

## **TECHNICAL PROTECTION OF BELARUSIAN BORDERS**

## **ТЕХНИЧЕСКАЯ ЗАЩИТА БЕЛОРУССКОЙ ГРАНИЦЫ**

Дурко К. О., Торчило М. В.

Научные руководители: Кажемская Л. Л., Точилина А. К.

Белорусский национальный технический университет

As a result of increase in the world trade the necessity of fast and easy transportation of goods by auto, railway and air transport puts tremendous pressure on customs services all around the world. Because of a great deal of commercial goods are transported in large-scale containers, the traditional inspection methods meet lots of physical and financial difficulties, especially much time is needed for inspection. To get rid of these difficulties Inspection Complexes (HCV-Stationary, NUCTECH RF9010) for cargo control were developed. Customs inspection complexes for control are intended for application at customs security checkpoints: at railway stations, airports and automobile checkpoints. The inspection takes place in a special venue, which is protected from radiation.

State customs committee together with other ministries and departments is conducting purposeful work on timely reconstruction of check points, especially on equipping these check points with modern customs control facilities. Introduction of customs inspection complex allows to raise border security, to increase the number of examined transport vehicles without loading Customs officials with additional work. Today customs officers use ten customs inspection complexes. A complex like this allows exercising customs control of vessels, semi-trailers, refrigerators and tanks without opening them. Customs inspection complex consists of two elements: the main equipment and a protective structure [2]. Eight stationary X-ray control systems of a new generation are installed at seven automobile (“Warshavskiy most”, “Kozlovichi”, “Bruzgi”, “Berestovica”, “Kotlovka”, “Peschatka”, “Grigorov china”) and one railway (“Brest-Severny”) check points at the border with the European Union. There are also twelve survey dosimeters, three portable laboratories with radiometric equipment introduced at these check points. The newest machineries are able to detect even the smallest particles of radioactive material [1].

The purpose of Inspection Complexes is examination of vehicles and large-scale containers without their opening to expose contraband goods. X-ray examination of objects is performed by means of an X-ray beam, which is generated by a linear electron accelerator. Penetration through the object is registered by a detector line. Signals from the detectors are preliminarily processed and transmitted to the work places of customs officers.

Special software processes the data from the detector line and visualizes high-resolution image of the inspected object on screens of computers at the work places in the real time mode.

Basic (minimal) set of customs inspection complexes consist of:

- Linear electron accelerator
- X-ray beam collimation system
- Detector line
- Data transfer system
- Data processing and visualization system
- Transportation system of the examined object
- Transportation system of linear accelerator, detector line and X-ray beam collimation system (HCV-Stationary)
  - Radiation, electrical and mechanical safety system
  - Control system
  - Cargo shipping documents input system
  - Archival system.

The purpose of HCV-Stationary is the examination of vehicles at roads with high cargo traffic. Stationary Customs inspection complex HCV-Stationary is a stationary X-ray inspection system, which is intended for examination of loaded trucks and containers. It provides simple and fast processing of goods with a minimal number of service personnel. The system permanently installed on the designated area allows implementation of quick inspection procedures for full loaded trucks (chassis, wheels, fuel tanks, cargo and trucks) and containers, while ensuring the revision of customs documents. In addition, its interface, which is easy to use, allows to do image analysis. The HCV-Stationary system has a steel penetration capacity of up to 410 mm and a scanning capacity of up to 25 trucks per hour at a 24-hour working day. HCV-Stationary is manufactured in various configurations, for example, the system can be supplied with a standard or extended tunnel. A high-energy identification of material is offered as options [3]. All these capabilities provide detection of illegal objects, such as disguised goods, weapons, explosives, drugs, etc. The linear accelerator, the detector line and the X-ray beam collimation system are installed on a special transportation system ensuring their move concerning the object under inspection.

NUCTECH RF9010 is intended for freight trains inspection at the railway stations. While being scanned a freight train moves across the X-ray beam at 5 m/s (18 km/h) permanent speed. A stationary Customs inspection complex for the railway transport control NUCTECH RF9010 is a mobile X-ray system for the inspection of loaded wagons and containers, providing a high level of penetrating capability and superior productiveness. The installation is distinguished by the most modern technical features: the speed of scanning is 24

meters / minute, and penetration of 330 mm on steel, estimated time of monitoring cargo is 1.5 min, and a throughput of 30 trains per hour [3]. A customs inspection complex reveals hidden drugs, explosives, weapons, ammunition, determines the discrepancy between transported and declared goods, detects people, who are illegally cross the border.

*Comparison with similar systems.*

The developed system of X-ray examination differs from similar ones of the famous firms (Heimann, Hi-Co-Scan, British Aerospace, Corrigan) by using specially elaborated effective mathematical software and hardware for data processing and visualization. The most significant features are:

- Spatial super resolution achieved by using a synthetic point spread function
  - Deep noise suppression by continuous wave let transformation and cluster analysis
  - Outstanding dynamic range of detector line
  - Discrimination of the groups of material according to the atomic number (as an option)
  - Stereoscopic representation of the objects examined (as an option).

Through the close analysis of the functioning of two kinds of a stationary Customs inspection complex (automobile and railway) we have found out the following advantages:

- Continuous round-the-clock operation of customs check point resulting in its higher throughput, efficiency and quality of inspection at lower expenditures
- Obtaining most exhaustive real-time information on the object under inspection
  - High-speed data processing and high quality of images ensured by the software applied
  - Opportunity to compare the actual contents of inspected containers with the cargo declared in the cargo manifest
  - Opportunity of a scrupulous analysis of suspicious objects without reduction of the complex throughput due to several work stations available.

To sum up, the modernization of customs technologies and infrastructure is an integral part of the development in the customs sphere. This process helps to organize proper and timely information exchange with business community and other competent bodies in external trade, to create modern customs infrastructure that corresponds to the growing workload in customs work, to counteract illegal movement of goods across the Belarusian customs border, to develop new customs technologies, including effective customs control technical facilities, examination systems and radiation control measures.

### Литература

1. Вежновец, С. Ради безопасности каждого / С. Вежновец // Таможенный вестник. — 2014. — № 2. — С. 55.
2. Гузик, Д. Проекты сотрудничества /Д. Гузик // Таможенный вестник. — 2013. — № 11. — С. 16–18.
3. Учебные материалы [Электронный ресурс]. — Режим доступа: [https://works.doklad.ru /view/yuI0DYeSM8w/all.html](https://works.doklad.ru/view/yuI0DYeSM8w/all.html). — Дата доступа: 25.03.2018