trial consists of preliminary safety and immunogenicity testing, is typically randomized, placebo-controlled, while determining more precise, effective doses.

Phase III trials typically involve more participants at multiple sites, include a control group, and test effectiveness of the vaccine to prevent the disease (an "interventional" or "pivotal" trial), while monitoring for adverse effects at the optimal dose.

Definition of vaccine safety, efficacy, and clinical endpoints in a Phase III trial may vary between the trials of different companies, such as defining the degree of side effects, infection or amount of transmission, and whether the vaccine prevents moderate or severe COVID-19 infection.

2. ANALYTICAL PART

2.1. Biological materials transportation market analysis

Transportation of special cargo with the participation of air transport is currently of great importance both for the transport complexes of the countries and for the world economy as a whole. Given the relevance of the chosen research topic, the most noteworthy are the characteristic trends in the markets of air freight and global freight forwarding.

The main principle of the organization of delivery of special cargo with the participation of air transport is to ensure the safety of transportation, especially for the delivery of dangerous goods. Among the problematic issues of ensuring the safety of delivery of these types of goods should be noted the lack of licensing for the delivery of special categories of goods, including dangerous goods, and this also applies to the loading and unloading operations.

Another important principle in organizing the delivery of special cargo with the participation of air transport is to ensure the quality of delivery, which directly depends on the set of organizational, economic, technical and technological measures implemented for this in the airline, TEP, airport and other participants in the delivery process.

It is worth remembering the effect of synergy, when a quality interaction between the participants in the process can provide a greater effect than a simple set of actions of these participants. The wide use in production of modern methods of cargo delivery management, the application of the latest world developments in the field of computer technology and communications can ensure the efficiency of delivery in general.

Studies conducted by leading experts in the field of aviation, in particular, ICAO and IATA, showed that the change in world gross product has a significant impact on freight traffic, a change in gross product by 1% leads to a change in traffic by 1.5-2%. Analysis of the dynamics of world trade suggests that there is a direct relationship between world trade and air freight.

The increase in demand for air freight has led to an increase in the average payload capacity of aircraft, an increase in the average flight length and a focus on the development of jet aircraft, which now form the basis of the world's fleet of aircraft. Another important point is that today more than half of all cargo is transported in the cargo compartments of passenger and cargo aircraft, and therefore this is another segment of the freight market. Transportation of cargo in an important compartment of such aircraft allows to place 5-6, sometimes more, pallets with cargo. The negative point is the specifics of the formation of freight and passenger flows, which almost never coincide.

According to Boeing's forecasts for the structure of the cargo fleet in 2031, the fleet will be based on aircraft with a payload of up to 45 tons (1215 units), while aircraft with a payload of 45 to 75 tons and more than 75 tons will be 832 and 1151 units. in accordance. Currently, up to 60% of traffic is carried out by purely cargo aircraft. As for the domestic fleet of cargo aircraft, it should be noted that it is outdated, airlines will spend more money on its maintenance and modernization, which is essential due to the new requirements of ICAO.

Volumes of freight traffic on scheduled flights tended to increase (Table 2.1), but due to the crisis in 1998 and the events of 2001 in the United States there was a slight decrease in subsequent periods.

It should also be noted that the growth rate of regular domestic traffic is much lower than on international scheduled flights.

An analysis of the current situation in the global freight market, published in the publications of IATA and Boeing [145], shows that today the market has already gone through a recession, the lower point of decline has now certainly passed.

It is necessary to further restore the confidence of freight customers in the market and ensure the stability of the situation, although this applies not only to the transportation market, but also to the economy as a whole. High growth rates of traffic volumes are possible not earlier than the middle of 2015.

Table 2.1

Worldwide cargo turnover on regular and charter flights

Yeah	Freight ton-kilometers were performed on regular flights		Freight ton-kilometers on charter flights were performed	
	Mln.	Annual growth, %	Mln.	Annual growth, %
2010	156568	3,5	18124	–3,3
2011	162213	3,6	17421	–3,9
2012	169681	4,5	16512	–5,7
2013	174589	2,9	17125	–3,2
2014	168456	–9,6	16345	–9,6
2015	167813	–1,2	16256	–1,3
2016	171213	1,9	17124	2,3
2017	174219	1,1	17232	1,4
2018	181233	2,1	17953	1,2
2019	187235	2,4	18321	2,5

The table is based on ICAO and Boeing data.

An analysis of the current situation in the global freight market, published in the publications of IATA and Boeing, shows that today the market has already gone through a recession, the lower point of decline has now certainly passed. It is necessary to further restore the confidence of freight customers in the market and ensure the stability of the situation, although this applies not only to the transportation market, but also to the economy as a whole. High growth rates of traffic volumes are possible not earlier than the middle of 2015.

The total level of income of air carriers is 12-15%, but there are also carriers that keep their own profitability at 35-40%. Such a high level of profitability is achieved through the transportation of special categories of goods, effective planning of commercial loading and other tools. The actual level of profitability of airlines from the performance of freight traffic in 2011 was slightly more than 0.4 (the unit is the level of profitability from the performance of freight traffic in 1987). Airlines were forced to compensate for this shortfall by reducing the cost of maintaining offices and operating aircraft, as well as to introduce innovative technical and technological solutions into their work.

The air cargo market is currently divided into the following regional markets - Europe, Asia-Pacific, North America, Latin America, Africa and the Middle East. The Asia-Pacific region has developed the most dynamically, there is a positive trend in traffic in the Middle East and North America, Europe has lost some position.

Hong Kong remains the largest cargo airport, despite the fact that the total tonnage of handled cargo decreased in 2011 by 4.7% to less than 4 million tons. The three leaders are the airports of Memphis (USA) and Shanghai (China). At Memphis Airport, the volume of handled international cargo increased significantly, but because it accounted for less than 7% of the total, it affected them very little.

As for the expert forecasts of the growth of the world freight market, the experts are divided. IATA forecasts an average annual growth of world tonnage of 4.2% over the next 5 years, while the growth of world tonne-mileage is projected at 4.8% (ACI), 5% (IATA) 5.9% (Airbus), 5.6 % (Boeing).

The role of freight forwarding companies specializing in freight is growing, today they have an impact, according to various estimates, on 65-75% of the market. Recently, companies focused on the provision of agency services, or as they are called - "virtual airlines", have started to appear on the air freight market. The tasks of these airlines also include the organization of sales and advertising of transportation, logistics and documentation.

Another trend is cooperation through non-profit agencies such as Cargo 2000 and Cargo 3000. These agencies unite airlines, forwarding companies, providing them with the regime of the greatest assistance in the organization of transportation, standardization, planning. The process of connecting flights is actively implemented by a group of airlines, for example, through the first WOW cargo alliance, which brought together Lufthansa, Singapore Airlines, SAS and JAL.

Today in the world markets of air cargo transportation of special cargoes, in addition to recognized airlines, there are so-called freight agents. Increasing

competition in global transportation markets dictates the need to stand out from the competition, both through image and global recognition, and through the provision of a wide range of services with a high level of quality at relatively low prices.

Leading classic airlines are not very interested in providing a full range of services for the service of special categories of cargo for various reasons, the main of which is their low profitability when it comes to business diversification. On the other hand, these airlines do not want to lose the markets for special categories of cargo and therefore turn to freight agents, various logistics intermediaries, TEP, which organize the entire process of servicing special cargo, while allowing the airline to earn on these categories cargo.

Pharmaceutical equipment is an extremely important commodity, accounting for 4.9% of the structure of freight traffic from Europe to Asia. Significant volumes of air transportation of pharmaceutical products also take place within China. The modern pharmaceutical industry is extremely powerful and requires separate phases of research in different places, in some cases the area of collection of clinical trials and laboratories that analyze them in detail are located on different continents.

The process of conducting clinical trials of a drug can take up to 15 years, and the delivery of clinical trial results to the relevant medical institutions must be in compliance with very strict rules and regulations

At present, services for the transportation of perishable products by air are becoming increasingly available at major airports around the world. Some airports offer a well-organized system for processing perishable products, in other airports this system is worse organized or does not have the necessary equipment in full. Ideally, the number of special cooling chambers at the airport should be slightly higher than the maximum required for a certain period of time, as the forecast limits may be exceeded.

In fig. 2.1 shows the percentage of refrigerators in airports around the world. From these data it can be concluded that 79% of airports offer at least one refrigerator, more than 1/5 of the world's airports do not have refrigerators. 54% of

airports have 1 to 4 refrigerators, 14% of airports have 5 to 10 refrigerators, and 11% of airports have more than 10 refrigerators. Airports with more than 10 cameras are large transit centers where most of all perishable goods are handled.

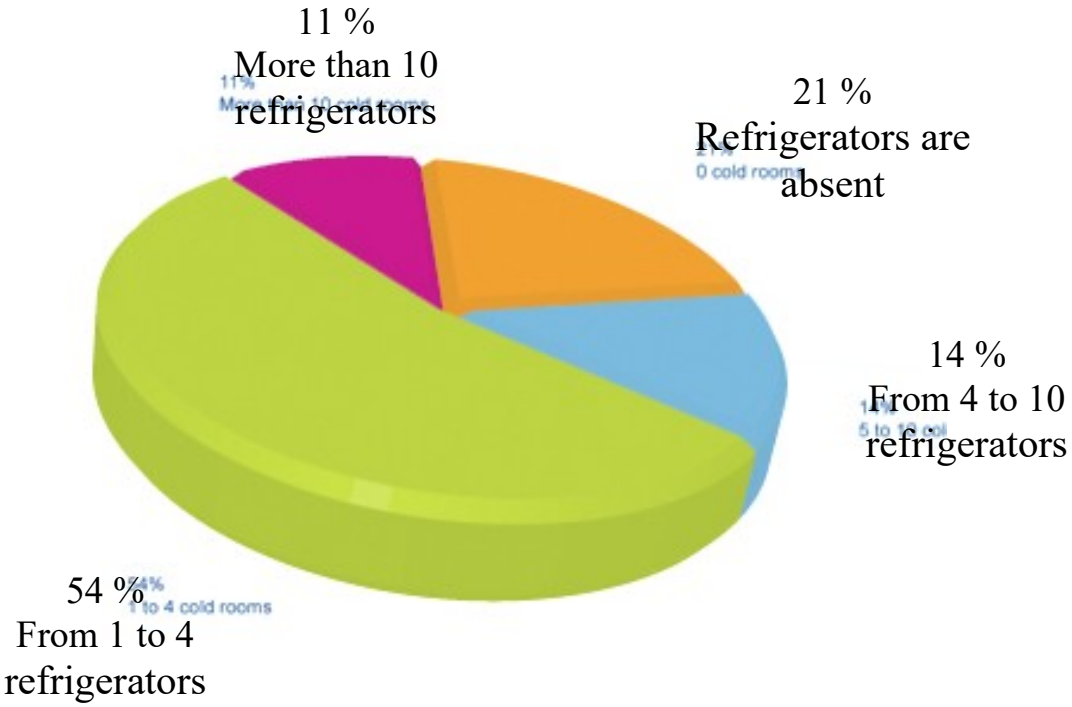


Fig. 2.1. Percentage of refrigerators in airports all over the world

In fig. 2.2 shows the percentage of the total volume of all refrigeration chambers at airports around the world. Thus, more than 30% of the available refrigeration chambers at airports have a volume of up to 100 м^3, 10% - from 100 to 500 м^3, another 10% - from 500 to 1000 м^3, 20% - from 1000 to 5000 м^3, another 20% - from 5000 to 10000 м^3 and only 10% - more than 10000 м^3.

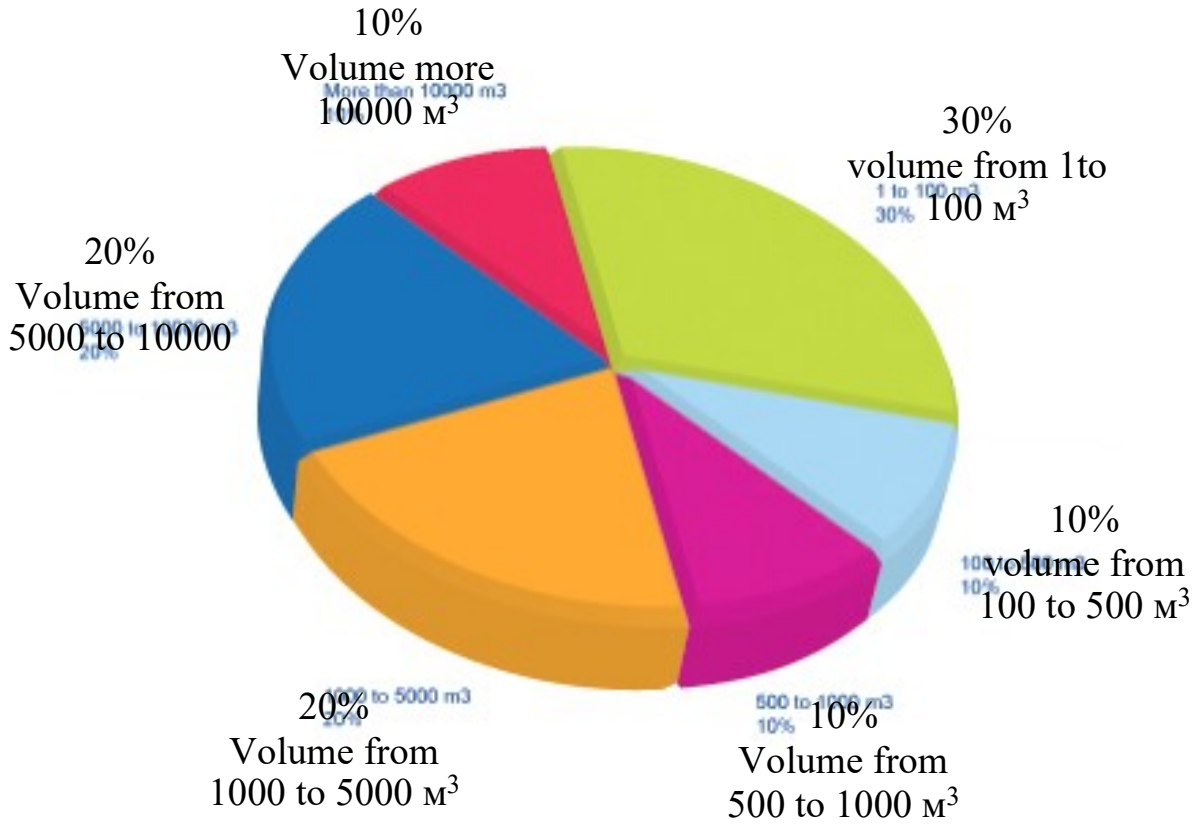


Fig. 2.2. Percentage of total refrigeration at airports worldwide

Concluded that there is an imbalance in the location of specialized facilities at airports around the world. In some cases, the placement of special refrigeration equipment is limited by the size of the airport, as well as other factors. In order to ensure an efficient chain of delivery of perishable goods, some airports establish partnerships with freight forwarding and logistics companies.

There is no clear trend in the international transportation of medicines, but it can be argued that in 2010 there was a slight decline compared to 2009. In 2012, the total volume of medical transportation by air exceeded that of 2009. In general, this market is affected by the same indicators as other freight markets, but there are a number of characteristics that are related to the situation of the target consumer market, as well as the financial capacity of clinics and laboratories around the world.

In the future, it is necessary to focus on the market of delivery of goods that have both dangerous and perishable properties. The world pharmacological market is currently estimated by experts at more than 780-800 billion dollars. USA, at the

same time the market for organic products can be estimated at 75-80 billion dollars. USA. This market is very attractive for the world's leading energy companies. A wide range of biological sample delivery services are offered by such recognized leaders in the global freight forwarding market as DHL and TNT.

Extremely interesting is the Clinical Express service offered, in particular, by TNT. This service applies to all types of clinical products, delivery of dry ice, as well as delivery of patients, tracking of clinical shipments and advice on customs clearance of such goods. The carrier provides all the necessary conditions for transport and medical equipment.

It is worth noting that pharmaceutical companies have a significant level of profitability, the introduction of the chemical on the market costs 0.8-1 billion dollars. US, and biotechnology - 1.2 billion dollars. USA. At the same time, these figures are an order of magnitude higher than those spent on these needs a quarter of a century ago. Currently, the CIS countries are increasingly involved in the supply chain of organic products, including Ukraine, where there is an extensive medical industry that is able to ensure the timely collection of quality samples of clinical trials.

This potential is not fully used today, but there are all the prerequisites for an effective system for collecting and delivering clinical trial results. A significant problem in the functioning of the market for the delivery of clinical trial results is the bureaucratic and organizational difficulties that cause obstacles at different stages of the transport process.

Analyzing the research conducted in on the work of pharmaceutical and medical-biological enterprises, it should be emphasized that most of the business processes they implement their own efforts, at the same time, they provide storage and transportation in more than a third of cases external service to specialized forwarding companies (Fig. 2.3).

This situation is due to the complexity of the delivery process for this category of goods. In the process of organizing and delivering such goods involved manufacturers (factories, hospitals, clinics), manufacturers and distributors of

containers, packaging, refrigerants, carriers of various modes of transport, companies engaged in the provision of transport and warehousing services, PL-providers and TEP.

