Annex III

BEST PRACTICES USING NII EQUIPMENT (CHINA CUSTOMS)

Practice of Centralized Image Processing for NII Equipment by China Customs

Summary

As one of the Customs administrations to first apply large-scale NII equipment for inspection, China Customs introduced large-scale NII equipment to examine cargoes and vehicles as early as in 1991. At present, extensive NII scanners have been deployed at China's main ports. To cope with the challenges of strengthening security access control and promoting trade facilitation, as well as manpower resources shortage caused by the rapid growth of freight volume and the professional requirements for NII scan image analysis, since 2010, China Customs has initiated centralized image processing (CIP) to enable networking of NII equipment used for cargo/vehicle inspection. The work related to system development, equipment modification along with operation procedure optimization has been carried out and led to successful outcomes. Based upon all these achievements, China Customs will make efforts to further expand the application scope of CIP and to explore intelligent image analysis.

1. General Overview of Large-scale NII Equipment Deployment and Applications

With the continuous growth of global freight volume, the worldwide customs administrations are generally confronted with dual pressures of stringent regulatory control and expedited clearance. The WCO SAFE Framework of Standards demands Customs control to strike a balance between security and facilitation. It emphasizes that non-intrusive inspection equipment should be available and preferably used for customs inspection.

In 2017, China Customs controlled over 105 million TEUs of sea containers, as well as 33.98 million inbound and outbound vehicles. The immense workload has imposed onerous burden on China Customs in terms of enhancing the clearance efficiency and strengthening the risk prevention. China Customs actively applied high-tech means to cope with the challenges, mitigated the impact of inspection on Customs clearance and increased the inspection speed while ensuring effective Customs control via wide application of NII equipment.

1.1 Overview of NII deployment by China Customs

Beginning in 1991, China Customs gradually deployed NII equipment within nationwide Customs territory. By the end of 2017, over 200 large-scale container/vehicle NII scanners have been installed at major coastal and border crossings in 36 Customs districts, to scan containers, trains and vehicles, covering seaports, airports, land ports, railways and other types of ports. Some ports with large volume of transactions were equipped with multiple scanners, such as Shanghai Waigaoqiao Port equipped with 4 large-scale NII scanners. Currently, the NII scanners deployed by China Customs are supplied by multiple manufacturers. Additionally, small-scale NII scanners such as X-ray equipment and CT have also been utilized.

There are mainly four types of radiation generators of large-scale NII scanners deployed by China Customs, including linear accelerator, betatron, isotope and X-ray device. The main types of equipment are: fixed system, relocatable system, mobile system, drive-through fast-scan system, relocatable/fast-scan dual mode (auto-mobile fast-scan) system and passenger cars inspection system. In order to enhance the efficiency of NII equipment, Optical Character Recognition (OCR) system, radiation detection system and load meter are integrated with NII equipment.

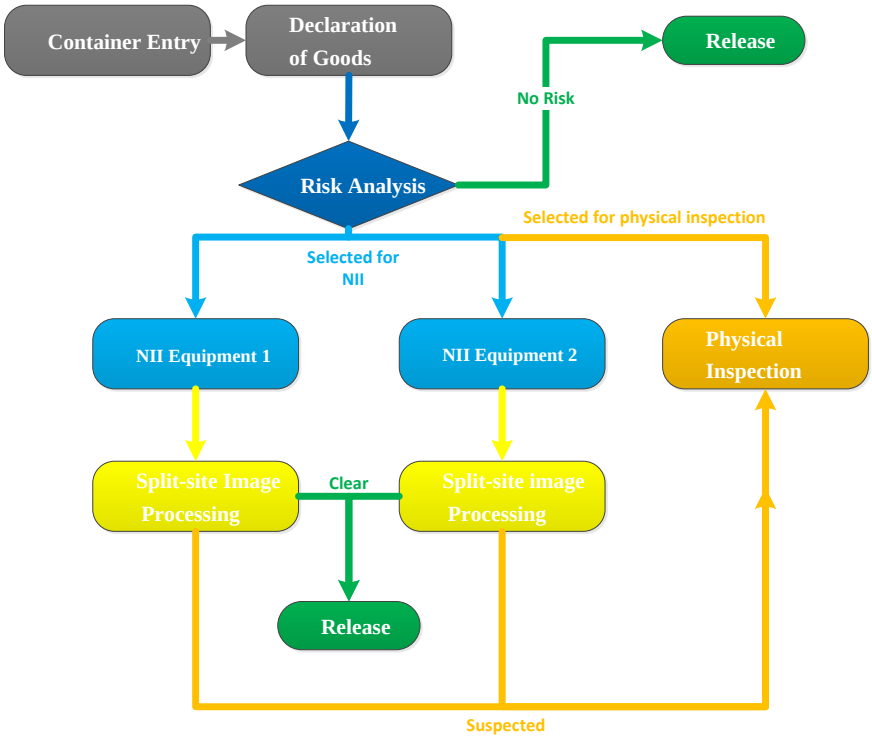
In recent years, 31.9 million containers/vehicles are scanned and 220,000 cases are seized with NII equipment by China Customs.

