

# ALTERNATIVE METHOD FOR EDS ACQUISITION

## WHY?

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Consequently, TSA and vendor officials' confidence that it will be feasible and cost effective to upgrade deployed machines at airports may be unwarranted as it has not been based on experience, supported by analysis, or a documented plan.

From a GAO report on Aviation Security of July 2011 (<http://www.gao.gov/products/GAO-11-740>)

EDS (EXPLOSIVES DETECTION SYSTEM) IS A MISNOMER.

EDS is merely a device, instrument, which deduces physical parameters from the attenuation of x-rays. It indirectly measures the density of an object, in dual energy mode, Z effective may be calculated.

Detection as inferred subsequent to artifact correction, reconstruction, segmentation (yielding technically, volume, mass, density of every object in the passenger bag)

If we accept the premise that EDS CT is basically a measurement instrument, then the best CT would yield the lowest possible Pfa.

- 1) Government would purchase CT hardware based on Image Quality (segmentation?) with or without ATR.
- 2) CT EDS for all practical purposes become commodities. Vendors will have the freedom to select and implement any design they wish as long it generates the best match with reality after segmentation. At segmentation CT EDS images would no longer have any genetic fingerprint DNA of the hardware. All systems can be compared and evaluated on level playing field. A quick test is to try this concept on the NIST phantom, or another phantom may be developed and distributed to current and future vendors.
- 2) Vendors will on their own go out and seek third parties in medical and other fields, to adapt best reconstruction, artifact correction, and segmentation methods.
- 3) True Competition for hardware acquisition, based on bag per hour scanned.

4) Elimination of the medieval torture gauntlet called CRT, Certification is streamlined and very compacted and technically a confirmation of the results known to the vendor. (vendor can now grade their hardware based on how congruent is segmentation to reality of bag content)

5) EDS CT and X-rays do not have unique behavior based on whether objects are explosives or play dough or cheese or any of the four standards. Minimizes if not totally eliminated the need for explosives. (Perhaps only as a confirmation at the final stage)

6) Vendors no longer need to know explosives or any of their codes or amounts or any other property.

7) Vendors can no longer juggle or trade PD and Pfa from one threat to another to meet average performance requirements.

Contrary to a growing chorus, XRAYs are still the best and most effective method likely to remain as the technology of choice for carry on, checked and cargo screening.

At no time would TSA encounter Zero Pfa, for even with the best Instrument and scanner, there will always be Explosives whose properties (Zeff and Density) match items in checked luggage.

What is surprising that no serious effort has been made to determine the lowest possible Pfa.

However, the lower the fidelity of the CT (myopic in terms of CT as a lens) the more likely that higher Pfa will result . A series of curves gradually moving to the left hand corner as best possible outcome.

What are the implications of TSA deciding to acquire EDS systems based on their fidelity, ie how well or close to physical reality of the bag are the results of the segmentation?

It is not necessary to wait till a most effective System is developed, there are a couple of interim methods that TSA can and should implement ASAP, if indeed the threat detection and HME is a desirable and achievable goal.

Short term considerations

First Exercise:

TSA would request from the IT&E folks to put together 10 to 20 bags, with known substances (not threats. Play dough, runner sheets, peanut butter, as creative they can get in concealment)and objects (mass, density, Zeff) and proceed to scan them through all the scanners, request vendors to collect images and report back in 2 to 4 weeks, the results of the segmentation

IT&E would not grade the systems on how much fidelity between the found truth and what the vendors report.

Say best case all systems report 100 percent congruence? At that point it might be inferred that software may be responsible for performance (why not approach 100 percent detection and 5 to 7 % Pfa)

Are all the systems the same (no secret sauce?)

Lower performance may drive vendors to seek third parties to acquire best artifact correction methods, reconstruction and segmentation.

TSA has the right and obligation to determine on an absolute basis how good are the current technology and designs.

Might this lead to an opportunity for TSA should they so desire to develop a single classification and they and they only would be responsible for threats, amounts? And can update threat tables at will based on Intelligence and RISK?

Second Exercise

For fundamental scientific reasons, it is not pertinent to look for texture as a tool to use in classification.

If anything the constant property of HMEs is their range of textures some even time dependent.

Many of the misconceptions are due to the fact that accurate and reliable synthesis of these substances has not been carried out for the last 7 years, if they did, we would not be in this predicament.

TSA has access to Zeff and Density data (from Micro CT and Lab measurements) of selected number of HME formulations.

Given that the vendors have accumulated data from thousands of bags and have acquired a distribution of mass, Zeff and CT number for the prevalence items.

Vendors ought to predict the expected Pfa for each formulation. Indeed there is significant evidence in TSAs hands that this method is robust and is fairly accurate (within a few percent, for example Pfa actual 3.5 percent, Pfa predicted 3.6 percent)

Vendors can refine their method by applying this method their data on military and conventional threats.

If this method is successful and there is every reason to expect it to, then maybe the tortured data collection can be avoided and truncated to a very very limited cases for validation.

CONCLUSION

The current construct has failed, time for innovation