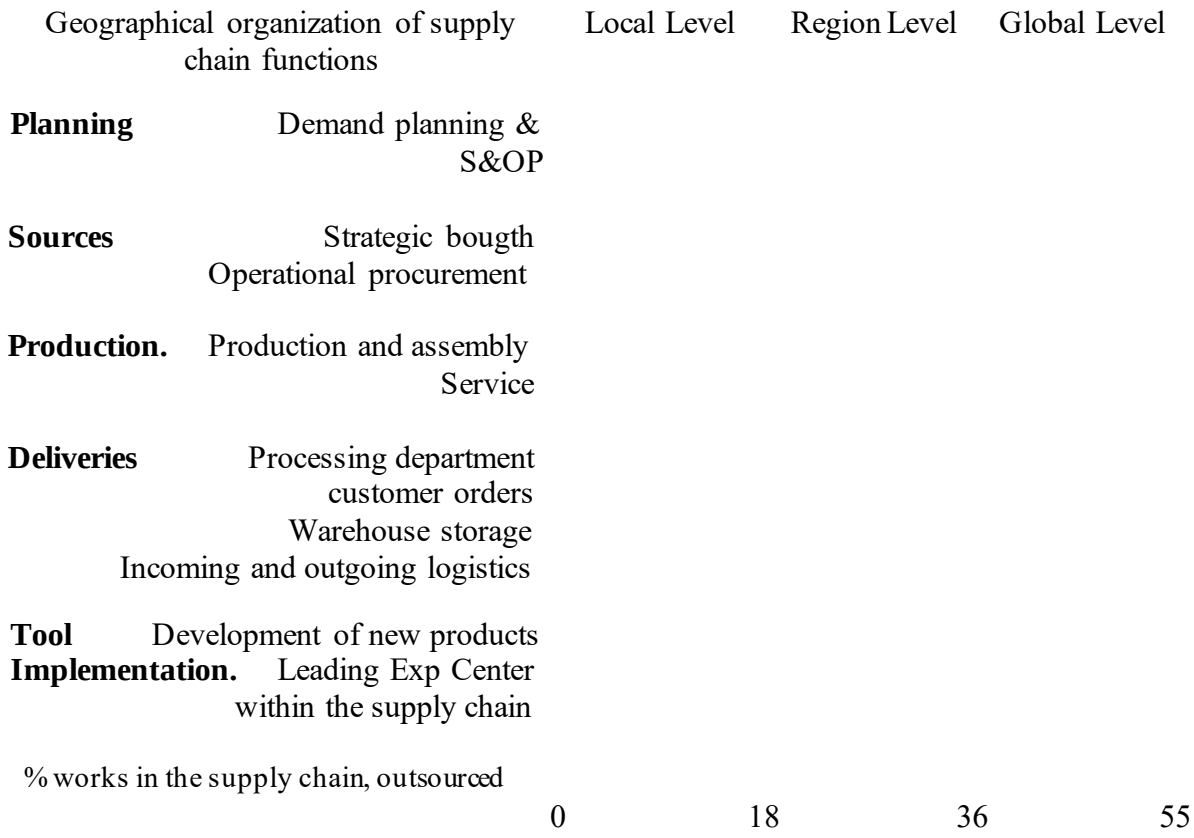


Fig. 2.3 Organizational model of pharmaceutical enterprises and medical and biological industry зроби красивий рисунок

A multi-stage distribution and transportation scheme complicates the process of delivery of pharmaceutical and medical-biological products. Increasing the number of intermediaries and participants in the delivery process increases the impact of external factors on the cargo (transshipment, transportation by several modes of transport, weather and climatic conditions.

Another factor complicating the delivery process is the lack of specialized service providers (vehicles, containers, warehouses, refrigeration equipment) that have passed the relevant certification and can provide services of the appropriate level of quality. Domestic providers are not yet able to provide them at the appropriate level. The use of the services of European providers increases transport costs.

According to experts, since 2009, international players have begun to actively explore the Ukrainian market of delivery of pharmaceutical and medical-biological products. The implementation of a full cycle of service delivery of such goods has necessitated the implementation of the process of customs clearance and organization of consolidation and deconsolidation works in commercial warehouses and terminals.

There are few companies that provide a full cycle of service for such goods, as providing a full range of services is an extremely difficult task. The possibility of this exists only in companies with significant volumes of traffic. Currently, in the market of delivery of pharmaceutical and medical-biological products in Ukraine, the leading role is played by three major players that control almost 75% of the market. The position of these companies is dominant and the opportunities for new large companies to enter the market are significantly limited.

The Ukrainian market for pharmaceutical and medical-biological products tends to grow due to the increase in the number of drugs that require temperature control, as well as due to the significant interest of foreign laboratories in the results of clinical trials from Ukraine.

In today's market of freight forwarding and logistics services, there are several factors that complicate the process of organizing delivery and reduce its efficiency. The first is the contradiction and unregulated regulatory framework. If the regulations define the requirements for transportation and storage of vaccines, there is no similar mechanism for biotechnological products that require temperatures from +2 to +8 ,C. Therefore, security of supply issues throughout the chain are not supported by legal requirements. The second factor is the underdeveloped transport infrastructure, which does not allow the use of optimal transport solutions and leads to increased transport costs.

According to a report by the European Federation of Pharmaceutical Industries and Associations, the pharmaceutical industry is one of the world's leading high-tech industries in terms of profitability and the use of innovation. In general, the processes of implementing innovative products in the pharmaceutical

industry take years and sometimes decades. Moreover, according to the results of clinical trials, only 0.01–0.02% of all substances eventually enter the pharmaceutical market.

It is also necessary to analyze in detail the reasons for the differences in the efficiency of the supply chain between leaders and lagging companies, which were identified by PwC experts in. The operating profit of these companies is explained by the fact that the leading companies have better opportunities in the market, namely large customers, use more advanced technologies for organizing work and managing their own profitability.

The difference in delivery timeliness between leading and lagging pharmaceutical companies is much smaller at 21%. However, it should be noted that disruption of delivery of even a single batch of pharmaceutical products can have catastrophic consequences for the supplier and lead to complete loss of cargo, and therefore significantly affect the profitability of the company.

Among the most important factors in the supply chain for pharmaceutical companies are: cost minimization, maximizing supply efficiency, complexity management, maximizing supply flexibility and minimizing risks (Figure 2.4).

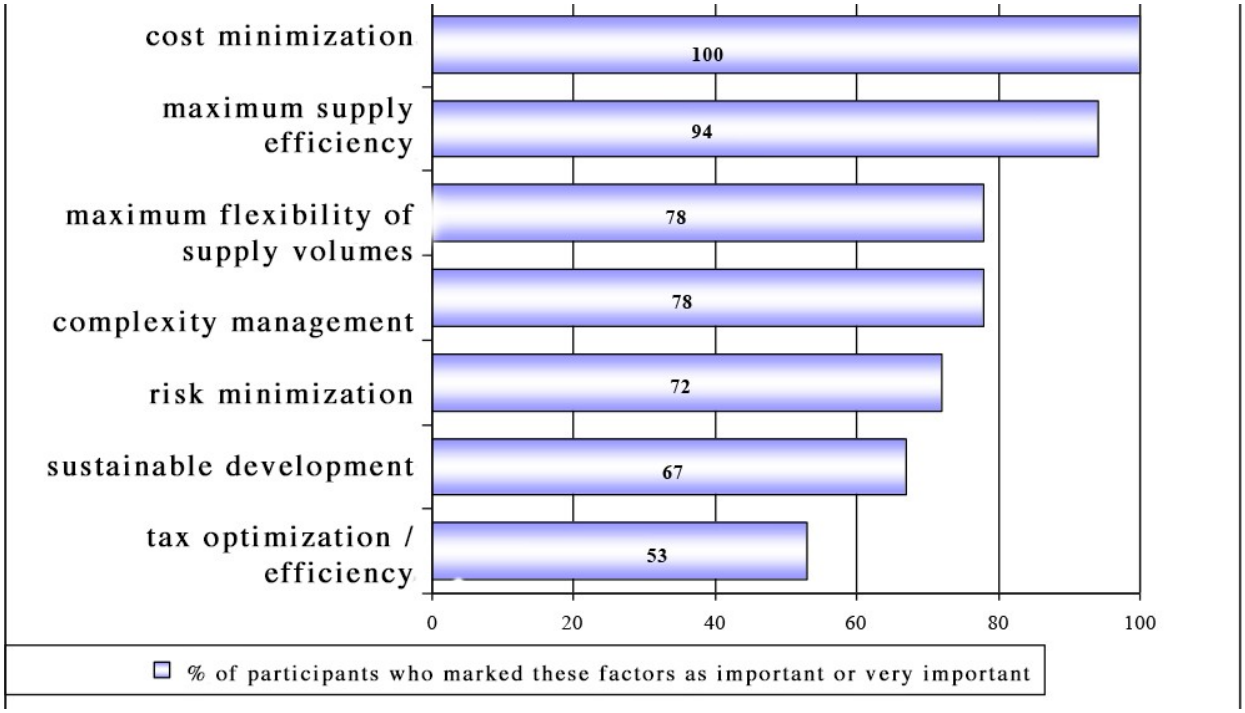


Fig. 2.4 The most important factors in the supply chain for pharmaceutical companies

Therefore, there is a problem in the simultaneous consideration of many criteria in the delivery of products of the pharmaceutical and medical-biological industries.

Ukraine International Airlines (UIA) was founded in 1992 through the establishment of a subsidiary Air Ukraine International. Airline has been assigned rights to implement flights to Western Europe. The first flight was made on the route Kiev-London-Kiev on November 25, 1992. After the suspension of flights by Aerosvit airline, UIA act as a national carrier of Ukraine. Meanwhile, UIA succeed to obtain a connection on most routes, which were previously provided by Aerosvit airline.100% of UIA is privately owned.

The main activity of the airline is the performance of passenger and freight transportation. UIA's fleet consists of 33 modern aircrafts: 4 long-haul Boeing 767-300ER, 14 medium-haul New Generation Boeing 737, 10 medium-haul classical Boeing 737 (including one freighter 737-300SF), and 5 medium-haul Embraer-190. The main base airport of UIA is the State International Airport Borispol.

The most important priority for the UIA today is safety standards that must correspond and meet high international standards. UIA were the first airline on the territory of CIS countries that received a certificate IOSA (International Operational Safety Audit) and became an international registry as IATA (International Association of air transport).

In 2011, the airline has once again successfully passed inspection for compliance with the requirements of modern operational safety and received their next fourth "certificate" as a reliable provider of IOSA. In May 2014 it is entered into force new requirements for regulation EU 452/2014 for the authorization procedures and security monitoring of aircrafts of operators from third countries (Third Country Operators) that are flying into European airports.

A single certificate Third Country Operators authorization replaces all previously issued documents by every European country for UIA and allows airline to fly in the airspace of the European Union and the four countries of the

European Free Trade Association - Iceland, Liechtenstein, Norway and Switzerland.

This event was followed by another confirmation of the UIA's high level of aviation safety and adherence to operational, which fully meet international ones.

Therefore, UIA can be described as:

- Airline actually acts as a monopolist on Ukrainian market by offering the largest number of European destinations from Ukraine than any other airline;

- A modern air carrier that has its network, which enables to connect major cities in Ukraine, and Ukraine with all major cities in Europe, CIS, Asia, the Arab Gulf and the US;

- Reliable airline, which is continually expanding its geography, thanks to agreements with leading aviation companies from all over the world.

Fleet of UIA contains aircraft types from two manufactures, represented by Boeing and Embraer. All the diagrams presented above are taken for the May 2016. Average fleet age is 14.9 years.

The share of the frequency of utilization of Boeing aircraft is 75,8%, while the utilization of Embraer aircraft is 24,2%. The seat capacity is higher in Boeing aircrafts that makes 81,5%, while seat kilometres represents 86,4 compare to 13,8% in Embraer aircraft (Figure 2.5).

On April 2, 2016 it was introduces new Boeing aircrafts scheduled for transportation. UIA fleet replenishment in early summer season is very justified, since the summer of 2016 year UIA is expanding its route network and increasing frequency on many popular destinations.

The first two aircraft already in service, and the next two Boeing 737-800 aircraft are scheduled to enter service in early May 2016. Additionally, in 2016, UIA is considering to lease 4 more aircraft.

As at 28 May 20 16 the airline's fleet consists of 33 aircraft of various modifications.

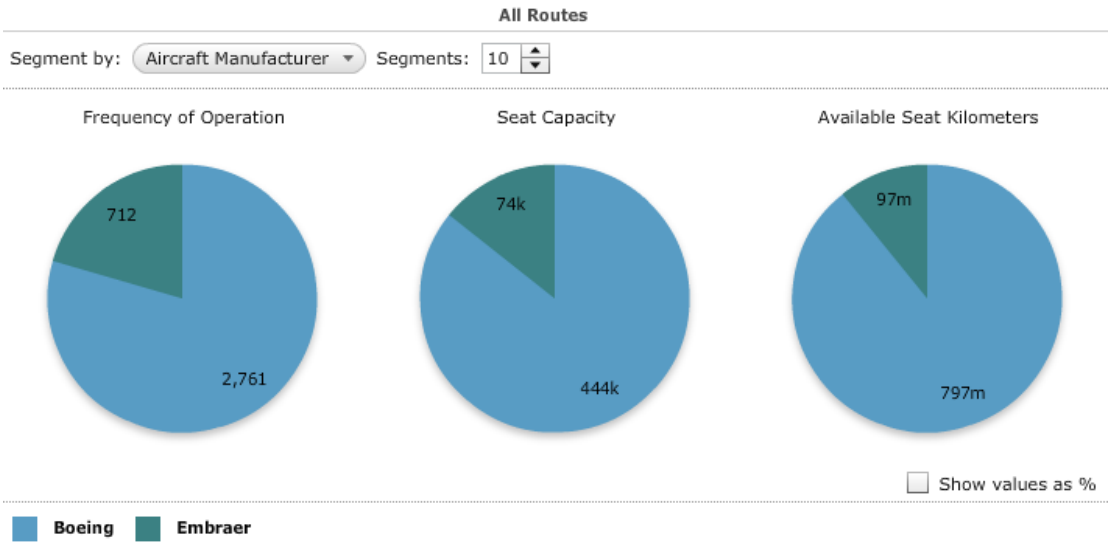


Fig.2.5 Aircraft manufacturer for UIA's fleet

According the aircraft type UIA use mainly four types of aircrafts:

- Boeing 737 Freighter
- Boeing 737 Passenger
- Boeing 767 Passenger
- Embraer 170/190

Different modifications (Figure 2.2) are possible depending on the demand of transportation and optimization criteria. It is important to consider all major characteristics of presented aircrafts, while it directly influences on transportation as the aircrafts are the main resource that airline has.

Table 2.2

Fleet of UIA

Aircraft type	**Max. cruising speed**	**Seating capacity**	**Max. range approx.**	**Quantity**
Boeing 767-300ER	850 km/h	up to 261	11,070 km	4
Boeing 737-300	880 km/h	up to 135	5,000 km	3
Boeing 737-500	880 km/h	up to 112	5,000 km	6
Boeing 737-800	940 km/h	up to 186	6,000 km	10
Boeing 737-900	970 km/h	up to 189/215	6,000 km	4
Embraer-190	890 km	up to 104	3,300 km	5

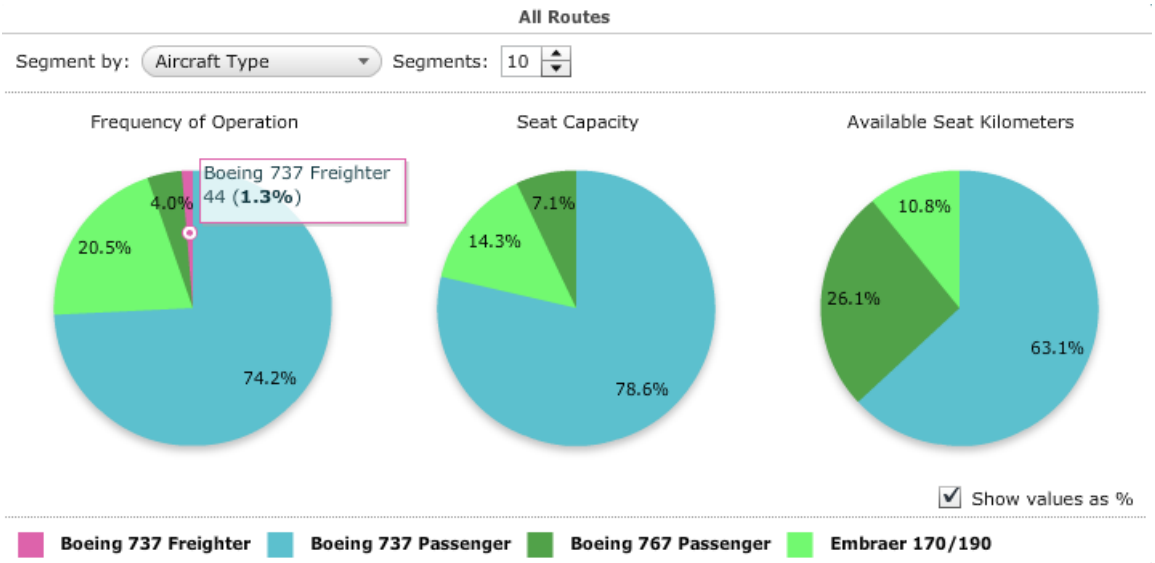


Fig.2.6 Aircrafts' modifications

Boeing 737-800 as an aircraft subtype is mostly used on UIA flights. All parameters, such as frequency of operations, seat capacity and available seat kilometres are higher than in other aircraft subtypes used, representing 27%, 28,3% and 31,2% accordingly.

Meanwhile, for example such an aircraft which provide also the high level of available seat kilometres is not used frequently, as Boeing 767 passenger modification.

To note, fleet the airline "International Airlines of Ukraine" consists mainly of aircraft from Boeing (Figure 2.3), the company which is known for its good attitude towards the environment, and which embodies a number of advanced technologies.

Modern aircraft company Boeing can produce much less noise compare to 30 years ago - on average by 75%. The noise level of modern aircraft is regulated by the International Civil Aviation Organization (ICAO). Aircrafts Boeing-737 and Boeing-767 comply with the standards of International Civil Aviation Organization, Section 3, on noise levels, as well as the basic requirements of emissions.

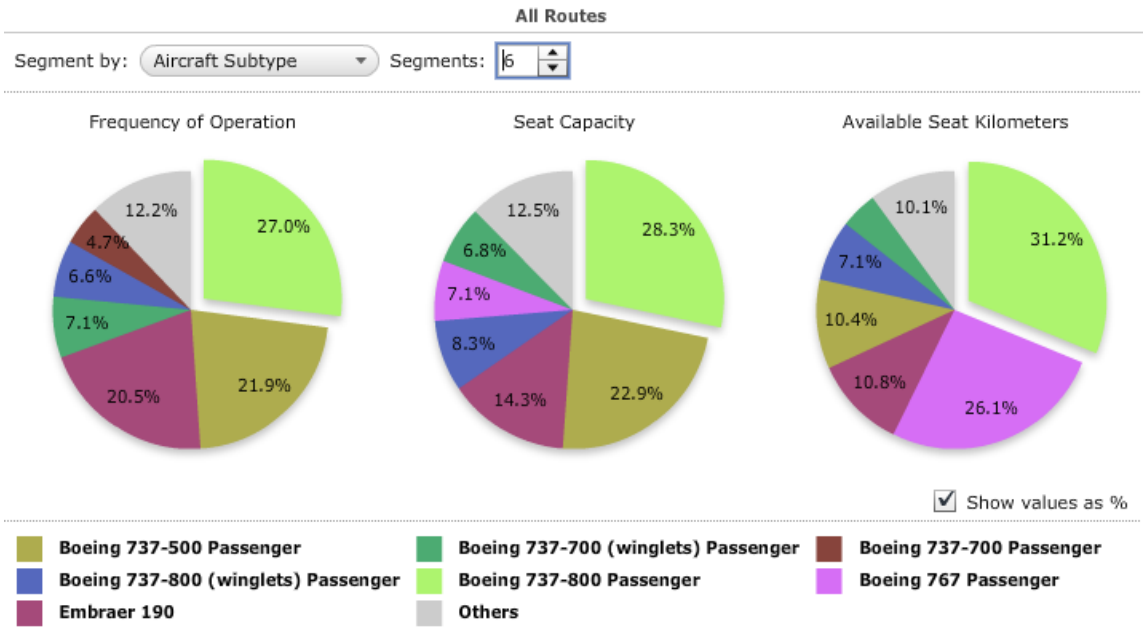


Fig.2.7 Aircraft subtype for UIA's fleet

The majority of flights is realised with narrow body aircrafts, which consist of 96% of operations. This type of aircraft is used for short and medium haul flights. Wide body aircrafts are used for the long haul flights and the available seat kilometres represent 26,1% in May 2019.

