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Comparative analysis of the effectiveness of trolley and self-propelled technologies for processing aviation containers on the platform

The article is devoted to the study of two technologies for processing aviation containers on the platform - trolley and self-propelled, with the aim of comparing their efficiency. The main factors that determine the advantages and disadvantages of each technology are analyzed, in particular, the factor of the use of the operational field during the ground maintenance of aircraft

Introduction. Transportation, loading and unloading of aviation containers on the apron is one of the important stages of the operation of the ground handling system of aircraft (aircraft) at airports.

The main factors affecting the quality of using a certain technology for processing aviation containers are the reliability and time of their transportation, the economic feasibility of the technological processes of loading/unloading containers, maneuverability of transportation, territorial accessibility, technological versatility, the carrying capacity of aviation ground equipment (AGE), seasonality of operation, independence from weather conditions, etc.

In order to implement effective processing of aviation containers in platform conditions, it is necessary to choose the most optimal working technology, which would take into account the above factors as much as possible.

Main text. The technological process of ground handling of goods during their transportation in containers and on pallets consists of the following operations:

- selection of documentation and cargo for the flight and transportation from the storage areas to the container (pallet) assembly area;
- packing of containers (pallets) with their sealing and processing of documentation on them;
- storage of completed containers (pallets) on roller racks or on a loading ramp;
- formation of loading for the flight;
- overloading of containers (pallets) on vehicles;
- transportation of containers (pallets) from the cargo or passenger terminal to the parking lot and back;
- loading (unloading) containers or pallets on the aircraft with the transfer of material responsibility;
- mooring (fastening, fixing) of containers in the cargo compartment of the aircraft.

AGE, which is used for the transportation of containers and loading and unloading works near the aircraft, are classified according to the technology of operations as follows:

- those that only transport containers;
- those who perform only loading and unloading work near the aircraft;

- those that combine loading and unloading operations and transportation of containers [1].

Let's consider two alternative technologies for processing containers on the platform.

Implementation of trolley technology for processing aviation containers (technology A).

A mobile container loader (MCL) and a road train with container trolleys are heading to the plane parking place on the platform. Upon arrival at the parking lot, the extendable supports of the loader are released, both platforms are raised and the main bridge platform is connected to the threshold of the baggage compartment of the aircraft. Then two containers are unloaded on the rear platform. The rear platform lowers, the first carriage of the train is docked with the MCL. The platform of the cart is turned for overloading by 900 and the first container is unloaded onto it. The trolley platform returns to the transport position. Similar actions are carried out with the second cart. At the same time, the third container is unloaded on the MCL bridge platform. The freed rear platform rises to the level of the front one and accepts the following containers. The platform lowers again and the second cycle of overloading the trolleys begins.

After the end of the overload, the trolley car train goes to the terminal, and the PNK lowers both platforms into the transport position, removes the supports and moves away from the plane.

The technology of processing containers when loading planes for departure is performed in a similar way in the reverse order [2].

Self-propelled technology for processing air containers on the platform (technology B). The self-propelled technology of processing air containers on the platform begins with the fact that a car with a lifting platform - the container carrier APK-KB goes from the terminal to the place where the plane is parked [3].

Upon arrival at the place, he approaches the airport at a slow speed in front and, before reaching the threshold of the luggage compartment of 300-500 mm, stops. Retractable supports are produced. The driver-operator climbs onto the work platform to manage transshipment operations. The platform of the APK-KB rises to the level of the threshold of the cargo compartment and, moving forward longitudinally, contacts the threshold of the compartment. After that, all containers are sequentially unloaded onto the APK-KB platform. The platform is lowered. The machine is transferred to the transport position and moves to the terminal.

Comparison of the effectiveness of technologies. Comparative evaluations of efficiency are implemented in two ways:

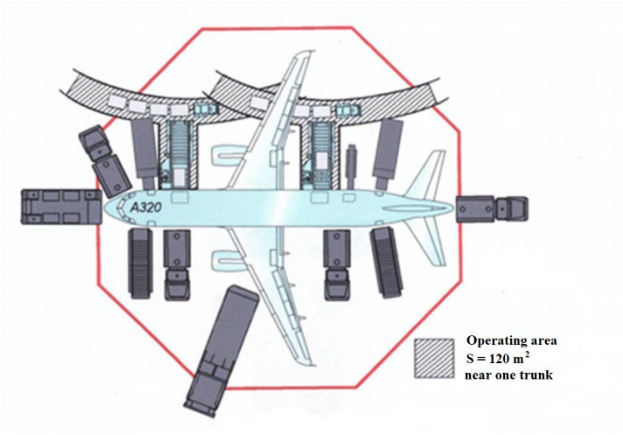
- qualitative - according to the main factors influencing the conditions and quality of operations;
- quantitative - by productivity.