1.2 Staff and institutions for NII

There are approximately 600 front-line Customs officers engaged in large-scale NII image analysis, accounting for 10% of cargo inspection officers. In the traditional mode, the Customs NII working sites are mainly distributed in port locations. In the CIP mode, the image processing locations can be concentrated in one site, and the particular place can also be reset for image analysis. NII staff is specialized in image analysis, while the work of site guidance, image scanning and others work involved are conducted by staff in other positions.

1.3 Workflow of NII

Once containers or vehicles loaded with cargoes enter the Customs territory of China through the ports, Customs will carry out a risk analysis on relevant cargoes to determine whether to perform inspection, and choose NII scanning or physical inspection according to the nature of cargoes. After NII scanning, unsuspected cargoes will be released directly while suspected cargoes will be transferred for further disposal by physical inspection department.



2. Practice of CIP Carried out by China Customs

2.1 Challenges and drives

(1) Serious shortage of human resources

With the continuous growth of cargo volume, the number of NII equipment rapidly increased and correspondingly the demand for NII image analysts has risen exponentially. This is incompatible with the current allocation of human resources where a huge gap exists.

(2) Demand for higher professional level of image analysts

To accommodate the wide application of more and more NII equipment, the NII image analysts need to perform more rapid and precise image interpretation processes, which poses higher professional requirements for image analysts who need to get proficient with more types of NII images and follow uniform law enforcement. Obviously, the traditional mode is adverse to the promotion of analysts' specialization, due to its scattered analysts and limited image types.

(3) Increasing operation costs

With the wide application of NII equipment, and the matching supporting service including terminal construction, the supporting service including office leasing, hardware device procurement and workstation deployment is required for each equipment conventional operation, which caused the gradual rise in operation cost and pressure on Customs.

2.2 System architecture

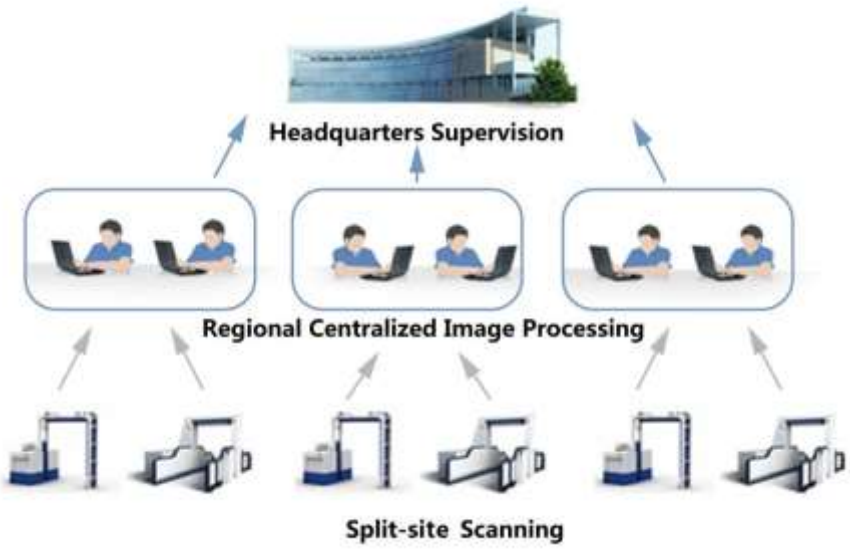
To solve the above problems, China Customs centralizes the regional multiple large-scale NII image processing into one office location (center) where real-time analysis is performed through network and identification results are provided immediately to the site officers, who are responsible for the subsequent disposal. The image analysts are centralized to work in one place without the need for the assignment of analysts to each equipment unit.