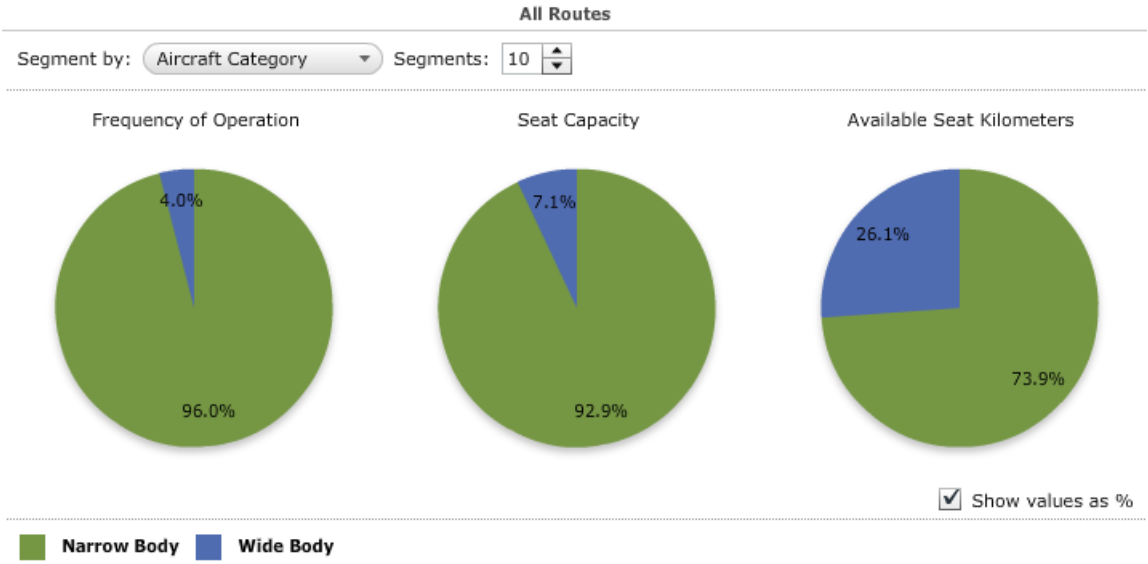


Fig.2.8 Aircraft category for UIA's fleet

The majority of flights is realised with narrow body aircrafts (Figure 2.8)

UIA provides different cabin classes for its passengers on all flights. Mainly, the majority of passengers travel in economy class (88,5%), in business class there

is around 11% of passengers and premium economy was chosen just by 1,4% of UIA's passengers (Figure 2.9).

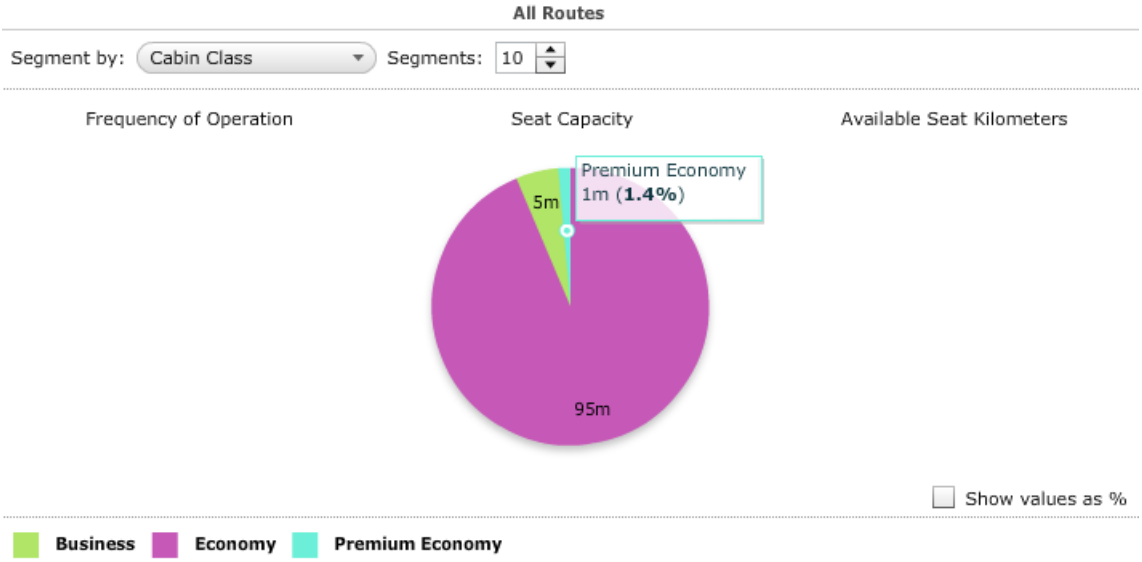


Fig.2.9 Cabin class for UIA's fleet

Wizz Air, legally incorporated as Wizz Air Hungary Ltd. (Hungarian: Wizz Air Hungary Légiközlekedési Kft.) and stylised as W!ZZ Air, is a European ultra low-cost airline with its head office in Budapest. The airline serves many cities across Europe, as well as some destinations in North Africa and the Middle East. It has the largest fleet of any Hungarian airline, although it is not a flag carrier, and currently serves 44 countries.

Its Jersey-based parent company, Wizz Air Holdings plc, is listed on the London Stock Exchange and is a constituent of the FTSE 250 Index. As of 2020, the airline has its largest base at Budapest Airport and Luton Airport with 70 destinations. In 2019 the airline transported 39.8 million passengers.

The airline was established in September 2003. The lead investor is Indigo Partners, an American private equity firm specialising in transportation investments. The first flight was made from Katowice International Airport on 19 May 2004. The airline's CEO is József Váradi, former CEO of Malév Hungarian Airlines. The company is registered in Pest County (Hungary).

On 25 February 2015, Wizz Air started trading on London Stock Exchange.

In November 2017, Wizz Air announced that they were planning to launch a British division called Wizz Air UK. The airline is based at London Luton, mainly

to take advantage of a number of take-off and landing slots acquired from Monarch Airlines when the latter entered administration in 2017.

The airline applied successfully to the CAA for an AOC and a Type A Operating Licence. The airline launched operations in March 2018 using British registered aircraft. Wizz Air UK will start to take over the flights to the UK that are currently operated by Wizz Air. Wizz Air said that the airline will employ up to 100 staff by the end of 2018.

In November 2018, it was reported that Wizz Air had announced plans to reactivate its Wizz Air Ukraine subsidiary, approximately three years after it was shut down. Under the plan, Wizz Air Ukraine will seek to complete certification in 2019 following the acquisition of twenty A320/321 neo jets. Bases will be developed in Kyiv as well as other cities across the country. By 2025, it aims to have a passenger throughput of 6 million passengers per annum.

In July 2020, the airline announced that it will form a joint venture with the Abu Dhabi Developmental Holding Company. In October 2020 the airline announced that its first Scandinavian base would be opened at Oslo's Gardermoen Airport in November 2020: the two aircraft based there would also undertake domestic flights within Norway.

Wizz Air dismissed concerns about the damage the airline may be causing to the environment, raised by the "flightshame" movement. This dismissal was based on the airline's per-passenger emission level.

The company said that it would reduce emissions per capita by an additional 30 percent by 2030.

At the same time, Wizz Air condemned inefficient airlines - such as Lufthansa - offering business class and using outdated technologies, which cause far more specific environmental damage than Wizz Air.

Wizz Air fleet

Aircraft	In service	Orders	Passengers	Notes
Airbus A320-200	72	—	180 186	
Airbus A320neo	6	59	186[45]	
Airbus A321-200	41	—	230	
Airbus A321neo	15	171	239[46]	Deliveries to finish in 2026
Airbus A321XLR	—	20[47]	239[48]	Deliveries from 2023 to 2026[48]
Wizz Air cargo fleet				
Airbus A330-200F	12	—	Cargo	
Total	**135**	**250**		

Fig 2.10 Wizz Air fleet

2.2. General characteristics of the selected airline

The environment of the organization is characterized by diversity, complexity, constant change and in general is unstable. This circumstance, along with the unpredictability of the behavior of staff and managers and gives the activities of the organization, especially in the future, an element of uncertainty.

Wizz Air operates regular services and any organization is an open system. A sign of the modern organization is resilience, ie the ability to function and develop in conditions external and internal influences, outrageous, while maintaining balance use a business model that is characterized by features: the main activity is the transportation of passengers and goods; a large network of routes; availability of own pricing policy; complex implementation system through global systems; availability of an agency network for product sales on the market; large fleet of aircraft; in-house maintenance of aircraft.

Compared to previous years, the airline is increasing its capacity and expanding its services in new territories. Thus, according to the company's official website, the official profit for 2019 amounted to more than 1,700 million euros.

Wizz Air has vertical connections due to the presence of departments with a manager at the top of each. This structure makes it easier to organize the workflow. But linear systems are also available. Wizz Air uses a mixed organizational structure.

The airline plans to operate more than 160 aircraft in 5-7 years. Wizz Air aircraft are easily visible at airports because of their colors - white, pink and purple.

Wizz Air Ukraine started operating in 2008. On March 26, 2015, it was announced that the Ukrainian branch of the company would be liquidated. But on April 10 it was announced that the company will remain. There were 4 Airbus A320-232s with a capacity of 180 people in Ukraine as of 2010. As of January 2016, the activities of the Ukrainian branch have not been resumed, flights are operated directly by the main company - Wizz Air.

Maintenance is provided by Lufthansa Technik and SAS Technical Services.

The increase in the fleet is a planned stage in the airline's development of transportation on already mastered routes. This will optimize the docking domestic, medium-haul and transatlantic flights, as well as from 2019, it is planned to attract Airbus A321Neo, which accommodates 239 passengers.

Thus, the system is characterized by the presence of goals. For anyone the company's main and overall goal is to survive in the market as long as possible. Of course, profit, combined with the creation of new ones markets with the help of new customers are gaining, is an essential feature as well.

The success of the enterprise in a market economy is closely linked to the right and prudent chosen mission. Because organizations are open systems, they can only exist when they satisfy some need outside the system. Thus, the task of transport companies and airlines, in particular, are to meet customer needs in a timely and quality manner transportation.

In a market economy, the strategy of air transport management can be formulated as maximizing profits from the performance of air transportation

through the use of modern marketing principles, economic and mathematical methods and models, and so on.

Successful solution of these problems is impossible without the use of information and analytical systems. The goal tree method is the main universal method of systems analysis.

They have taken various initiatives during the COVID-19 pandemic to safeguard the Company's cost position and excellent balance sheet with €1.5 billion of cash, one of the strongest in the airline industry. We remain focused on best servicing our markets, while protecting the health of customers and employees. Their new health and safety protocol is designed to ensure that their customers and crew can fly safely during this unprecedented time for the global aviation industry.

In addition, they are taking advantage of arising market opportunities and have recently announced the expansion of our network with new bases in Albania, Cyprus, Italy and Ukraine, with more exciting developments to come. They are confident that we can ramp up operations quickly, re-stimulate demand with our ultra-low fares and contribute to the vital recovery of travel and tourism in our markets.

The airline industry is facing unprecedented times and challenges due to COVID-19 but the performance of Wizz Air in 2020 provides a strong foundation to underpin the business. Wizz Air once again delivered an outstanding performance against a challenging backdrop in 2020: passenger numbers grew by 15.8 per cent to 40 million, with revenues up 19.1 per cent and a statutory net profit of €281.1 million.

The Company maintained its position as the lowest cost, lowest emission airline in Europe and the leading player in the growing Central and Eastern European market. Wizz Air's financial resilience to the current volatile environment, resulting from our focus and discipline on cost and cash management, stands in stark contrast to the fragility of the vast majority of airlines operating in Europe today. This financial strength, as evidenced by our strong

balance sheet, together with the strength of the entire Wizz Air team, makes Wizz Air uniquely positioned to take advantage of a market that will continue to show exciting growth opportunities as and when demand for air travel returns.

Wizz Air's strategy has remained constant throughout our 16 years of operation. They deliver high-quality customer experience at the lowest cost, deploying a highly efficient fleet and ensuring that we meet the highest safety, operational and environmental standards. With a future order book of 268 new aircraft, they are confident in thei ability that they can further improve customer experience and increase both the diversity of our network and operational and cost competitiveness whilst reducing our carbon footprint by a further 33 per cent by 2030.

In addition to the above, in April 2020, Wizz Air was deemed an eligible issuer under the UK Government's COVID Corporate Financing Facility (CCFF) and raised £300 million, which further strengthens the Company's already strong balance sheet.

In the past financial year, Wizz Air continued to successfully stimulate traffic and increase passenger numbers by 15.8 per cent to 40 million at a load factor of 93.6 per cent (an increase of 0.9 percentage points). They remained the undisputed market leader in the CEE region, with a market share of 39.6 per cent in the low-cost sector and 17.5 per cent of the total CEE market, up from 16.3 per cent last year. During FY 2020, they launched 98 new routes and now operate from 25 bases which connect 155 destinations in 45 countries. They remain confident in the potential of the region and are taking advantage of valuable market opportunities in and beyond CEE.

Wizz Air new base in Krakow opened in May 2019 with two based Airbus A321 aircraft. In addition, they started operations to two new destinations in CEE (Kazan in Russia and Odessa in Ukraine), as well as to seven new destinations across Western Europe and the Middle East.

2.3. Production indicators analysis of the selected airline

Wizz Air operates flights in 75 countries: scheduled flights are operated in 59 countries while charter flights in 12 countries. Regular flights are operated on 67 routes, charter - on 30. On average across the year Wizz Air performs about 800 flights per week. To note, about 73% of passengers on Wizz Air flights and 27% for cargo.

At the same time the number of people who travelled abroad is still high regarding the total population of country. Meanwhile, one of the most popular foreign destination countries is Poland, where Ukrainians prefer to travel by bus due to the lower cost of transportation. For instance, Turkey remains one of the most popular destinations for Ukrainians and majority prefer to travel by air transport. At the same time, air carriers should understand that nowadays it is the century of competition and air transport can compete not just among different carriers, but as well with other modes of transport. Wizz Air have a strong competition with trains and buses in Ukraine and by choosing new strategy for its development can find new demand for air transportation.

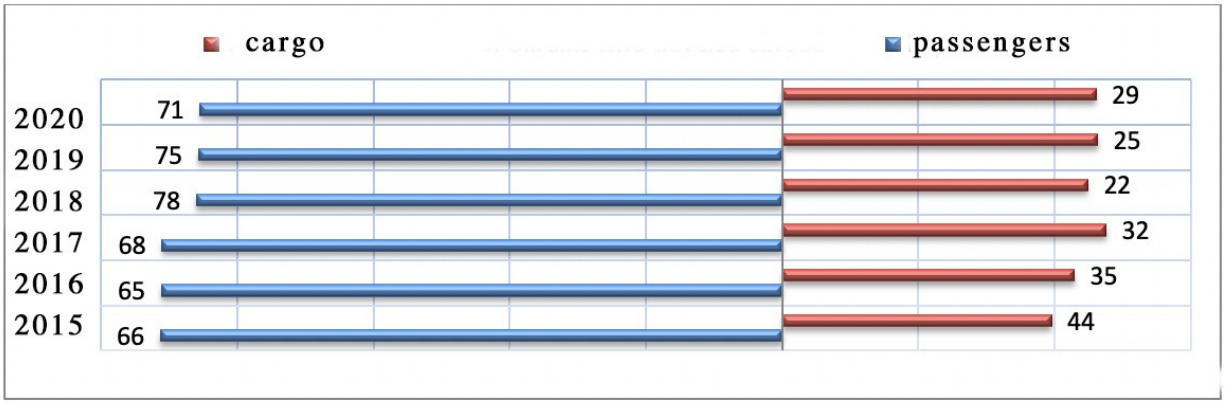


Fig.2.11 Cargo flights and passanger flight ratio

For the number of passengers transported by Wizz Air, we can observe the similar rise from 8.1 million in 2015 to 17,8 million in 2020. Therefore, we can state that the average seat occupancy has also risen. At the same time, Wizz Air has not shown a steady growth along all this period. For example, there was a

significant drop in 2018 due to the political conflicts and economic crisis on the territory of Ukraine. The drop accounted 37% in comparison to the previous year.

Table 2.3

Passengers' transportation by Wizz Air

Year	The number of flights operated	The number of pasengers transported	The change to previous year (%)	The average seat occupancy by passengers (%)
2014	111544	11500000	-	68,5
2015	128560	11900000	26,67	70,1
2016	221180	11800000	-5,26	72
2017	251116	12800000	55,56	75,8
2018	282180	14600000	64,29	78
2019	303471	13800000	-17,39	80,4
2020	391081	17800000	26,32	82,98

It is strongly believed that there is a correlation between the GDP growth and passenger traffic. It is connected with the effect of affordability of air travel among the population and the existing demand that is formed due to that.

Aviation market greatly depends on the economy of state. In conditions of stabilizing inflation, it is believed that it is possible to estimate future growth of air transportation market, focusing on the predicted values of Ukrainian nominal GDP.

GDP at current prices and the basic parameters of the air transportation market have historically high correlation. There is a principle of assessment of air flows: the correlation with GDP growth. That is, 1% of GDP growth gives an average of 1% growth in the airline industry.

2.4. Financial performance analysis of the selected aircarrier

Economics factors include both national and global trends that can influence on the demand. Demand for air transportation services has always very closely interconnected with income growth. While income or gross domestic product (GDP) rises, passenger and cargo traffic increase and inverse. IHS Economics is forecasting GDP to grow at 3.1 percent over the next 20 years. Regional variations are prevalent, with emerging regions growing above world trend and more mature economies growing below world trend (Figure 2.12).

Based on the expected growth in GDP, airline passenger traffic is projected to grow at 6.5 percent and air cargo traffic at 4.4 percent (Figure 2.13, Figure 2.14). As with the economy, world traffic varies by market (Figure 2.15).

Over the next two decades, fast growth in China's domestic market will make it the largest domestic market in the world and traffic within Asia is set to become the largest travel market.