Regarding conducting a qualitative analysis of the main factors affecting the conditions and quality of operations, it is worth focusing attention on the use of the operational field when servicing aircraft on the apron. The need to reduce the time of aircraft parking on the ground always remains relevant. Technological congestion in the parking lot limits the speed of service and directly affects its safety. A large number of technical means, simultaneously involved in the commercial and technical maintenance of the aircraft, the intensification of the use of parking spaces require, for each type of

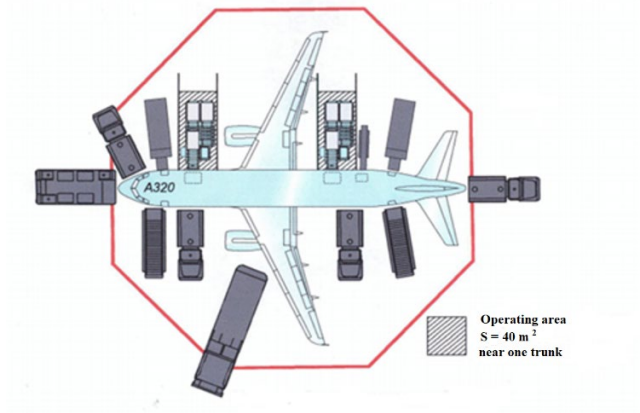
maintenance, the minimization of both the area of the operating field and the time of performing operations on the apron.

The main factors affecting the area of the operational field are the number of technical means used simultaneously during maintenance and the need to maneuver them during transshipment operations.

In this regard, the cart technology requires a significant area of the operating field, and maintenance with the help of a self-propelled loader-container truck is minimal (Fig. 1).



a)



b)

Fig. 1. Operational area when implementing various technologies:
a – cart technology with the approach of 4 container carts; b – self-propelled technology with a transport capacity of 4 containers

Operating hours of service. The amount of operating time directly depends on both the total number of operations during maintenance and the duration of each operation.

The most time-consuming are the operations of moving transshipment means, docking these means with each other, and operations of non-mechanized manual transshipment.

It is clear that, first of all, this refers to the maneuvering of the trolley car train, docking the trolleys with the MCL platform and overloading the containers onto the trolleys.

Another important factor is the number of lifting operations during maintenance.

Table 1

Scheme of comparison of 2 technologies of processing aviation containers on the platform

	Area of the operating field, S, m^2	Time for operation, T, min	Parameter $P=S \cdot t$, m^2/h	Coefficient comparative efficiency $E_{v/a} = P_a/P_v$
Technology A	120	18	36	6.3
Technology B	40	8.5	5.7	

A comparison of two different technologies for the use of the operating field both in terms of area and time when overloading 4 containers is presented in the table 1.

Obviously, the best option is to approach the plane with a self-propelled loader-container truck with a full set of luggage compartment containers, raise this set to the level of the threshold and mechanized reloading into the plane.

The factor of the number of technical means involved in aircraft maintenance operations. Of course, the fewer the technical means used at the same time, the more effective the technology.

Better use of the operational field, a higher level of efficiency of its application, less need for personnel, better occupational safety, less possibility of damage to the aircraft or other means of maintenance, less influence of road and climatic conditions, and, finally, less time spent on organizing maintenance and performing preparatory operations - all the above factors are met by the implementation of technology B.

However, it should be emphasized that the implementation of this technology is relevant at a low intensity of container flights (1-2 flights per day), when the preparation time is much longer than the operational time near the aircraft, in particular, in regional airports with a small turnover of containers.

A comparative analysis of the factors of wheel traffic and speed of movement of technical equipment, operational readiness of technical equipment for aircraft maintenance, working conditions of personnel, operational flexibility of service on the platform, carrying capacity during transportation also shows the advantages of technology B.

Conclusion. So, the technology using a self-propelled loader-container truck with a large carrying capacity under certain conditions has important advantages in comparison with the trolley technology. As a result of a comparative analysis of the use of self-propelled and trolley technologies for processing air containers on the platform, it became obvious that the implementation of self-propelled technology in regional airports is more promising.

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