

Automation reliability, human-machine system performance and operator compliance

David Huegli

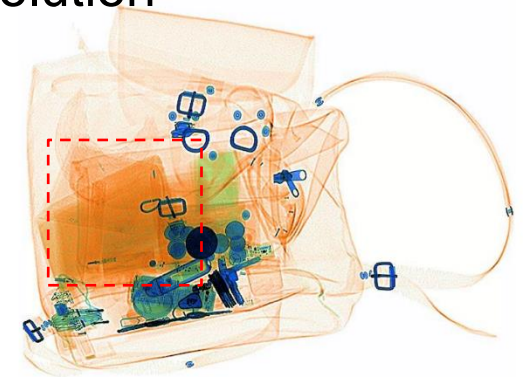
david.huegli@fhnw.ch

Huegli, D., Merks, S., & Schwaninger, A. (2020). Automation reliability, human-machine system performance, and operator compliance: A study with airport security screeners supported by automated explosives detection systems for cabin baggage screening. *Applied Ergonomics*, 86, 1-12.
doi:10.1016/j.apergo.2020.103094 [\[PDF\]](#)

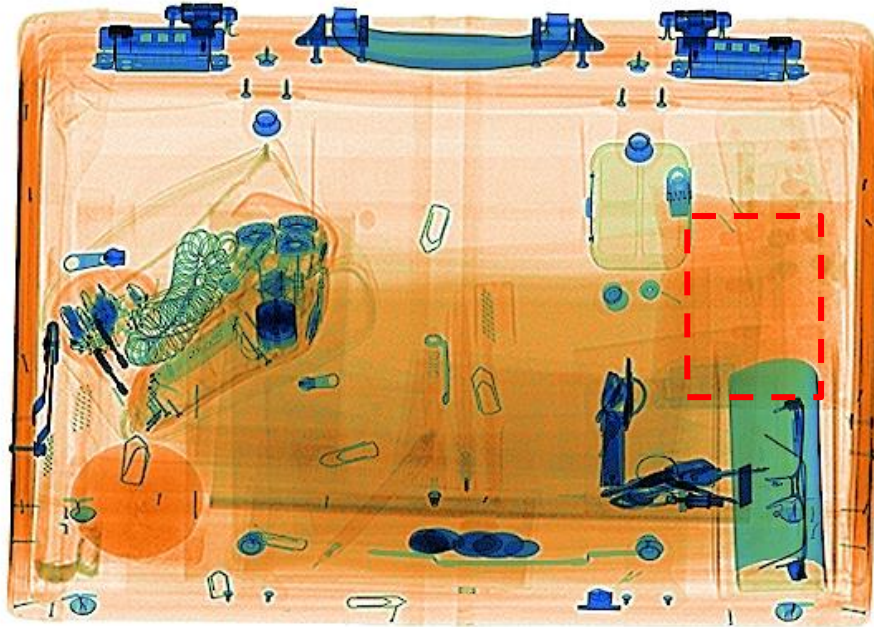
ADSA 22, 11/24/2020

So what? Who cares?

- › Space: Human-machine interaction when using explosives detection system for cabin baggage screening (EDSCB)
- › Problem: Almost all EDSCB alarms are false alarms due to extremely low target prevalence, and operators may ignore EDSCB alarms (cry-wolf effect) and miss explosives if not properly instructed
- › Results: False alarms lead to a cry-wolf effect, and benefits of automation depend on automation reliability and unaided performance
- › Solution: Automated decision or clear instructions for on-screen alarm resolution



Explosives detection systems for cabin baggage (EDSCB), on-screen alarm resolution



Bare explosive



Conclusion



- Automated decision and/or clear instructions for on-screen alarm resolution
- Option: Use TIP with EDSCB alarms to increase target prevalence and PPV, and for measuring compliance with EDSCB alarms with on-screen alarm resolution instructions
- Make sure screeners still see many explosives (TIP and covert tests) to prevent skill loss
- It should be noted that the human–machine system hit rate of a whole airport security checkpoint is different, because additional security measures are implemented e.g. risk-based and random pat down, manual bag search, explosive trace detection, behavioral security screening, video surveillance, and explosive detection dogs.




Publication

Applied Ergonomics 86 (2020) 103094

Contents lists available at [ScienceDirect](#)

 **Applied Ergonomics** 

journal homepage: <http://www.elsevier.com/locate/apergo>



Automation reliability, human–machine system performance, and operator compliance: A study with airport security screeners supported by automated explosives detection systems for cabin baggage screening

David Huegli^{*}, Sarah Merks, Adrian Schwaninger

University of Applied Sciences and Arts Northwestern Switzerland, School of Applied Psychology, Institute Humans in Complex Systems, Rigenbachstrasse 16, CH-4600, Olten, Switzerland

<p>ARTICLE INFO</p> <hr/> <p>Keywords: Human-automation interaction Airport security baggage screening Visual search</p>	<p>ABSTRACT</p> <hr/> <p>Using a simulated X-ray screening task, we tested 122 airport security screeners working with the support of explosives detection systems for cabin baggage screening (EDSCB) as low-level automation. EDSCB varied systematically on three automation reliability measures: accuracy, d', and positive predictive value (PPV). Results showed that when unaided performance was high, operator confidence was high, and automation provided only small benefits. When unaided performance was lower, operator confidence was lower, and automation with higher d' provided large benefits. Operator compliance depended on the PPV of automation: We found lower compliance for lower PPV. Automation with a high false alarm rate of 20% and a low PPV of .3 resulted in operators ignoring about one-half of the true automation alarms on difficult targets—a strong cry-wolf effect. Our results suggest that automation reliability described by d' and PPV is more valid than using accuracy alone. When the PPV is below .5, operators should receive clear instructions on how to respond to automation alarms.</p>
--	---

Huegli, D., Merks, S., & Schwaninger, A. (2020). Automation reliability, human–machine system performance, and operator compliance: A study with airport security screeners supported by automated explosives detection systems for cabin baggage screening. *Applied Ergonomics*, 86, 1-12. doi:10.1016/j.apergo.2020.103094 [[PDF](#)]

Who is CASRA?

Center for Adaptive Security Research and Applications

- › The main aim of CASRA is to increase security and facilitation at airports and other environments involving people and security
- › Two organizations: University of Applied Sciences and Arts Northwestern Switzerland and APSS Software & Services AG
- › Located in Zurich, Switzerland
- › Leading organization in security research and applications
- › Software, methods and procedures based on scientific research
- › 100+ scientific publications and software applications installed in 50+ countries at 900+ airports

Thank you for your attention!

CASRA-Newsletter: <https://www.casra.ch/news/>

**If you have any questions or inputs, please contact:
david.huegli@fhnw.ch**

ADSA 22, 11/24/2020