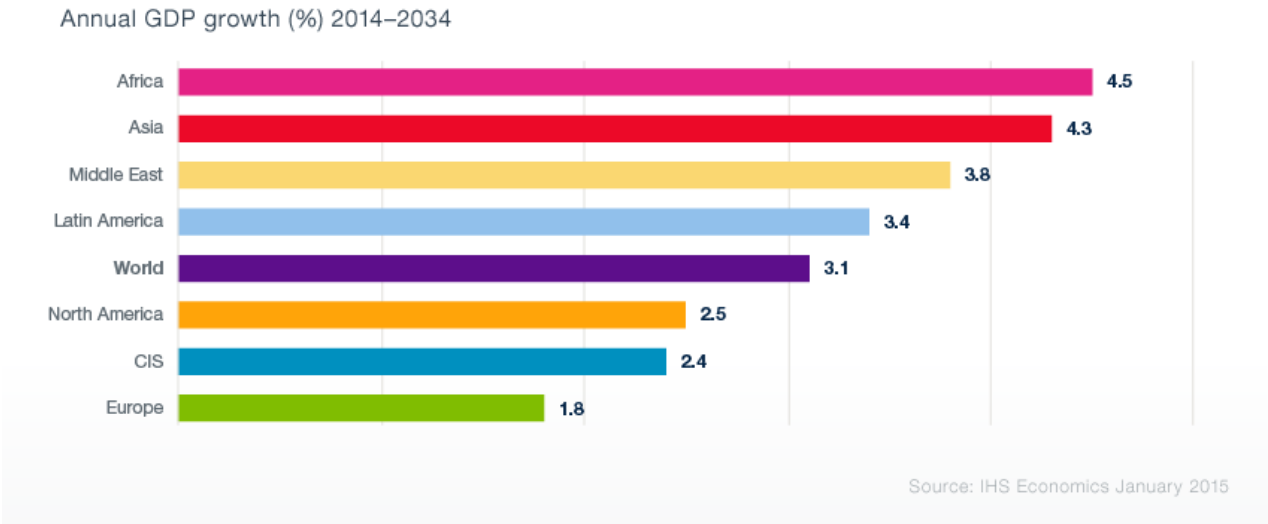


Fig. 2.12. Emerging markets are driving growth

As a consequence of is low unit cost, Wizz Air is able to price its fares below almost all of its competitors, while remaining profitable, and thus to drive demand and market share. This allowed Wizz Air to grow passenger numbers at a compound average growth rate of 31% pa in the ten years to FY2018.

As noted above, only Pegasus and Ryanair are in the same bracket as Wizz Air with respect to unit cost.

Pegasus operates almost entirely in different markets, although Ryanair has a significant overlap with Wizz Air (see Threats below). Wizz Air also generates a high level of ancillary revenue and uses this to keep its basic prices low.

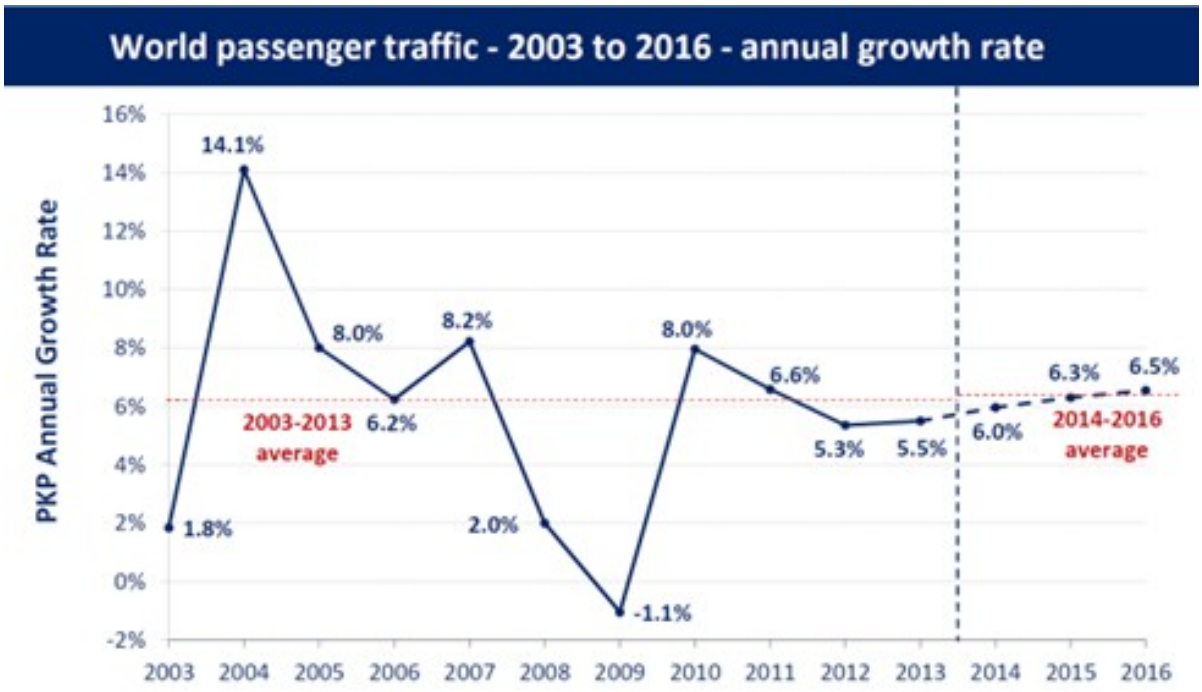


Fig. 2.13. PKP Annual Growth Rate

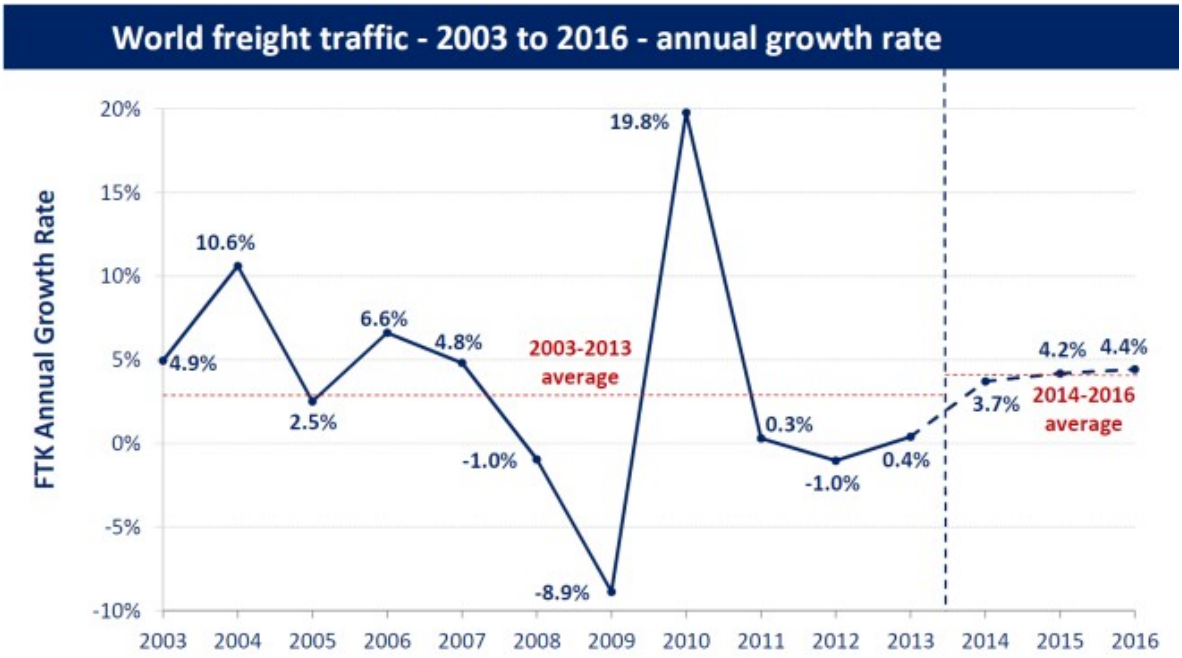


Fig. 2.14. FTK Annual Growth Rate

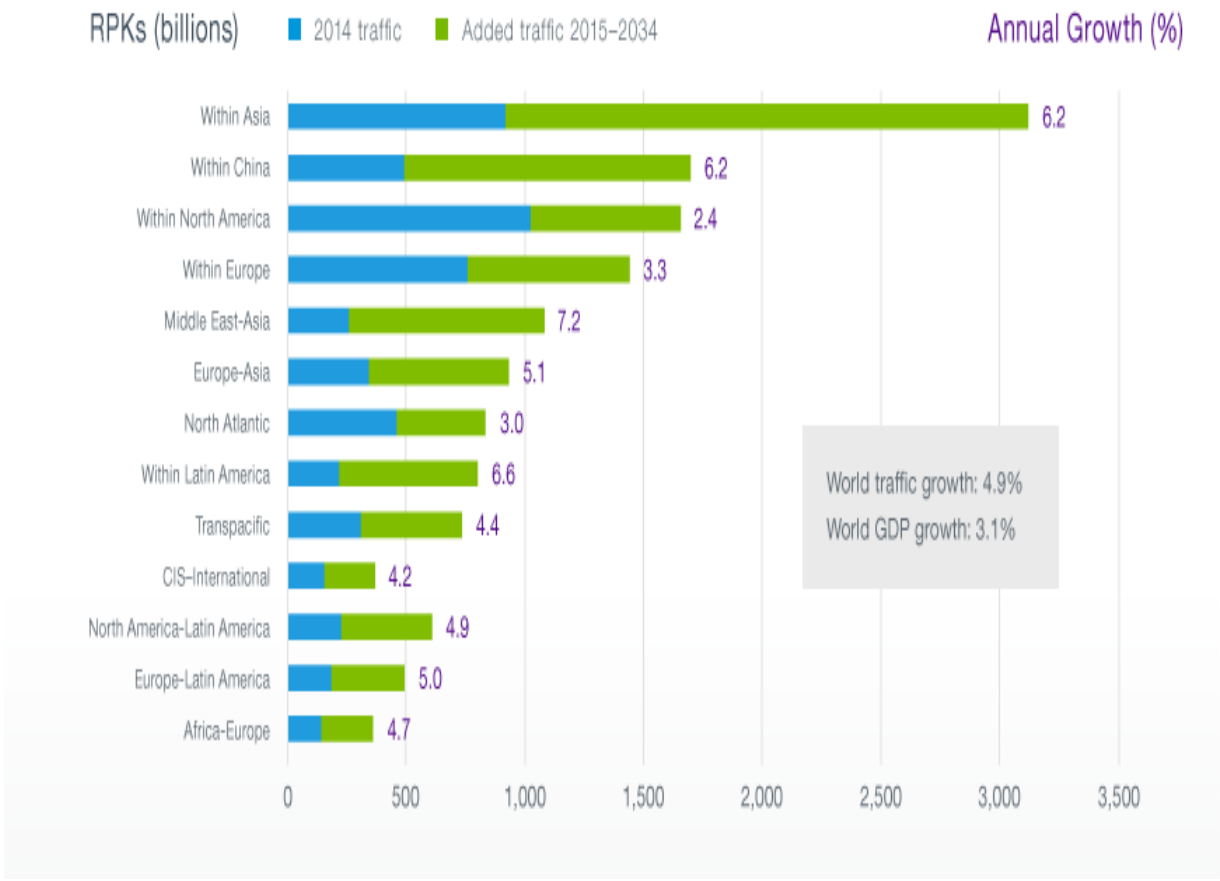


Fig. 2.15. World traffic varies by market

Other important economic factors which influence the airline's ability to operate efficiently and passenger's ability to afford travel are cost factors. These include air fares which dropped significantly due to deregulation of an industry and more efficient operations. One of the main components of air fare is a fuel, the price of which is remaining uncertain and will raise significantly in coming years.

Trends in social factors will have widespread consequences for airline marketing, such as population and demography (age, household, occupation) and cultural factors (attitudes, preferences, values, beliefs, religion and lifestyle) [33].

- Demand

Air transportation is becoming more affordable and safer mode of transport

- Lifestyle

Passengers demanding enhanced travel experience: faster, more efficient and seamless service, both at the airport and beyond it;

- The ageing population

The product that is offered by airports should evolve with more provision being made for disabled passengers and those needing help at airport, medical care services. In addition, advertisement should not be primarily focused on fun-loving young people.

- Changing family structures

There are very important sub-segments to the market (singles, gays, one-parent families) whose particular requirement should be taken into account.

- The number of female business travelers increases.
- Shifting labor flows and a weakening of links related to historic emigration patterns.

These are causing a shift in the key markets related to visiting friends and relatives.

- Passenger travel preferences.

The passengers, particularly those who travel a lot, are becoming more demanding in relation to service.

- The population is becoming more environmentally friendly.

The airlines should make a special ecological program, while the construction of a new airport can be banned due to pollution constrains. At the same time, the residents of near-airport area can complain because of noise and pollution, which can be a threat for an airport.

Technological Factors

The technologies are the fastest changing features of the macro-environment.

In order to handle passengers and to increase the quality of service, aviation industry should focus on the use of advanced information technologies designed to simplify the work of employees of airlines and airports, make the service faster and less expensive.

It can be created competent infrastructure by applying the latest IT technologies at the airport and airline: from automated surveillance systems that allow dispatchers to monitor the airspace to the baggage control systems that make suitcases delivered to the right destination points.

Self-registration via the Internet along with general use self-registration kiosks gives an opportunity to reduce airport congestion and increase the satisfaction of passengers from traveling. These technologies facilitate the passage of passengers at the airport's formal procedures and relieve the stress associated with queues, which is now extremely important as there is a tendency of constant increase in passenger traffic. In addition, SITA's passenger self-service survey demonstrates the high levels of demand among the passenger.

Investments in the development of information technology in airports across the globe in 2015 will be about USD 6 billion, according to a research made by SITA (Société Internationale de Télécommunications Aéronautiques). According to the 10th annual review of the company SITA, conducted with the support of the Airports Council International and the magazine Airline Business, technology development of passenger service is a top priority for airports worldwide. Airports also invest in technology in the field of passenger transportation organization and in the sphere of information services.

Advanced information technologies are becoming a major competitive advantage for airlines and airports serving major transportation hubs. They enable to manage resources more effectively, improve the quality and reduce the time of service, provide an acceptable level of expenses and with their help to establish and maintain standards in civil aviation.

Environmental Factors

Environmental factors have always been a key feature of the marketing macro- environment but have received a greater profile recently as nowadays government and companies have paid more attention to environmental sustainability, to a factors as global warming, pollution control, waste disposal and conservation of energy and other scarce and natural resources.

Airport operations involve a range of activities that affect the environment, including

- the operation of aircraft;

- the operation of airport and passenger vehicles, and airport ground service equipment (GSE);
- cleaning and maintenance of aircraft, GSE, and motor vehicles;
- deicing and anti-icing of aircraft and airfields;
- fueling and fuel storage of aircraft and vehicles;
- airport facility operations and maintenance;
- construction.

The aviation industry recommends that, as part of a comprehensive approach to address air transport's climate impacts, a single global market-based measure (MBM) be agreed (Figure 2.16). This must be seen as part of a broader package of measures including new technology, more efficient operations and better use of infrastructure.

The industry believes that a simple carbon offsetting scheme would be the quickest to implement, the easiest to administer and the most cost-efficient.

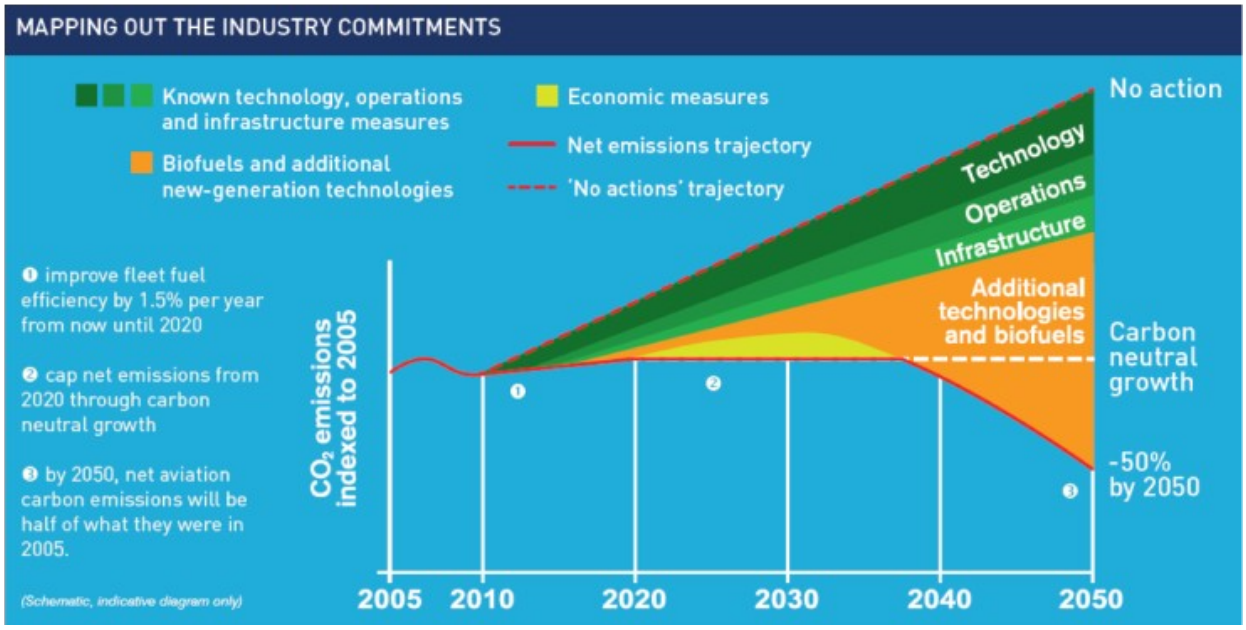


Fig. 2.16. Mapping out the industry commitment.

The industry will have to demonstrate that it is investing as heavily as it can in the technological development which will increase the efficiency of aircraft and airports.

2.5 Wizz Air SWOT analysis

SWOT analysis (or SWOT matrix) is a strategic planning technique used to help a person or organization identify strengths, weaknesses, opportunities, and threats related to business competition or project planning.

This technique, which operates by 'peeling back layers of the company is designed for use in the preliminary stages of decision-making processes and can be used as a tool for evaluation of the strategic position of organizations of many kinds (for-profit enterprises, local and national governments, NGOs, etc.).

It is intended to specify the objectives of the business venture or project and identify the internal and external factors that are favorable and unfavorable to achieving those objectives.

