

# When do you know?

*Gustavo L. Bottan  
of Passport Systems  
looks at new ways to  
improve the efficiency  
of cargo scanning*



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The opinions expressed in this article are solely the author's and do not represent those of Passport Systems Inc. or any of its clients.

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At a recent conference on transportation security, one of the speakers asked: 'When do you know you have sufficient security built in?'

This question resonated in my mind. As a simple example, I imagined my briefcase going through the x-ray scanner at an airport passenger checkpoint. One or more images provide the operator with a view of my belongings (shape, density and even colours to distinguish between organic and metal items).

When I pack too much, on occasions my briefcase gets rescanned in a different position to provide 'better inspection'.

Yet, how does the operator decide there was sufficient security built into his or her inspection? Would this operator use the same criteria or degree of efficiency at all times? After all, there have been times when I have forgotten to remove some liquid items and they have gone unnoticed in one airport and not in others during the same trip. The operator's training, the state of mind, and other factors play a part in how well the inspection procedure was performed.

**Inspection parameters**

But, back to the question: I believe the speaker posed it to assess if the procedures in place were adequate as opposed to whether they were carried out consistently, efficiently, and with accuracy. So, once again, I wonder: 'How do operators know they have conducted the inspection with the necessary quality?' What are the parameters that define such inspection quality?' It can't be a case of just saying: 'I looked at the image for x amount of time and saw nothing.'

How does an operator know when the inspection analysis has produced the minimum required probability of detection? For a given inspection time, is the same accuracy obtained for finding a liquid explosive as it is for an illegal drug? When can the inspector say: 'I've cleared this cargo and I have x% confidence there is no item A, B, C, etc.'

Next, I imagined an air cargo pallet or sea cargo container inspection. When does one conclude they were inspected enough? The issue here is not whether

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the inspectors have inspected for long enough, but if they have reached the necessary confidence for clearing the container from containing undeclared cigarettes or alcohol. What about drugs? Perhaps if some of these items are missed, the consequence is the collection of less revenue (via tariffs, fees and penalties); but what if the missed contents consisted of explosives or weapons of mass destruction (WMD)?

So what can be done about measuring the quality of each inspection? Dual energy x-rays used in passenger carry-on and checked luggage at airports are recent improvements in scanner technologies. Algorithms are becoming more sophisticated and some automation or operator aids are coming online. However, nothing I have yet seen provides operators with a quantifiable measure of the efficiency of their inspection or tells them how long they should x-ray the object to achieve the necessary confidence that a substance is or is not present. It is difficult to conceive that radiography by itself would be able to provide this anytime soon.

However, there are technologies which can identify cargo contents with a quantifiable level of confidence and our goal should be to integrate them into

a cost efficient cargo inspection system to obtain all their benefits without impeding the flow of commerce.

One of them, Nuclear Resonance Fluorescence (NRF), provides a statistical predictive way to tell the operator how long the probing beam has to dwell on a given container position in order to detect or clear a given substance amount. The operator could track this information and decide to leave the system to automatically alert if a given confidence level has been attained for finding it (say 95% confidence for x mass of a given material) or allow NRF to dwell for a little longer to achieve a higher confidence, e.g. 99%.

Because NRF is not specific to one threat or material, it can be used to simultaneously scan for any material of

interest. For example, if the inspection was made to find explosives and drugs, one or both may be found as well as one or both could be cleared (i.e. the material can be said not to be in the container). This is significant because not seeing an item in an x-ray image does not mean such an item is not present, while if the NRF inspection is conducted until a given confidence level (for the material not being in the container) is reached, the inspector would know the correct inspection was made.

When operators have information about the time the inspection will require and can complete their work with a quantifiable measure, then inspection quality will be measurable and an answer to the question 'Is this sufficient security?' would be meaningful.

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