Three-tier structure for centralized image processing (CIP):

(1) Split-site scanning by local Customs

(2) Networked CIP by Image Interpretation Centers

(3) Real-time centralized monitoring by General Administration of China Customs (GACC)



Compared with the original scattered image processing mode, the operation procedure of CIP remains basically stable operation procedure and makes some changes in the location and mode of image processing. To meet the requirements of CIP mode, China Customs carried out reforms on its organizational structure by canceling local image processing organizations and redeploying the staff to the newly established image processing centers.

2.3 System development

Based on the application status of NII scanners, a centralized image processing system (CIPS) with a nationwide unified version should be developed with the following main functions:

(1) Networked transmission of images

All types of large-scale NII equipment procured by Customs will be integrated into the system to realize the centralized images transmission and image analysis at CIP centers.

(2) Compatibility with various image file formats

CIPS should ensure the image analysts to process images of NII scanners provided by different suppliers, in different periods and with different models. The system offers a unified platform where different manufacturers can develop corresponding plug-ins to achieve the compatibility of Customs CIPS with various models and suppliers.

(3) Random assignment of images

The CIPS is capable of randomly assigning all NII scanned images to the Customs image analysts based on the number of workstations at the center.

(4) Interconnecting with the Custom Operation System

The CIPS should be connected with the Customs Operation System to bundle and correlate scanned images with declaration data. The image analysts can perform image analysis based on declaration information and images. The analysis results can be delivered to the Customs Operation System automatically.

(5) Monitoring equipment operation

Basic operating information involving the start-up/shut-down time for the equipment, the number of scanned containers/vehicles, and the quantity of detected anomaly will be uploaded to the CIPS regularly. The regional image processing centers and GACC can perform an effective monitoring of the operating status of each equipment unit via relevant data.

2.4 Infrastructure construction

CIP centers should be set up with a certain scale depending on the amount of cargoes and the number of NII equipment deployed. The construction of a CIP center involves the following key elements：

(1) Deployment of central server

A central server is deployed in the CIP center with its magnetic disk arrays configured according to the estimated storage capacity for images.

(2) Installation of a certain number of workstations

A certain number of workstations are installed according to the freight volume in the region on an average image processing capability of 30-50 images per day for each workstation. Taking Ningbo Customs District as an example, there are 9 sets of large-scale NII equipment in the region, with daily 500 scanned images and 10 sets of workstations installed for image processing.

(3) Setting up of transmission network

The network consists of two parts. One part is the equipment terminal network that commonly utilizes the existing facilities at the port for optical fiber wiring; the other part is the long-distance transmission network connecting the equipment terminal to the CIP center, which is realized by renting network from network operators.

(4) Equipment with corresponding office appliances

The center needs to be equipped with office tools including furniture, supporting books, paper and pens, etc.

2.5 Funding arrangements

(1) Cost of system development: development, testing, deployment, trial operation and subsequent maintenance of the nationwide unified CIPS.

(2) Cost of equipment and network modification: building a unified software/hardware interface to ensure the equipment in various models and from different suppliers access to the CIPS, upgrading and modifying old equipment and network.

(3) Cost of network rental: wiring optical fiber cables of equipment terminal, renting long-distance transmission network from network operators.

(4) Cost of CIP center construction: modifying the original image processing locations or repositioning and rebuilding CIP centers, including CIP center construction cost and operation expenses and so on.

(5) Cost of data management: allocating sufficient disk arrays to store data considering the potential role of CIP centers as the nationwide connecting points for data aggregation after the promotion of CIP.

2.6 Staff training

2.6.1 Training system

Two-tier training system comprising GACC and Customs district levels.

Chinese Academy of Customs Administration is responsible for the NII training at GACC level. The academy possesses NII simulated teaching and research laboratory, NII software image analysis classroom and simultaneous interpretation classroom. Currently, China Customs is planning to build a specialized NII training center on a larger scale equipped with all types of NII equipment or simulators for training.

NII training on district level is mainly performed by well experienced experts through lectures, exercises and on-site practice.