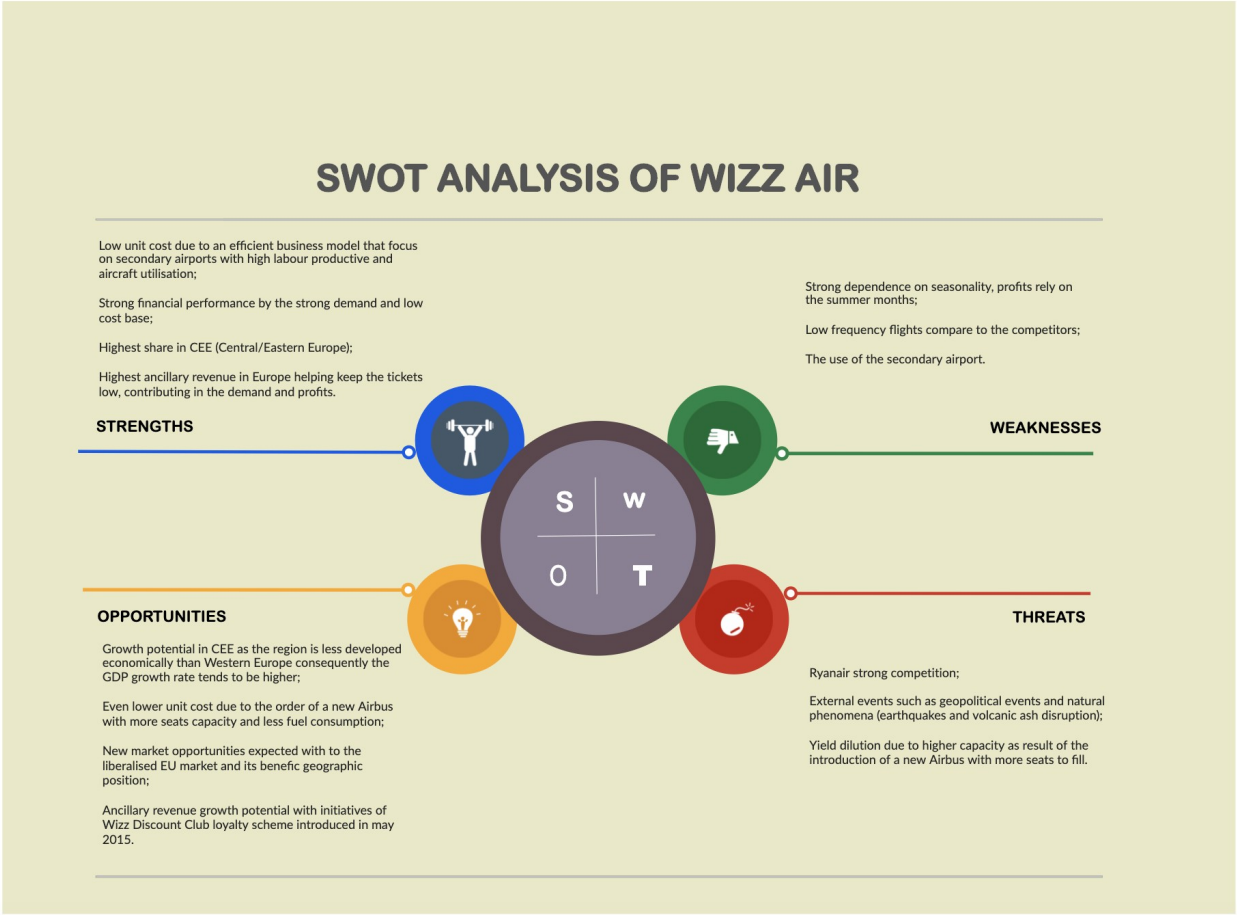


Fig 2.17 SWOT analysis of Wizz Air

Users of a SWOT analysis often ask and answer questions to generate meaningful information for each category to make the tool useful and identify their

competitive advantage. SWOT has been described as the tried-and-true tool of strategic analysis, but has also been criticized for its limitations.

Wizz Air operates only new, best-in-class aircraft, the Airbus A-320, which it orders directly from Airbus, and is serviced by the most recognized and reputable companies, such as Lufthansa Technik and SAS Technical Services.

Fuel supplier: UkrTATnafta. However, the possibility of changing the fuel supplier for the company is currently being considered.

SWOT assumes that strengths and weaknesses are frequently internal, while opportunities and threats are more commonly external. The name is an acronym for the four parameters the technique examines:

Strengths: characteristics of the business or project that give it an advantage over others.

Weaknesses: characteristics that place the business or project at a disadvantage relative to others.

Opportunities: elements in the environment that the business or project could exploit to its advantage.

Threats: elements in the environment that could cause trouble for the business or project.

Internal factors are viewed as strengths or weaknesses depending upon their effect on the organization's objectives.

What may represent strengths with respect to one objective may be weaknesses (distractions, competition) for another objective. The factors may include personnel, finance, manufacturing capabilities, and all of the marketing mix's 4Ps.

External factors include macroeconomics, technological change, legislation, and sociocultural changes, as well as changes in the marketplace. Results are often presented in the form of a matrix.

SWOT analysis is a method of categorization for which lists are compiled, uncritically and without prioritization, rather than seeking important factors to achieving objectives; weak opportunities may appear to balance strong threats.

Competitive forces analysis

The following analysis is based on Michael Porter 5 Forces Model that gives a more precise idea of the positioning in the airline worldwide where Ukraine International Airlines can defend itself against or influence competitive forces (Figure 2.18).

Fig. 2.18 The five forces framework

As aforementioned, governments play an important role and it is thus understandable that the Singapore's state is in the capital structure of the airport and has an interest to develop and promote the airline activity by investing costs in it. Generally, competition does not exist on the national market but is very present outside.

A high degree of rivalry will usually compromise the potential profitability of an industry and will typically result in innovation, which stimulates consumer demand for the products of the industry.

Threat of new entrants

The airline industry is a capital-intensive utilizing enormous range of expensive equipment and facilities. In order to set up an airline companies need to have either good credit rating to lease some planes or the capital to buy them. So the initial cost of entry is high. Additionally, a potential entrant also needs working capital to absorb several months or years of losses and the cost of a launch campaign.

In addition, there are high barriers to entry, as the government, citizens and support stakeholders have to be involved in a designing process, which is complex task. To be noted, existing Wizz Air is a mature and stable market; hence, the entry of new entrants is unlikely to occur.

First of all, there is a legislation and government action barrier as they both prefer to develop already existing airline. Such barriers can take the form of tariffs or regulation of markets. Moreover, the Wizz Air has important opportunities of economies of scale, making it expensive for new entrants to try and reach such levels of service that would require both money and time due to the effects of the experience curve.

Threat of substitutes

This threat is rather medium with other transportation alternatives not having the same speed, convenience and flexibility as air travel. If we compare the price/ performance ratio between a civil aircraft and a train, it is so that the train is cheaper even if it has a lower speed performance. Therefore, other transportation modes and other substitutes remain interconnected and complementary.

Bargaining power of suppliers

Suppliers provide the airlines with services and goods which relate to the attractiveness to target market. Airlines can outsource service providers basing on their financial activity, which will directly influence on the price and quality of service.

The services provided in the airports by suppliers are mainly: passenger search, hold baggage, access control, trolley circulation, fire service, air traffic

control, car park operations, direct retailing, cleaning, passenger handling, baggage handling, freight handling, fuel supply. Therefore, it can be estimated that the suppliers in the airport are vital, but they are price takers.

Upon completing the analysis of Wizz Air, we can compile them into a chart that sums up the power of the five forces on five axes. The power diminishes as points go further on the axes (Figure 2.19).

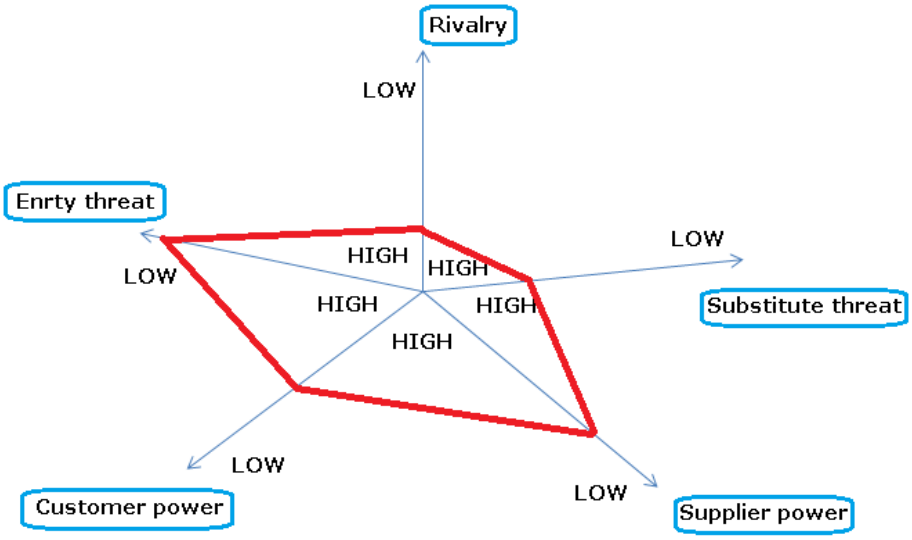


Fig. 2.19. Comparative industry structure analysis

Rivalry is high for Wizz Air, even though the threat of new entrants is relatively low. As said previously, competition is severe on a global scale as more and more governments aim at developing ambitious projects that will generate high return of investments. The threat of substitute is medium as they provide primarily interconnected and complementary service.

The supplier power is qualified as low because there is diversified portfolio of suppliers, which are vital but just a price oriented.

Regarding the entry threat, due to the investment and time, the expected retaliation barriers together with the legislation action are so important that they dissuade new entrants. For instance, strong relations between strengths and opportunities can suggest good conditions in the company and allow using an aggressive strategy.

2.6. Conclusions to Analytical part

During analitycal part was selected Wizz Air airline cause during analysis was shown, very stable in the air carrier market. I also have a good fleet of the latest aircraft, including for the transport of dangerous goods such as medicines. He also has a colossal and successful experience in the transportation of ADR cargo. Everything is performed to the highest IATA standards.

And it is a stable airline that, during the COVID-19 pandemic, managed to maintain its leadership position in the air carrier market. And also without reducing the working staff, which numbers thousands of people.

A distinctive feature is functioning of new logistics technologies for the delivery in long-distance communication is the formation of permanent operational and organizational and permanent information, management "chain" structures.

The introduction of logistics technologies is also associated with the need to improve and enhance the efficiency of management and organizational functions of the physical flow processes of movement of goods and information.

It was found that among the most important factors for special cargo companies are: cost minimization, maximizing supply efficiency, complexity management, maximizing supply flexibility and minimizing risks. Emphasis is placed on the nonlinearity of the links between these factors and the solution of the multicriteria problem by the participants of the logistics supply chain, which, in particular, makes it difficult to develop the relevant developments.

3. DESIGN PART

Air Transportation Management Department				NAU 20.05.50. 300 EN			
Researcher	Mezey V.				Letter	Sheet	Sheets
Supervisor	Ivannikova V.Yu.				D	97	31
Normative Supervisor	Shevchenko Yu.V.			DESIGN PART	FTML 275 ОП- 202Ма		
Head of the Department	Shevchuk D.O.						

3.1. How much vaccine is needed

The emergence of a vaccine that protects against infection with the SARS-CoV-2 coronavirus is expected in Ukraine with no less impatience than in other countries. Therefore, immediately after the news that BioNTech and Pfizer were going to apply for admission of the vaccine for use and begin its production, the country started talking about the possibility of purchasing the vaccine and the required number of doses.

A preliminary plan for the procurement of the drug has already been drawn up, told DW in the Ukrainian Ministry of Health. Ukraine also expects that in a few weeks the research results will be presented by a number of other companies working on the development of a vaccine against SARS-CoV-2. At the same time, the Russian vaccine against coronavirus in Ukraine will not be purchased.

"There is no evidence that the vaccine, which is being discussed in the Russian Federation, has passed all phases of clinical trials, especially the third. There are many other vaccine manufacturers in the world - quite powerful companies that are at the final stage of clinical trials," said the Minister of Health of Ukraine Maxim Stepanov.

Ukraine expects to gain access to the future vaccine against coronavirus within the framework of the global COVAX initiative, a mechanism designed to provide countries of the world with equal access to safe and effective vaccines after their licensing and registration. This initiative is jointly coordinated by the Coalition for Epidemic Preparedness Innovation (CEPI), the Global Alliance for Vaccines and Immunization (GAVI) and the World Health Organization (WHO). COVAX's mission is to distribute safe and effective vaccines among the participating countries by the end of 2021 in proportion to their population.

To date, 172 states have joined the COVAX initiative, including Ukraine. The government expects that for the first stage of vaccination against COVID-19 COVAX will provide Kiev with the number of doses required to vaccinate 20 percent of the population, says Serhiy Litovka, head of the expert group on immunization of the Ministry of Health of Ukraine

The Ministry of Health plans to vaccinate the entire population of the country. For this, Ukraine needs 42 million doses of vaccines if the vaccine is a single one, or 84 million if a second injection is needed. Under the COVAX program, we are guaranteed to receive the first eight million doses of the future vaccine

The projected cost of one dose of the vaccine will range from $ 30 to $ 50, says the head of the expert group on immunization at the Ukrainian Ministry of Health. According to him, it is planned that countries with a high level of income will receive the vaccine at the full price, countries with low and middle income - at a fivefold reduction, and poor countries - for free. Ukraine expects to buy the first batch of vaccine at $ 8-10 per dose, and part of the doses will be received free of charge.

Who in Ukraine will be the first to receive vaccinations against coronavirus?

Who to get vaccinated in the first place, when the coronavirus vaccine appears, has already been decided in Ukraine. The Ministry of Health says that the first in line for vaccination will be people at risk, or those who are in closer contact with people than other population groups. Priority groups include medical workers, military personnel and representatives of law enforcement agencies, including the police, the State Border Service or the National Guard, as well as teachers and people over 65.

The Ministry of Health has already calculated that for the vaccination of all priority groups, Ukraine will need 16 million doses of the vaccine - or 32 million in the case of a double vaccination. And if Ukraine receives eight million doses - half of this number - within the framework of the COVAX initiative, then the country will have to buy the other half at the full price, says Sergey Litovka. According to him, both legally and financially, Ukraine is ready to purchase a future vaccine produced by any company - provided that the safety of the drug is proven, it will pass all stages of testing with international confirmation of its effectiveness and will be officially registered on the international market.

Ukraine is ready to make purchases, distribute the vaccine to regions and districts and vaccinate. We have capacities for storing vaccines, there is a

regulatory framework that allows the use of the drug for epidemic indications. But it all depends on the vaccine manufacturer and on how many doses of the vaccine it is ready to sell to Ukraine.

The government of Ukraine has put in the draft budget for 2021 more than 2.6 billion hryvnia for vaccination against coronavirus. Whether this money will be enough to vaccinate 42 million inhabitants of Ukraine is not yet clear. In addition, not all Ukrainians want to be vaccinated against COVID-19: the results of a September study by the Research & Branding Group sociological company showed that half of the country's residents would not even agree to free vaccination.

Conditions for storing vaccines in Ukraine.

In addition to the availability of funds for the purchase of the drug from COVID-19 and the willingness of the manufacturer to provide the required number of doses, another important issue is the creation of infrastructure for the transportation and storage of the vaccine. So, as far as is known today, vaccines using synthetic mRNA to activate the immune system - namely, such a vaccine developed by Pfizer and BioNTech - must be transported and stored at extremely low temperatures: down to -80 ° C.

The creation of these conditions can be problematic for Ukraine. The head of the expert group of the Ministry of Health on immunization says that the infrastructure for maintaining the "cold chain" when storing vaccines in the country is there, but it is designed for drugs that are stored at higher temperatures - from + 2 ° C to + 8 ° C. "The company" Ukrvaktsina "says that it is able to simultaneously receive, store and logistically distribute 30 million doses of vaccine at temperatures from + 2 ° C to -20 ° C. If it is lower, for example, -80 ° C, then we also have refrigeration equipment - but to a lesser extent, "Sergei Litovka noted.

Ukrainian Health Minister Maxim Stepanov said that Ukraine will not buy the Russian vaccine, since it has not passed the third stage of clinical trials.

There is no evidence in the world that the vaccine that they are talking about in the Russian Federation has passed all phases, especially the third, clinical trials.

The third stage involves a large number of people who are volunteers. Now there is not even a subject of conversation for discussion - to buy or not.

The minister noted that, first of all, one must understand the safety of any vaccine and only then can it be recommended. He added that any vaccine must pass certain stages of clinical trials before being registered.

As for free tranches of the vaccine, they can be expected in the first half of 2021.The Minister of Health Maxim Stepanov told about it during a briefing on November 20. "By December 7, we must sign all technical documents. We expect that in the first half of 2021 we will begin to receive appropriate vaccines. The first tranche is 1.2 million doses, "Stepanov said. As mentioned earlier, priority groups that are at risk will be vaccinated as a matter of priority.

The country is ready to accept even ultra-cold vaccines. Ukraine is ready, in particular, we have refrigeration units that are able to store the vaccine even at temperatures up to -70 ° C, if any.

COVAX, the vaccines pillar of the Access to COVID-19 Tools (ACT) Accelerator, is co-led by the Coalition for Epidemic Preparedness Innovations (CEPI), Gavi, the Vaccine Alliance, and the World Health Organization (WHO) – working in partnership with developed and developing country vaccine manufacturers. It is the only global initiative that is working with governments and manufacturers to ensure COVID-19 vaccines are available worldwide to both higher-income and lower-income countries.

In order to be able to secure enough doses of vaccines to protect the most vulnerable populations, such as health workers and the elderly, the next step for the partnership is to confirm potential self-financing participants' intent to participate by 31 August and to turn these into binding commitments to join the COVID-19 Vaccine Global Access Facility (COVAX Facility) by 18 September, with first upfront payments to follow thereafter, and no later than 9 October 2020.

"Equal access to a COVID-19 vaccine is the key to beating the virus and paving the way for recovery from the pandemic," said Stefan Löfven, Prime Minister of Sweden. "This cannot be a race with a few winners, and the COVAX

Facility is an important part of the solution – making sure all countries can benefit from access to the world's largest portfolio of candidates and fair and equitable distribution of vaccine doses."

The COVAX Facility is a Gavi-coordinated pooled procurement mechanism for new COVID-19 vaccines, through which COVAX will ensure fair and equitable access to vaccines for each participating economy, using an allocation framework currently being formulated by WHO.T

he COVAX Facility will do this by pooling buying power from participating economies and providing volume guarantees across a range of promising vaccine candidates, allowing those vaccine manufacturers whose expertise is essential to large scale production of the new vaccines, to make early, at-risk investments in manufacturing capacity – providing participating countries and economies with the best chance at rapid access to doses of a successful COVID-19 vaccine.

The goal of COVAX is by the end of 2021 to deliver two billion doses of safe, effective vaccines that have passed regulatory approval and/or WHO prequalification.

These vaccines will be offered equally to all participating countries, proportional to their populations, initially prioritising healthcare workers then expanding to cover vulnerable groups, such as the elderly and those with pre-existing conditions.

Further doses will then be made available based on country need, vulnerability and COVID-19 threat. The COVAX Facility will also maintain a buffer of doses for emergency and humanitarian use, including dealing with severe outbreaks before they spiral out of control.

To date, a total of 184 countries participate in the COVAX Facility, being 92 of them low and middle-income economies eligible to get access to COVID-19 vaccines through Gavi COVAX Advance Market Commitment (AMC).

3.2. Amount of money that country needs to buy vaccine

According to V. Lyashko, the commercial proposal was sent by a company from China, which is the first in the WHO list of developers.

“The vaccine will cost around $ 20, that is, about UAH 500 per dose. It will be necessary to vaccinate twice, ”said the chief sanitary doctor and specified that to protect a person from COVID-19, about 1000 hryvnia will be needed.

According to him, the timing of when it will be possible to buy the vaccine is not known, because clinical trials are still being conducted, there are no instructions, the drug has not been registered.

In terms of vaccination of the population, it is planned to cover 40% of citizens for the funds of the state budget. First of all, they will vaccinate medical workers and law enforcement officers.

“The second stage is the elderly, since this is the largest risk group. We have 6-7 million of them today. In the future - people with chronic diseases, ”added V. Lyashko. How much money will have to be allocated for this, the representative of the Ministry of Health promised to announce later.

The minister explained that people who have had coronavirus may have a decrease in the number of antibodies over time. Accordingly, such a person is again at risk of infection.

"The vaccine produces antibodies that fight the virus. If a person who has relapsed begins to lose antibodies, it is clear that they need to be updated, it is also at risk, especially if it is at risk. But you will need to look at a specific vaccine. ", - Stepanov explained.

The head of the Ministry of Health also expressed hope that the coronavirus vaccine would be delivered to Ukraine at the international initiative of COVAX next year, 2021. Currently, the Ministry conducts daily negotiations for the vaccine with various companies.

"By December 7, we have to sign all the technical documents with them all to get the vaccine under this mechanism, it's 8 million doses. In addition, there are

talks with other companies, they go every day. I hold meetings every day, and there is a corresponding dynamics with others. companies in which we intend to buy the vaccine.

The second issue concerns the trust in vaccination in Ukraine. We have a flu vaccine, but in Ukraine only half a percent of the population is vaccinated against the flu. And against the background of mistrust, the emergence of even such a dissident movement against the coronavirus, when people do not believe in the presence of the virus itself, this may be another deterrent to the average Ukrainian about the availability of these vaccines. Because it is very difficult for us to convince manufacturers that we will buy this vaccine or the private market will buy this vaccine.

And the third is the issue of safety and effectiveness, which is currently being discussed, with people following various reports, such as side effects or inefficiencies. Given that two doses will need to be given, this will also affect the availability of this vaccine. If we talk about masculinity and real accessibility, I think it can take three to five years.

It is pharmaceutical products that are the leader in imports to Ukraine. The fastest and most reliable way to deliver pharmaceuticals is by air. In addition to the production process and the actions of medical personnel, the quality of imported drugs also depends on how much the carrier company and the logistician controlling the entire process will understand the nuances of such transportation, because the transportation of pharmaceutical products requires the use of special equipment and the availability of specialized knowledge and skills.

Such transportation takes from a week to two. It is easy to guess that during this time the cargo goes through various stages of registration and direct transportation, and the slightest mistake can affect the quality and suitability of the drug.

The main indicators that require careful monitoring during transportation are temperature, humidity and lighting. In particular, vaccines require compliance with

a certain temperature regime, the violation of which leads to a change in their pharmacological properties.

Temperature requirements are specified by the manufacturer. For example, for many vaccines, the optimal temperature is from +2 to +8 ° C. But the vaccine for the prevention of poliomyelitis is recommended to be stored frozen at a temperature from -15 to -25 ° C. When storing and transporting the vaccine at a temperature of +2 to +8 degrees ... The shelf life of such a vaccine is six months.

Vaccines should be transported by refrigerated transport in thermal containers, with indicator cards, freezing indicators and thermotesters. Thermal indicators are considered cheap, but not very reliable means of control.

These are disposable color film indicators that show only the fact of a violation of the temperature regime, but do not say anything about the duration of this violation. If the cargo is transported in several stages, it is better to use thermostats.

Loading of drugs into thermal containers is carried out in the refrigerating chamber. In some cases, loading at room temperature is allowed, but not more than 10 minutes.

Bulk storage warehouses should have enough thermal containers, ice packs, indicator cards, freeze indicators, thermotesters and thermostats. The warehouses must adhere to the appropriate air humidity and lighting regime (Light should not fall on vaccines).

It is prohibited to store vaccines together with other medicines and foreign objects, as well as storage in refrigerator doors. A contingency plan should be developed at each stage of transportation.

The carrier company must have a sufficient number of refrigerated vehicles to ensure transportation in full compliance with the cold chain, including taking into account force majeure situations.

The vehicle must be equipped with a driver alert system in case of temperature changes.

In order to check the condition of the cargo during the entire transportation, wireless sensors are used in air transportation, which are in "sleep" mode during the flight and record data. This active wireless sensor sends information about the temperature of the cargo (and about humidity in the future) in real time to the receiver, so called wireless sensor gateways (USG), which forward the data via LAN or GPRS to the monitoring tools of the logistics service provider. Thus, you can track the cargo in real time and see if the temperature meets the established standards.

After air transportation, it is important to check once again the observance of temperature standards, as well as the integrity of the package. The product in damaged packaging cannot be sold. In addition to health hazards, these are also reputational risks for the manufacturer.

It is important to avoid shipment of an expired vaccine, or vaccine that is less than one month old. The responsible person should have an agreed delivery schedule for vaccines and monitor the expiration dates of the drugs.

Further - the process of safe storage of drugs in pharmacies, healthcare institutions and the possible last stage of transportation.

It is important to know that the transport of vaccines by courier services is prohibited. The buyer can personally deliver the vaccine to the vaccination room, having previously taken care of the availability of a thermal container. Or use the corresponding service of the network of pharmacies. At the same time, it is important to check the integrity of the packaging, the presence of documents and the indicators of the temperature indicator.

Delivery of pharmaceutical products, including vaccines, is a very delicate process. Any mistake during the transportation stage can lead to financial losses, reputational risks and have a negative impact on the health of patients. That is why all participants in this process should be aware of their responsibility not only to business, but above all to humanity.

Packaging system for the packing and labelling of Category B infectious substances is UN3373 described in theoretical part of this work. It includes 5

positions for transporting tubes. As a relust, we can transport 5 points of vaccine in one package.

According to the information that is united in the media, the first purchase of the vaccine will be for 8 million units of injections. Now we need to calculate how many of these boxes will fit into the cargo plane of the airline we have chosen.

As a new-generation freighter derived from Airbus' proven A330 jetliner family, the A330-200F offers highly-efficient operation with less noise and emissions than mid-sized cargo aircraft in service today. Customers have praised the A330-200F for its outstanding flexibility, which is further enhanced by the freighter's full operational commonality with Airbus' fly-by-wire family of single-aisle and wide-body jetliners. In addition, its large main deck cargo door allows the aircraft to accept all commonly-used pallets and containers.

The A330-200F is a medium-sized long-haul cargo aircraft capable of carrying cargo weighing 65 tons over a distance of 4,000 nautical miles (7,400 km) or 70 tons of cargo over a distance of up to 3,200 nautical miles (5,950 km). The aircraft uses a new universal loading system on the upper deck, which allows you to place both pallets and containers. There are several options for arranging cargo on the upper deck, designed for different markets and cargo flows.

To compensate for the nose roll of the A330 in the ground position, the front rack of the chassis has been redesigned. The standard rack A330-200 is used, however the top point of its fastening is shifted downwards that required installation in the lower forward part of a fuselage of the blister covering a rack in the removed position.

This solution made it possible to obtain a flat surface of the upper deck. The powerplant consists of two Pratt & Whitney PW4000 or Rolls-Royce Trent 700 engines. General Electric does not plan to offer engines for the A330-200F modification.

In addition to the production of new aircraft, Airbus has offered a program to convert passenger A330-200 into cargo.

	A330-200	A330-200F	A330-300
Cockpit crew	Two		
Capacity	246 (36J @ 60 in + 210Y @ 32 in)	70,000 kg (154,324 lb)	300 (36J @ 60 in + 264Y @ 32 in)
Max seating[214]	406		440
Length	58.82 m (192.98 ft)		63.67 m (208.89 ft)
Span	Wing: 60.3 m (197.83 ft), Main gear: 12.61 m (41.37 ft)		
Wing	361.6 m^2 (3,892 sq ft), 25% chord wingsweep: 30°,[215] 10.06 Aspect ratio		
Height[214]	17.39 m / 57 ft	16.90 m / 55 ft 5 in	16.79 m / 55 ft
Fuselage	5.64 m (222 in) diameter, 5.26 m (207 in) cabin width		
Seat width	0.46 m (18 in) in 8 abreast economy, 0.53 m (21 in) in 6 abreast business		
Cargo volume	132.4 m^3 (4673 cu ft)	469.2 m^3 (16567 cu ft)	158.4 m^3 (5591 cu ft)
MTOW	242,000 kg (533,519 lb)	233,000 kg (513,677 lb)	242,000 kg (533,519 lb)
OEW	120,600 kg (265,900 lb)	109,400 kg (241,200 lb)	129,400 kg (285,300 lb)
Max Payload	49,400 kg (108,900 lb)	68,600 kg (151,200 lb)	45,600 kg (100,500 lb)
Fuel capacity	139,090 L (36,744 US gal) – 109,185 kg (240,712 lb)		
Engines (×2)[186]	GE CF6 (except -200F) / PW4000 / Trent 700		
Thrust (×2)[186]	64,500–71,100 lbf (287–316 kN)		
Cruise	Mach 0.82 (470 kn; 871 km/h),[b] 12,500 m (41,100 ft) Service ceiling[216]		
Range[214]	13,450 km / 7,250 nmi[c]	7,400 km / 4,000 nmi	11,750 km / 6,350 nmi[d]
Runway[e]	Takeoff: 2,770 m (9,090 ft), Landing: 1,730 m (5,680 ft)[217]		

Fig 3.1 Airbus A330 specifications

Fig 3.2 Airbus A330-200F view

he A330-200F features a common flight deck with the A330 passenger variant and virtually identical flying qualities with the A320, A340, A350XWB and A380 Families. Today airlines are benefitting from significant savings through reduced training requirements and a common pool of pilots. For a pilot already qualified on the passenger variant, only computer-based training is required in transitioning to the all-cargo version.

Airbus is a leading aircraft manufacturer with the most modern and comprehensive family of airliners on the market. Based on the highly successful A330-200, the A330-200F is the only new mid-sized, long-haul freighter. This flexible and technologically advanced aircraft builds on Airbus' successful experience in the regional freighter market and benefits from the experience of over 1,000 in-service A330s.

The A330-200F has payload, range and economics superior to previous generation freighters, carrying 70 tonnes with a range up to 4,000nm / 7,400km. As the most efficient, profitable and reliable freighter of its generation, the A330-200F provides similar unit costs compared to larger freighters.

Its versatile main deck accommodates standard industry pallets and containers, but also enables to carry oversized cargo with 16ft/20ft pallets. With the A330-200F you can be sure that your temperature or time sensitive goods are transported in optimal conditions. It will support you every day to deliver the highest quality of services to your customers.

In today's market larger freighters struggle to gather sufficient payload to reach profitability, resulting in more risk and lower frequencies. The A330-200F was launched to answer the need for efficient, mid-size aircraft that could be operated on thinner or frequency driven markets with economics equivalent to those of larger freighters. For example, at 70 tonnes, the A330-200F cost per tonne is 35 % lower than that of a larger freighter. Fuel-efficient technologies, flexible cargo configurations and optimised load factors make the A330-200F a highly cost-efficient freighter.

Fig 3.3 Precess of Airbus A330-200F loading

Looking on scheme of cargo loading we can't count how much UN3373 packages can be loaded in one Airbus A330-200F.

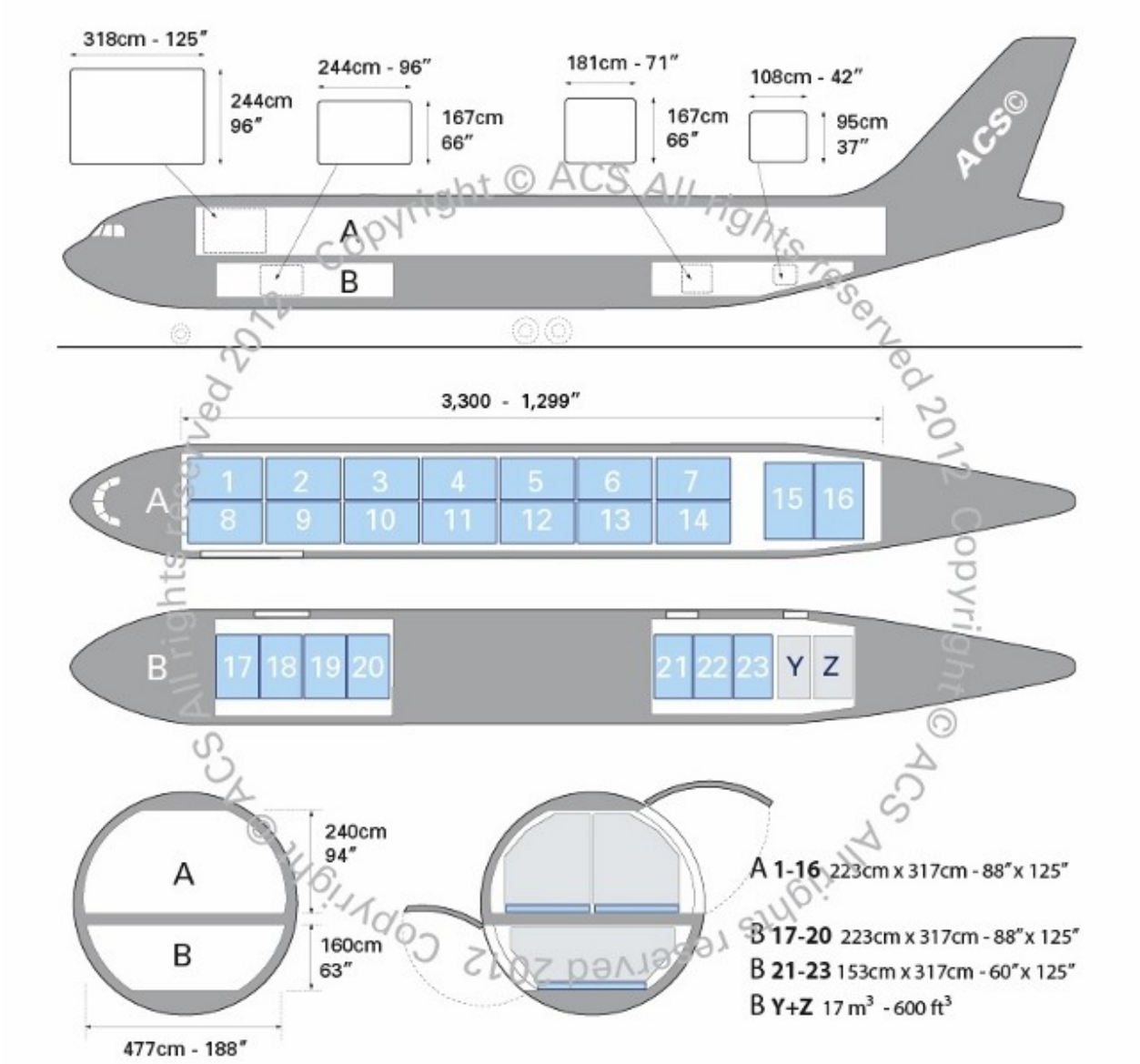


Fig 3.4 Airbus A330-200F scheme of cargo loading

The term "general packaging" is used in cases where several packages are combined into one cargo and sent to the same destination by one consignor. If for a refrigerant is used to protect the contents; be isolated vessels or flasks. If general packaging is used, the outer surface must also have all the necessary stickers and labels that available on separate packages. This requirement applies to infectious

Category A and B materials. In addition, the general packaging must read "general packaging". Coolants can be used to stabilize infectious materials of category A and B during transportation.

Ice or dry ice should be placed outside the secondary packaging. Plain ice is placed in a sealed waterproof container; the outer packaging must also be sealed. Dry ice should not be placed inside the primary container or secondary packaging due to the risk of explosion. When transporting goods with dry ice, a special separate packaging. If dry ice is used, the packaging should provide free exit of evaporated carbon dioxide. Follow the instructions 904 ICAO / IATA.

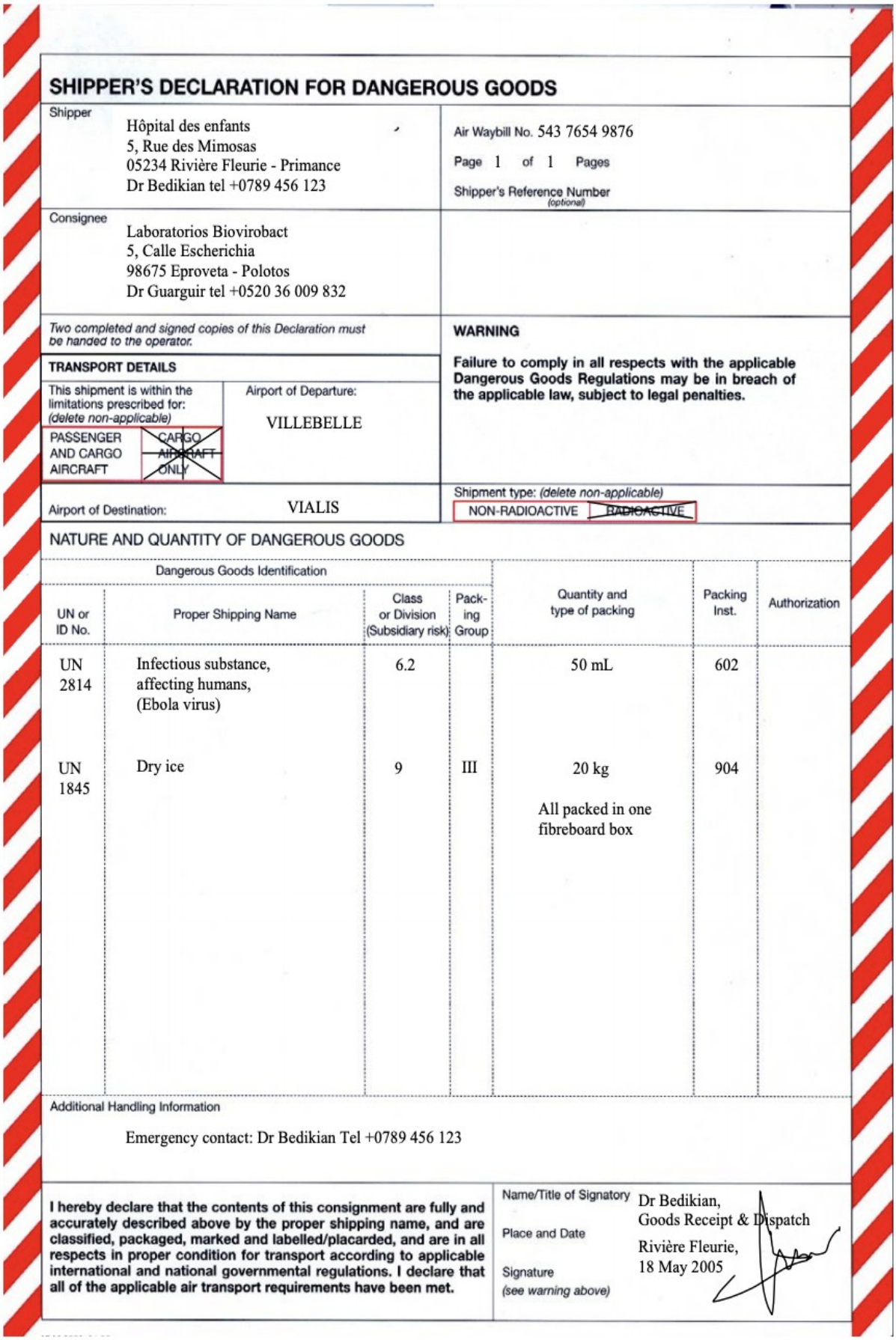
Secondary packaging must be reinforced in the outer packaging in such a way that ensure that the correct position of the inner packagings is maintained after the coolant will dissolve or evaporate. If dry ice is used for the carriage of infectious substances in Category A, In the Dangerous Goods Declaration, the shipper must provide details. Besides in addition, there must be a sticker on the outside of the outer packaging, indicating the use of dry ice (see fig. 4), and the corresponding markings. If a dry ice is used for the transport of infectious substances of category B, on packaging should indicate "Carbon dioxide, solid" or "Dry ice"; in these guidelines this issue is not considered in more detail.