2.6.2 Training resources

By collecting scanning images from local Customs, the Academy establishes the standard image database, typical case database and training exam question bank for training.

2.6.3 Faculty

The GACC-level training is delivered by academy full-time teachers, Customs part-time teachers, Customs experts and other specialists in relevant fields. The district-level training is carried out by Customs experts with more than10 years experience of image analysis.

2.6.4 Training approaches

NII training mainly includes cargo knowledge, radiation protection, image analysis skills, domestic and international laws & regulations related to NII inspection, etc. The training is delivered via various modes such as case analysis, hands-on practice and group discussion. Training certificates will be issued to the staff according to their grades. There is a mandatory requirement that all the Customs officers engaged in NII should be trained and certificated.

3. Outcomes and Benefits

3.1 Benefits to Customs.

(1) Optimize the allocation of human resources

Taking Ningbo Customs district as an example, in the traditional mode, at least 72 image analysts need to be posted in Ningbo Customs where 9 sets of large-scale NII equipment have been deployed. Whereas since adopting the CPI mode, only 14 image analysts are capable of completing all the NII image analysis within the customs district, savings up to 81% of human

resources. On the other hand, CPI mode also enhances the Customs anti-corruption capability by depriving NII analysts of the chance to contact the inspected objects.

(2) Improve the professionalism of image processing

The aggregation of images of different cargoes from multiple ports is conductive to establishing and enriching NII operation database and standard image database, optimizing risk information collection, organization and mining, accumulating analysis experience and effectively conducting training for image analysts so as to enhance their professional level of image processing.

(3) Increase the operating efficiency of equipment

CIP mode is conductive to monitoring the running status of the nationwide equipment from the global perspective, redistributing resources for inefficient equipment, optimizing the allocation of resources for corresponding inspectors, equipment and sites, so as to improve the proportion of NII.

(4) Optimize and integrate Customs operation systems

The interoperability of inspection equipment information and the Customs management system, is helpful for all aspects of the inspection data and risk analysis and profile information to form a closed loop for mutual verification. The data-driven approach supports Customs to continuously promote the modification and optimization of the overall inspection procedure.

(5) Reduce the cost of Customs and terminal operation

Separating equipment operation from image analysis reduces the number of on-site officers, decrease the rental of office spaces and cut down the procurement image analysis workstations. Besides, the centralized deployment is in favor of system maintenance.

3.2 Benefits to enterprises

(1) Enhance the unity of law enforcement

In the CIP mode, all the image analysts are centralized to perform image processing and the conclusions are reviewed by the experts, which effectively compensate the capability deficiency of some Customs officers and compress the discretion of Customs officers, so as to ensure the unity of NII enforcement and Customs clearance facilitation.

(2) Reduce clearance cost and promote trade facilitation

CIP mode centralizes Customs experts and creates an effective communication environment, which is helpful to decrease inspection time, increase the direct release rate of NII, dramatically reduce clearance costs, save clearance time and promote trade facilitation.

4. Prospects

(1) Expand the scope of network

Radiation portal monitors, cargo X-ray equipment and CT will be gradually integrated into the CIPS. Long-term plan is to integrate handheld devices such as Raman detectors, handheld radiation detectors into the CIPS, to achieve unified management and effective monitoring of all NII equipment.

(2) Implement cross-border exchange of images

Along with the deepening communications between worldwide Customs and the development of the “One Belt, One Road” initiative, Customs international exchanges in the field of supervision and control have ushered in new opportunities. Relying on the CIPS, China Customs may carry out image information transmission, sharing and exchange with other Customs administrations to promote mutual recognition of supervision among different countries.

(3) Innovate the mode of intelligent image processing

By collecting massive historical image data through CIP mode and performing a large number of data analysis, it could apply cloud storage & cloud computing technologies and use deep learning to establish Space classifier based on Customs HS code, promote the innovation of intelligent image processing and achieve the practical goal of “Machine replacing human”.

(4) Update equipment and technology

A global monitoring of NII equipment operation can be carried out through CIPS so as to perform big data analysis for the problems existing in the operation process. The future research will focus on new equipment with better integration, stronger mobile deployment capability and higher technical content. Meanwhile, more efforts will be taken to study the construction of automated terminals with the aid of new NII equipment.