If liquid nitrogen is used as a coolant, it is necessary to provide a special arrangement with the carrier. The primary container must withstand ultra-low temperatures, and packaging and documentation must comply requirements for the use of liquid nitrogen.

In particular, on the outside the surface of the outer packaging must have an appropriate sticker to indicate use of liquid nitrogen.

When transported by air packaging must also have a sticker indicating the use of cryogenic liquids in these recommendations, this question is not in more detail is being considered.

The principle of triple packing continues to operate, including for local shipments by land transport. However, packaging test results documents are not required. Instead of looking for a reputable supplier, you can use local sources packaging materials, provided that both the container manufacturer and the sender fully comply with the requirements of document P650.



SHIPPER'S DECLARATION FOR DANGEROUS GOODS

Shipper
Hôpital des enfants
5, Rue des Mimosas
05234 Rivière Fleurie - Primance
Dr Bedikian tel +0789 456 123

Air Waybill No. 543 7654 9876
Page 1 of 1 Pages
Shipper's Reference Number (optional)

Consignee
Laboratorios Biovirobact
5, Calle Escherichia
98675 Eproveta - Polotos
Dr Guarguir tel +0520 36 009 832

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: *(delete non-applicable)*
PASSENGER AND CARGO AIRCRAFT ~~CARGO AIRCRAFT ONLY~~

Airport of Departure: VILLEBELLE

Airport of Destination: VIALIS

Shipment type: *(delete non-applicable)*
NON-RADIOACTIVE ~~RADIOACTIVE~~

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification				Quantity and type of packing	Packing Inst.	Authorization
UN or ID No.	Proper Shipping Name	Class or Division (Subsidiary risk)	Packing Group			
UN 2814	Infectious substance, affecting humans, (Ebola virus)	6.2		50 mL	602	
UN 1845	Dry ice	9	III	20 kg All packed in one fibreboard box	904	

Additional Handling Information

Emergency contact: Dr Bedikian Tel +0789 456 123

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. I declare that all of the applicable air transport requirements have been met.

Name/Title of Signatory: Dr Bedikian, Goods Receipt & Dispatch
Place and Date: Rivière Fleurie, 18 May 2005
Signature *(see warning above)*

Fig 3.5 Example of a completed "Shipper's Declaration for Dangerous Goods"

For instance, in aviation the most important resource is a current fleet. Basing on previous investigation and analysis of a current market state, it should be done aircraft evaluation and fleet planning. The choice of an aircraft, as well as overall operating fleet is the important long-term strategic decision of an airline. The actual fleet of an airline is commonly planned on the basis of current situation on the market, transport demand and facilities, which further would provide maintenance of aircraft (emphasize on expenses).

All these factors have an influence on the transport mean choice, but their impact varies moderately (Figure 3.6).

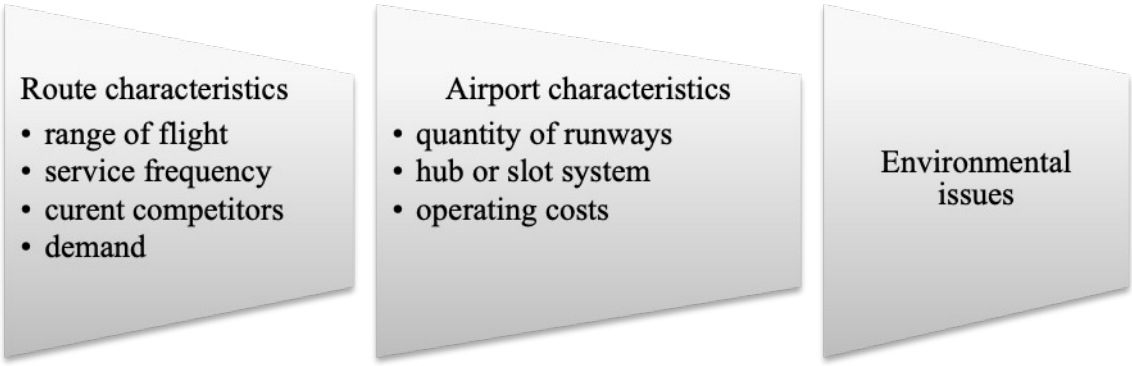


Fig.3.6 Main factors, which influence the choice of an aircraft

Firstly, the airline considers which kind of flights would be served by the aircraft, depending mostly on the demand. Commonly, if the demand of already existing routes increasing - the usage of larger aircraft is more sufficient, while there is a necessity to open a new route - the choice of an aircraft is based on the needed fling capacity and range.

In case of an increasing of a demand:

- Higher service frequency (reducing passenger and cargo delay);
- Higher aircraft size (increasing productivity in terms of passenger and cargo transported; range of flight increases).

Secondly, the airport characteristics are important. When introducing new aircraft should be taken into account terminal capacity of an airport, which would be a part of transportation process. This could include availability of maintenance of transport vehicle, acceptable areas and technologies for processing cargo and passenger as well as readiness to serve more flights (case of increasing service

frequency). The status of an airport if it is hub or a spoke must be considered, while the usage of regional jets during fly from spoke to a hub is more rational (availability to benefit with comparatively less expenses with providing more frequent flies to a hub.) The flights from the hub are carried out by the larger aircrafts.

Large aircraft are more expensive to serve in the airport, which can also influence on the choice of aircraft:

- The charges are calculated on the basis of the weight of aircraft;
- Personnel has higher salaries;
- Runway capacity price.

Thirdly, environmentally friendly airlines as well as governmental authorities consider the environmental issue is one, which affects the decision making.

Long haul routes were excluded, while the frequency of operation is considerably lower than on short haul routes and the airlines already prefer to use large aircrafts, which is more efficient. At the same time the flight with that ranges can be performed by large aircrafts only. While there is a flight from hub, usually the commercial load is higher as well which provoke necessity in higher maximum payload.

To predict the operational and financial efficiency of new airline creation, it should be done market share and revenue forecasting. It is hard to do, because as it was stated before, aviation is too global business, which depends on world's market state which is hard to anticipate.

3.3 Development of optimal vaccine delivery schemes

The GAVI Vaccine Alliance is a public-private partnership that helps ensure that half of the world's population is vaccinated against a range of deadly diseases. Since its founding in 2000, the Alliance has helped immunize more than 760 million children, a generation, and prevented over 13 million deaths, helping to halve child mortality in 73 developing countries.

The Alliance also plays a critical role in strengthening global health and safety by supporting health systems and funding global stockpiles of Ebola, cholera, meningitis and yellow fever vaccines. The GAVI Alliance is now building on 20 years of successful experience to protect a new generation and reach out to unvaccinated people whose needs were previously neglected, using state-of-the-art technology - from drones to biometric systems - to save millions. other lives, timely containment of outbreaks of epidemic potential, and help countries achieve self-reliance.

The Vaccine Alliance brings together developing and donor governments, the World Health Organization, UNICEF, the World Bank, vaccine manufacturers, technical agencies, civil society organizations, the Bill & Melinda Gates Foundation and other private sector partners.

In July, the GAVI Board agreed on a list of 92 countries that will receive COVAX support under Preliminary Purchase Commitments (PRPs). Below is a complete list of these countries.

Low-income countries: Afghanistan, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Democratic Republic of Congo, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Democratic People's Republic of Korea, Liberia, Madagascar, Malawi , Mali, Mozambique, Nepal, Niger, Rwanda, Sierra Leone, Somalia, South Sudan, Syrian Arab Republic, Tajikistan, Togo, Uganda, United Republic of Tanzania and Yemen.

Lower middle income countries: Angola, Algeria, Bangladesh, Bhutan, Bolivia, Cape Verde, Cambodia, Cameroon, Comoros, Congo, Ivory Coast, Djibouti, Egypt, El Salvador, Eswatini, Ghana, Honduras, India, Indonesia, Kenya, Kiribati, Kyrgyzstan, Lao People's Democratic Republic, Lesotho, Mauritania, Micronesia, Moldova, Mongolia, Morocco, Myanmar, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Philippines, Sao Tome and Principe, Senegal, Solomon Islands, Sri Lanka, Sudan, Timor-Leste, Tunisia, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Zambia and Zimbabwe.

Other countries eligible for assistance from the International Development Association (IDA): Dominica, Fiji, Grenada, Guyana, Kosovo, Maldives, Marshall Islands, Samoa, Saint Lucia, Saint Vincent and the Grenadines, Tonga and Tuvalu.

Of the nine candidate vaccines currently being evaluated for inclusion in the COVAX mechanism, two are being developed in China, two in the United States of America, one in the Republic of Korea, one in the United Kingdom of Great Britain and Northern Ireland, and one more globally. partnerships of various manufacturers.

According to the data on the COVAX website, most likely the vaccine will be supplied to European countries from United Kingdom of Great Britain, the United States will take the left hemisphere of our planet under its wing, and China will cover the countries of Asia. So, to calculate the route for the delivery of the vaccine to Ukraine, The United Kingdom of Britain was chosen.

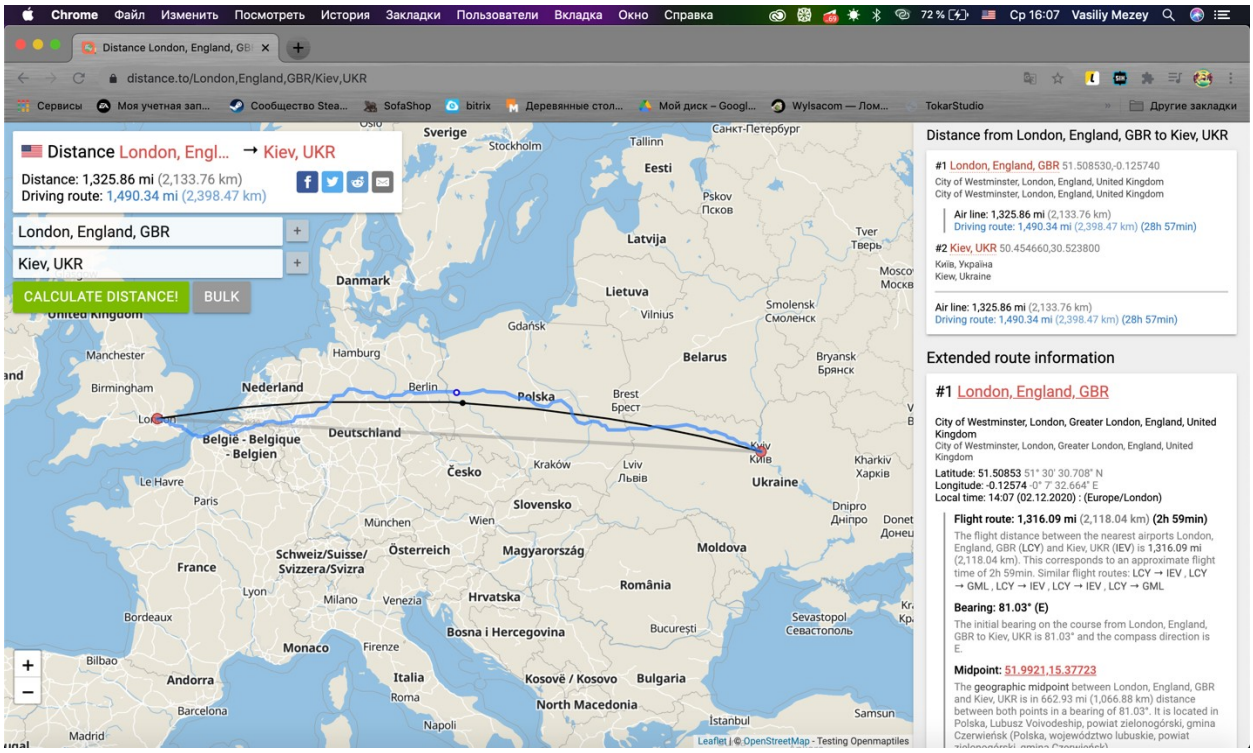


Fig 3.7 Distance from London to Kiev

The flight distance between the nearest airports London, England, GBR (LCY) and Kiev, UKR (IEV) is 1,316.09 mi (2,118.04 km). This corresponds to an approximate flight time of 2h 59min.

The geographic midpoint between London, England, GBR and Kiev, UKR is in 662.93 mi (1,066.88 km) distance between both points in a bearing of 81.03°. It is located in Polska, Lubusz Voivodeship, powiat zielonogórski, gmina Czerwieńsk (Polska, województwo lubuskie, powiat zielonogórski, gmina Czerwieńsk).

The time difference between London, England, GBR (Europe/London) and Kiev, UKR (Europe/Kiev) is 2 hours. This means that it is now 14:07 (02.12.2020) in London, England, GBR and 16:07 (02.12.2020) in Kiev, UKR.

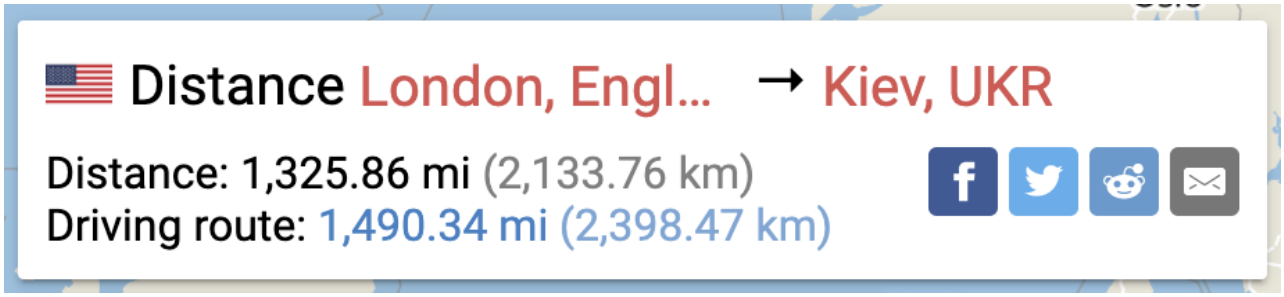


Fig 3.8 Distance from London to Kiev

To carry out its activities, the airline needs a slot.

Slot - a place in the schedule, the schedule of takeoffs and landings at the airports of departure and arrival.

Regulatory documents that establish the principles of slot allocation are the recommendations of ICAO "Regulatory aspects of the allocation of" windows "for the arrival and departure of flights at international airports and IATA "Worldwide Scheduling Guidelines".

Ukraine has rules for granting permits to operators to depart from Ukrainian airports and arrive at Ukrainian airports during international, domestic and transit flights.

One of the most important concepts of the IATA slot allocation system is the historical precedent for a particular slot, which the airline used effectively (at least 80%) in the same season last year. The right to a slot is in fact reserved for airlines, although legally these rights are not indicated in any way.

The second main point is the right of airlines to exchange received slots. Outwardly, it looks like a simple exchange, however, the airline buyer not only

gives the seller an unnecessary or little used slot, but often receives a certain amount for it.

The IATA slot allocation system has been operating for 66 years. However, we should not forget that in parallel with the official mechanisms of the airline use the opportunities of the "gray market".

The aircraft schedule is the main program document of the airline, which regulates the activities of all its services. The basis for scheduling is the plan of the aircraft.

When drawing up the flight schedule, it is necessary to take into account the flight and working hours of the crew - the sanitary norm. According to the Rules for determining the working time and rest time of crews of civil aircraft of Ukraine, the duration of daily work of aircraft crew members should not exceed 12 hours with subsequent rest time.

Route under consideration:

London Heathrow Airport (LHR) – Kyiv Zhuliani (IEV) - London Heathrow Airport (LHR)

Estimated flight time is 3 hours.

We depart from London Heathrow Airport (LHR) at 08:30, arrive in Kyiv Zhuliani (IEV) (08:30 + 3:00) at 13:30. The time difference between Ukraine and Great Britain is - 2 hours in summer and + 2 hours in winter.

Then we depart from IEV airport at 10:00 am, arrive in LHR (08:30 + 3:00) at 9:30 pm local time in London.

Table 3.1

Schedule of connecting flights

Flight	Airport of departure	Destination airport	The day of the week when the flight is performed	Departure time (behind Kyiv)	Arrival time (local time in London)
AD 714	Heatrow (LHR)	Zhuliani (IEV)	Thursday	08:30	13:30
AD 713	Zhuliani (IEV)	Heatrow (LHR)	Monday	08:30	09:30

Calculate the cost of the flight Kiev - London.

All planned costs for the flight E_{flight} consist of direct E_{dir} and indirect E_{ind} costs.

$$E_{flight} = E_{dir} + E_{ind} \quad (3.1)$$

Direct costs are calculated by the formula:,

$$E_{dir} = E_{fc} + E_{rest} + E_{repc} + E_{labc} + E_{dsot} + E_{insu} + E_{flcost} + E_{navfee} + E_{afee} \quad (3.2)$$

where E_{fc} – fuel costs, UAH / flight;

E_{rest} – costs for full restoration of the aircraft, UAH / flight;

E_{repc} - maintenance and repair costs, UAH / flight;

E_{labc} – labor costs of aircraft crew members, UAH / flight;

E_{dsot} – deductions for social and other obligatory types of insurance, UAH / flight;

E_{insu} - aircraft insurance costs, UAH / flight;

E_{flcost} – other flight costs, UAH / flight;

E_{navfee} – air navigation fees, UAH / flight;

E_{afee} - airport fees, UAH / flight.

Based on the flight speed on the flight (its section), the planned level of flight duration on a single flight (in one direction) and on each non-stop section of the flight is determined:

$$t_p = \frac{L}{V_{p.}}, \quad (3.3)$$

where V_p - flight speed, km / h;

L - distance between airports on the flight route, km;

$$t_p = 2150 / 750 = 2{,}9 \text{ hour}$$

The execution time of a single or even flight is determined by the sum of the flight time on all sections of the flight. In the planned calculations, the time of the

entire flight and the time of flight on all sections is increased due to the non-production raid associated with the implementation of training and auxiliary flights on the aircraft.

Thus, the planned cost of aviation fuel on the flight is determined by the formula:

$$E_{fc} = (1+ K_{non\text{-}ph})g \times C_{CTF} \times t_p, \quad (3.4)$$

where $K_{non\text{-}ph}$ - coefficient that takes into account the non-productive raid hours;

g – fuel consumption on average per hour, t;

C_{CTF} - the cost of one ton of aviation fuel at airports;

t_p – flight duration, h.

According to formula 3.4, the planned costs for aviation fuel on the flight will be:

$$E_{fc} = (1+ 0.05)4 \times 1000 \times 2,9 = 12,180\$/hour$$

Calculate the amount of depreciation for the restoration of assets, which include all spare engines, as well as those under repair. Depreciation of fixed assets, according to the "Accounting Regulation 7" Fixed assets ", approved by the Order of the Ministry of Finance of Ukraine 27.04.2000 №92" is calculated using the following methods:

1. rectilinear;
2. reduction of credit value;
3. accelerated reduction of residual value;
4. cumulative;
5. production.

The state regulates the remuneration of employees of enterprises of all forms of ownership by setting the minimum wage and other state norms and guarantees, establishing the conditions and amounts of remuneration of managers of enterprises based on state, communal property, employees of enterprises,

institutions and organizations funded or subsidized. from the budget, regulation of wage funds of employees of monopoly enterprises in accordance with the list determined by the Cabinet of Ministers of Ukraine, as well as by taxation of employees' incomes.

The conditions of remuneration of employees of institutions and organizations financed from the budget shall be determined by the Cabinet of Ministers of Ukraine, except for the case provided for in part one of Article 10 of this Law "On Remuneration of Labor".

Flight costs of flight crews are determined on the basis of the selected system of remuneration - hourly. For the commander of the aircraft the salary is $ 80, for other crew members - $ 60, for flight attendants - $ 20. per hour of flight. Total on board: 1 commander, 1 co-pilot, 1 flight engineer and 2 flight attendants.

Calculated by the formula:

$$E_{labc} = (80 + 2 \times 60 + 2 \times 20) \times 2{,}9 = 700\$, \quad (3.5)$$

Expenditures on social and other types of compulsory insurance of flight crews include insurance contributions for social needs to the Pension Fund, the Social Insurance Fund, the Compulsory Health Insurance Fund, and the Employment Fund.

In 2018, the insurance premiums transferred by the insured persons referred to in paragraphs 1, 2 and 5 of Article 14 of the Law of Ukraine “On Compulsory State Pension Insurance” to the solidarity system are paid in the amount of 33.2 percent. In this case, the insured referred to in paragraphs 1 and 2 of Article 14 of the Law of Ukraine "On Compulsory State Pension Insurance" for employees from among the flight crews of civil aircraft and flight operators who perform special work in flight pay insurance premiums in the amount of 42 interest and for working disabled people - 4 percent.

Enterprises of all-Ukrainian public organizations of disabled people, where the number of disabled people is at least 50 percent of the total number of employees, pay insurance premiums at the rate of 4 percent of the object of taxation for all employees of these enterprises.

These costs are determined by the following formula:

$$E_{dsot} = E_{labc} \times K_{ded} \quad (3.6)$$

where: K_{ded} - coefficient of deductions for social needs (take for 0.397).

According to formula 3.6, the costs of social and other types of compulsory insurance of flight crews will be:

$$E_{dsot} = 700 \times 0.397 = 278\$$$

Other flight costs associated with the implementation of transportation include the costs of freight forwarding organizations, insurance and intermediary organizations, agents and air transport agencies, the cost of which is included in the cost of transportation:

$$E_{flcost} = (C_{oth.} \times t_{p.}) / T_{per} \quad (3.7)$$

where: $C_{oth.}$ – other airline flight costs for a specific type of aircraft;

$t_{p.}$ – flight duration taking into account all sections of non-stop range, h;

T_{per} - production plaque of a specific type of aircraft fleet.

According to formula 3.7, other flight costs will be:

$$E_{flcost} = (5500000 \times 2,9) / 3500 = 4560\$$$

For airport service of aircraft (hereinafter - the aircraft) and passengers, related to the provision of: landing and take-off of the aircraft, passenger service at the airport, emergency parking of the aircraft, aviation security, airport fees are charged.

The charge for landing and take-off of the aircraft is set for each ton of the maximum take-off mass (hereinafter - MRM) of the aircraft, specified in the certificate of suitability for flight, depending on the type of service.

The fee for publication in international aviation directories is $ 10.50 for international flights. US for 1 ton of MZM PS.

If the landing-take-off of the aircraft at the airport is carried out in accordance with the purpose of a regular or charter airline, landing on an international flight, and departure on a domestic or vice versa (with a corresponding change of flight

number), the landing-take-off fee is set at 50 percent fees according to the types of connections.

A coefficient of 0.5 is applied to the landing-take-off fee.

The fee for passenger service at the airport for publication in reservation systems is $ 17.00 for international services. US for each passenger sent.

Airport fees, which are attributed to a particular flight, are determined on the basis of the declared fees and the coefficient of their reduction due to government regulation:

$$E_{afee} = k(E_{feetof} + E_{feecom} + E_{feetground}) \quad (3.8)$$

where E_{feetof} – the total amount of fees for takeoff and landing and maintenance of the aircraft at the airports of the airline, UAH;

E_{feecom} – the total amount of fees for commercial service of passengers, mail, luggage and cargo at airports, UAH;

$E_{feetground}$ – the total amount of fees for ground handling of aircraft at airports, UAH;

k – the coefficient of reduction of airport charges.

According to formula 3.8, the airport fee will be:

$$E_{afee} = 0,5(10,5 \times 175,5 + 17 \times 130 + 3500) = 3780\$$$

Air navigation charges for the flight consist of service charges on the route (R) and boarding fee (E_{feetof}):

$$E_{navfee} = E_{pos} + R \quad (3,9)$$

Тоді постійні витрати будуть складати:

$$E_{pos} = 187,5\$$$

The fee for air navigation services of aircraft (AIR) in the airspace of Ukraine, related to the organization of air traffic (ATS) on the route, as well as on the approach and in the area of the aerodrome, air navigation fees are charged at fixed rates.

The rates of air navigation fees are set regardless of the nationality of the aircraft and the form of ownership of the airline.

The fee (R) for air navigation service of aircraft in the airspace of Ukraine, related to the provision of ATS on the route, is determined depending on the maximum permissible takeoff mass of the aircraft specified in the operator's certificate, orthodromic distance and unit rate.

The unit rate (T) for ATS services on the approach and in the aerodrome area for international flights is $ 8.55. USA.

Fee for service on the route for 100 km of orthodrome distance is calculated by the formula:

$$R = TD\sqrt{\frac{G}{50}k}, \quad (3.10)$$

where: *T* – a single rate of service fee on the route for 100 km of orthodrome distance;

D – orthodromic distance, km;

G – take-off mass of the aircraft, t;

k – coefficient of reduction of air navigation fees.

According to formula 3.10, the service charge on the route is:

$$R = 50,96 \times 49,3 \times (\sqrt{(175,5/50)} \times 0,3) = 2578\$$$

Then the air navigation fee will be:

$$E_{navfee} = 187,5 + 2578 = 2765,5\$$$

Insurance protection includes: compulsory insurance of aircraft; compulsory insurance of the aircraft operator's liability for damage caused to third parties and the air carrier's liability for damage caused to passengers, luggage, mail, cargo; compulsory insurance of aircraft crew members and other aviation personnel.

The minimum insurance coverage in respect of liability to passengers for luggage and cargo should be:

a) in front of the passenger - SDR 250,000 (USD 378,825) for each passenger.

b) for passenger luggage - SDR 1,000 (USD 1,515.3) for each passenger.

c) for cargo - SDR 17 (USD 25.76) for each kg.

The sum insured established by the compulsory insurance contract must not be less than the book value of the aircraft.

The costs of aircraft insurance, which are attributed to the flight, require a preliminary distribution of total costs for all types of aircraft insurance for each type with the subsequent distribution of the amount received for each flight:

$$E_{insu} = C_{inscos} \times t_p / T_{prod} \quad (3.11)$$

where C_{inscos} - costs of the airline for the insurance of the fleet of a specific type, UAH;

t_p - flight duration taking into account all sections of non-stop range, h;

T_{prod} – annual production raid of a specific type of aircraft fleet.

According to formula 3.11, the costs of aircraft insurance will be:

$$E_{insu} = 2000000 \times 2,9 / 3500 = 1660\$$$

Therefore, the direct costs are (according to formula 3.2):

$$E_{dir} = 12180 + 700 + 278 + 1660 + 4560 + 2765,5 = 22145\$$$

Indirect costs are taken as 40% of direct costs:

$$E_{nepr} = 0,4 \text{ x } E_{pr} \quad (3.12)$$

$$E_{nepr} = 0,4 \text{ x } 22145 = 8858\$$$

The total cost of the flight is:

$$E_{flight} = 22145 + 8858 = 31003\$$$

Now we need to calculate how much vaccine an cargo aircraft can carry in one flight in order to calculate the number of flights that we need to transport the first batch of vaccine.

The total volume of our aircraft is.

One UN3373 package takes up space.

The total volume Airbus A330-200F aircraft is:

Sector A (1-16) 223cm x 317cm;

Sector B (17-20) 223cm x 317cm;

Sector B (21-23) 153 x 317cm

Sector B (Y + Z) 17 m^2

So now, we need to calculate total m^2 of our aircraft:

Sector A (1-16) 2.23m x 3.17m x 16 = 113 m^2 x 0.96 = 110 m^3;

Sector B (17-20) 2.23m x 3.17m x 4 = 28 m^2 x 0.96 = 27 m^3;

Sector B (21-23) 1.53m x 3.17m x 3 = 14 m^2 x 0,66 = 9 m^3;

Sector B (Y + Z) 17 m^2 x 0,66 = 11 m^3.

To summarise 110 + 27 + 9 + 11 = 157 m^3.

Our package UN3373 is 30x30x30cm. It is 0.027m^3

To calculate one full loading of amount of packages UN3373, we need:

157 m^3 / 0,027 m^3 = 5800 units.

One our UN3373 package can contain 30 positions for vaccine:

It means, that during one flight our Airbus A330-200F can carry:

5800 x 30 = 174000 units.

According to official sources and as reported in the press, the first wave of vaccine will be 8 million units, it means:

8000000 / 174000 = 46 flights.

And finally, it remains to multiply the cost of the flight from the country from where we will carry the vaccine by the number of flights to Ukraine, thereby we find out how much it will cost Ukraine to bring the first batch (8 million doses out of 40, where 40 is the approximate population of Ukraine):

TOTAL COST = 31003$ × 46 = 1 426 138$.

3.4 Conclusions of Design part

The Ministry of Health has already calculated that for the vaccination of all priority groups, Ukraine will need 16 million doses of the vaccine - or 32 million in the case of a double vaccination. And if Ukraine receives eight million doses - half of this number - within the framework of the COVAX initiative, then the country will have to buy the other half at the full price.

According to him, both legally and financially, Ukraine is ready to purchase a future vaccine produced by any company - provided that the safety of the drug is proven, it will pass all stages of testing with international confirmation of its effectiveness and will be officially registered on the international market.

In this part, by means of calculations, the cost of one flight to deliver the vaccine to Ukraine was calculated. The total cost of the flight is 31003$.

Further, it was calculated how many packages will fit on one aircraft, thus it is possible to calculate the number of necessary flights for delivery. According to official sources and as reported in the press, the first wave of vaccine will be 8 million units, it means 46 flights.

And finally, it remains to multiply the cost of the flight from the country from where we will carry the vaccine by the number of flights to Ukraine, thereby we find out how much it will cost Ukraine to bring the first batch: 1 426 138$.

SUMMARY

Air Transportation Management Department				NAU 20.05.50. 002 EN			
Researcher	Mezey V.			SUMMARY	Letter	Sheet	Sheets
Supervisor	Ivannikova V.Yu.				D	128	2
Normative Supervisor	Shevchenko Yu.V.				FTML 275 ОП- 202Ма		
Head of the Department	Shevchuk D.O.						

Infectious substances in Category A will not be accepted for shipment through postal services. Infectious substances in Category B may be shipped by registered air mail, and the Universal Postal Union recommends the following procedure.

The basic triple packaging system is used with the same requirements as for other means of transport. The address label shall display the word “Lettre” or “Letter” and the green Customs Declaration WHO/CDS/CSR/LYO/2005.22 Guidance on regulations for the transport of infectious substances. Label for Postal Mail is required for international mailing. “DIAGNOSTIC SPECIMENS”, “CLINICAL SPECIMENS” or “BIOLOGICAL SUBSTANCE, CATEGORY B” shall be identified with the white diamond label with black letters “UN 3373”.

Local/international restrictions may be in force. Prior contact should therefore be made with thenational public operator to ascertain whether the packaged material will be accepted by the postal service in question.

Statistical data collected by a group of central laboratories showed the efficacy of packaging compliant with P650 and P620 in assuring that infectious substances are transported without leakage and loss of materials. For the 4.92 million primary containers shipped in 2003 to any of the worldwide regional offices of these central laboratories, just 106 breakages, 0.002% of the total number, were recorded. Moreover, the leakages that did occur were all contained by the absorbent material, and no damage to secondary containers or outer packagings was reported.

CEPI classifies development stages for vaccines as "exploratory" (planning and designing a candidate, having no evaluation in vivo), "preclinical" (in vivo evaluation with preparation for manufacturing a compound to test in humans), or initiation of Phase I safety studies in healthy people. Some 321 total vaccine candidates are in development as either confirmed projects in clinical trials or in early-stage "exploratory" or "preclinical" development, as of September.

Definition of vaccine safety, efficacy, and clinical endpoints in a Phase III trial may vary between the trials of different companies, such as defining the

degree of side effects, infection or amount of transmission, and whether the vaccine prevents moderate or severe COVID-19 infection.

During analitycal part was selected Wizz Air airline cause during analysis was shown, very stable in the air carrier market. I also have a good fleet of the latest aircraft, including for the transport of dangerous goods such as medicines. He also has a colossal and successful experience in the transportation of ADR cargo. Everything is performed to the highest IATA standards.

And it is a stable airline that, during the COVID-19 pandemic, managed to maintain its leadership position in the air carrier market. And also without reducing the working staff, which numbers thousands of people.

It was found that among the most important factors for special cargo companies are: cost minimization, maximizing supply efficiency, complexity management, maximizing supply flexibility and minimizing risks. Emphasis is placed on the nonlinearity of the links between these factors and the solution of the multicriteria problem by the participants of the logistics supply chain, which, in particular, makes it difficult to develop the relevant developments.

Ukraine is ready to purchase a future vaccine produced by any company - provided that the safety of the drug is proven, it will pass all stages of testing with international confirmation of its effectiveness and will be officially registered on the international market.

One flight to deliver the vaccine to Ukraine was calculated. The total cost of the flight is 31003$.

Further, it was calculated how many packages will fit on one aircraft, thus it is possible to calculate the number of necessary flights for delivery. According to official sources and as reported in the press, the first wave of vaccine will be 8 million units, it means 46 flights.

And finally, it remains to multiply the cost of the flight from the country from where we will carry the vaccine by the number of flights to Ukraine, thereby we find out how much it will cost Ukraine to bring the first batch: 1 426 138$.

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APPENDICES

Air Transportation Management Department				NAU 16.10.11. 003 EN			
Researcher	Mezey V.				Letter	Sheet	Sheets
Supervisor	Ivannikova V.Yu.				D	137	2
Normative Supervisor	Shevchenko Yu.V.			SUMMARY	FTML 275 ОП- 202Ма		
Head of the Department	Shevchuk D.O.						

Appendix A. Indicative examples of substances

UN number and proper shipping name	Microorganism
UN 2814 Infectious substance, affecting humans	*Bacillus anthracis* (cultures only)
	Brucella abortus (cultures only)
	Brucella melitensis (cultures only)
	Brucella suis (cultures only)
	Burkholderia mallei – glanders (cultures only)
	Burkholderia pseudomallei (cultures only)
	Chlamydia psittaci – avian strains (cultures only)
	Clostridium botulinum (cultures only)
	Coccidioides immitis (cultures only)
	Coxiella burnetii (cultures only)
	Crimean–Congo haemorrhagic fever virus
	Dengue virus (cultures only)
	Eastern equine encephalomyelitis virus (cultures only)
	Escherichia coli, verotoxigenic (cultures only)[4]

UN number and proper shipping name	Microorganism
	Foot and mouth disease virus (cultures only)
	Lumpy skin disease virus (cultures only)
	Mycoplasma mycoides – contagious bovine pleuropneumonia (cultures only)
	Peste des petits ruminants virus (cultures only)
	Rinderpest virus (cultures only[5])
	Sheep-pox virus (cultures only)
	Goatpox virus (cultures only)
	Swine vesicular disease virus (cultures only)
	Vesicular stomatitis virus (cultures only)

UN number and proper shipping name	Microorganism
	Ebola virus
	Flexal virus
	Francisella tularensis (cultures only)
	Guanarito virus
	Hantaan virus
	Hantaviruses causing haemorrhagic fever with renal syndrome
	Hendra virus
	Hepatitis B virus (cultures only)
	Herpes B virus (cultures only)
	Human immunodeficiency virus (cultures only)
	Highly pathogenic avian influenza virus (cultures only)
	Japanese encephalitis virus (cultures only)
	Junin virus
	Kyasanur Forest disease virus
	Lassa virus
	Machupo virus
	Marburg virus
	Monkeypox virus
	Mycobacterium tuberculosis (cultures only)[1]
	Nipah virus
	Omsk haemorrhagic fever virus
	Poliovirus (cultures only)
	Rabies virus (cultures only)
	Rickettsia prowazekii (cultures only)
	Rickettsia rickettsii (cultures only)
	Rift Valley fever virus (cultures only)
	Russian spring–summer encephalitis virus (cultures only)
	Sabia virus
	Shigella dysenteriae type 1 (cultures only)
	Tick-borne encephalitis virus (cultures only)
	Variola virus
	Venezuelan equine encephalitis virus (cultures only)
	West Nile virus (cultures only)
	Yellow fever virus (cultures only)
	Yersinia pestis (cultures only)
UN 2900 Infectious substance, affecting animals only	African swine fever virus (cultures only)
	Avian paramyxovirus Type 1 – Velogenic Newcastle disease virus (cultures only)
	Classical swine fever virus (cultures only)

Appendix B. Marking and labelling

Example of triple packaging system for the packaging and labelling of Category A, UN2814 and UN2900 infectious substances (Figure kindly provided by IATA, Montreal, Canada).