Socio-Technical Approach to Aviation Security Screening

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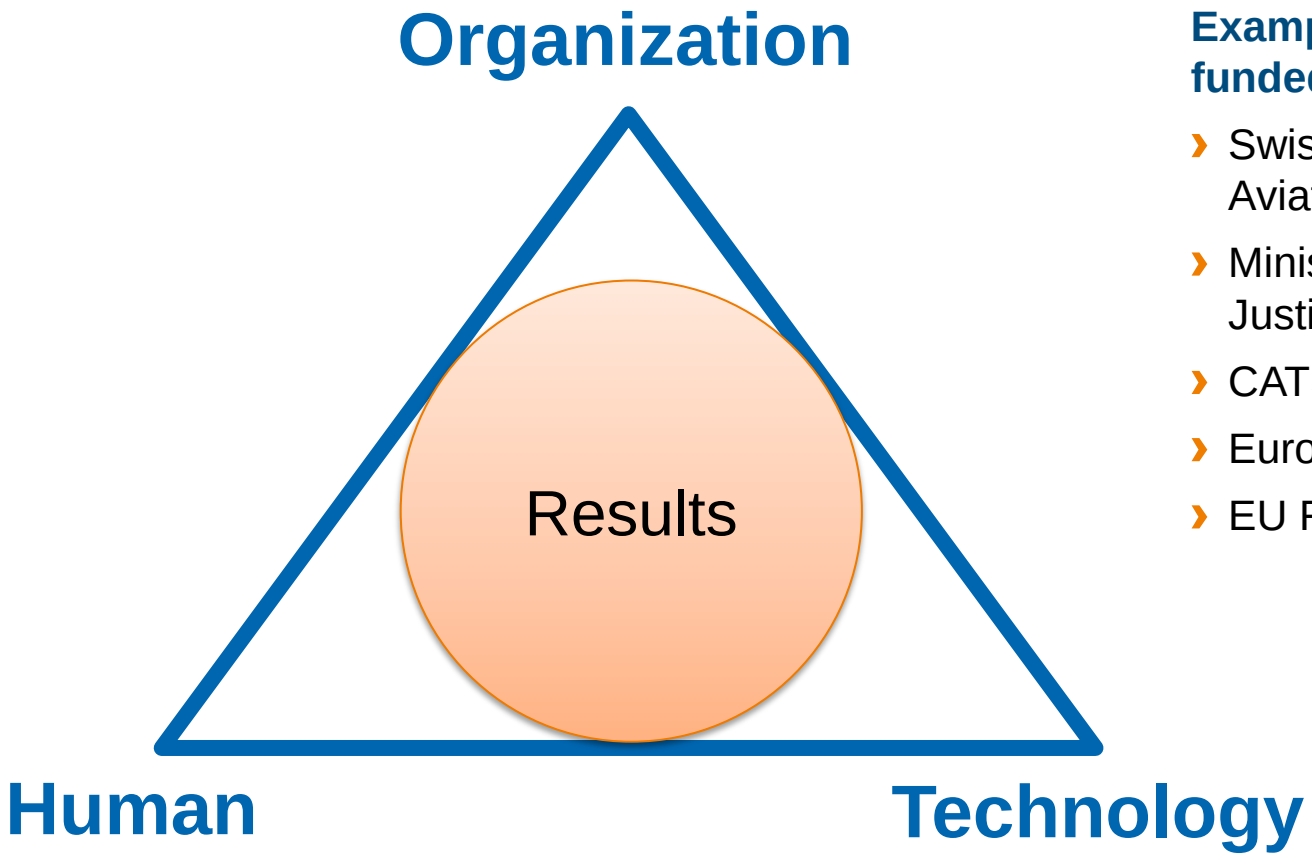
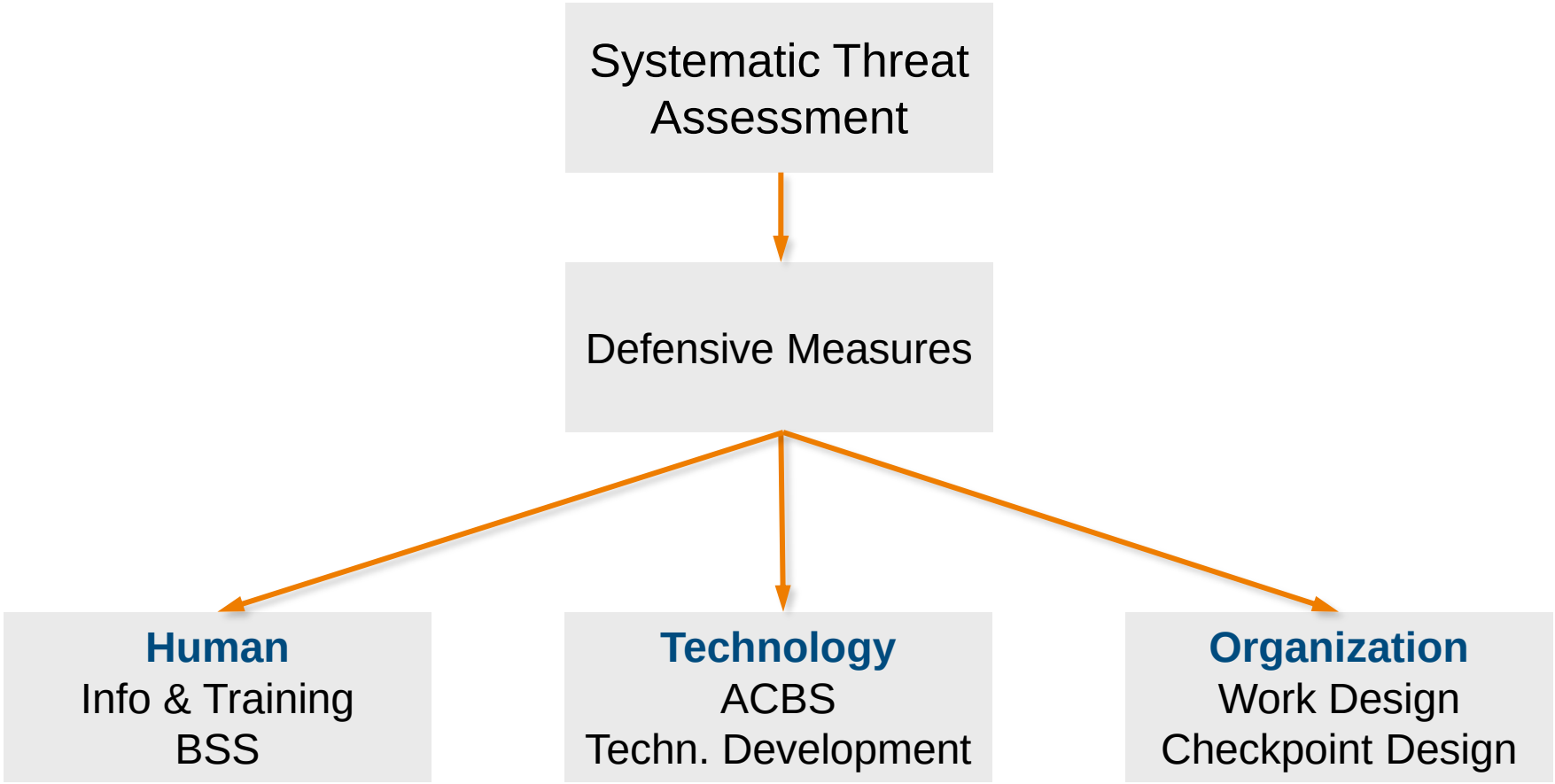
Socio-Technical Approach



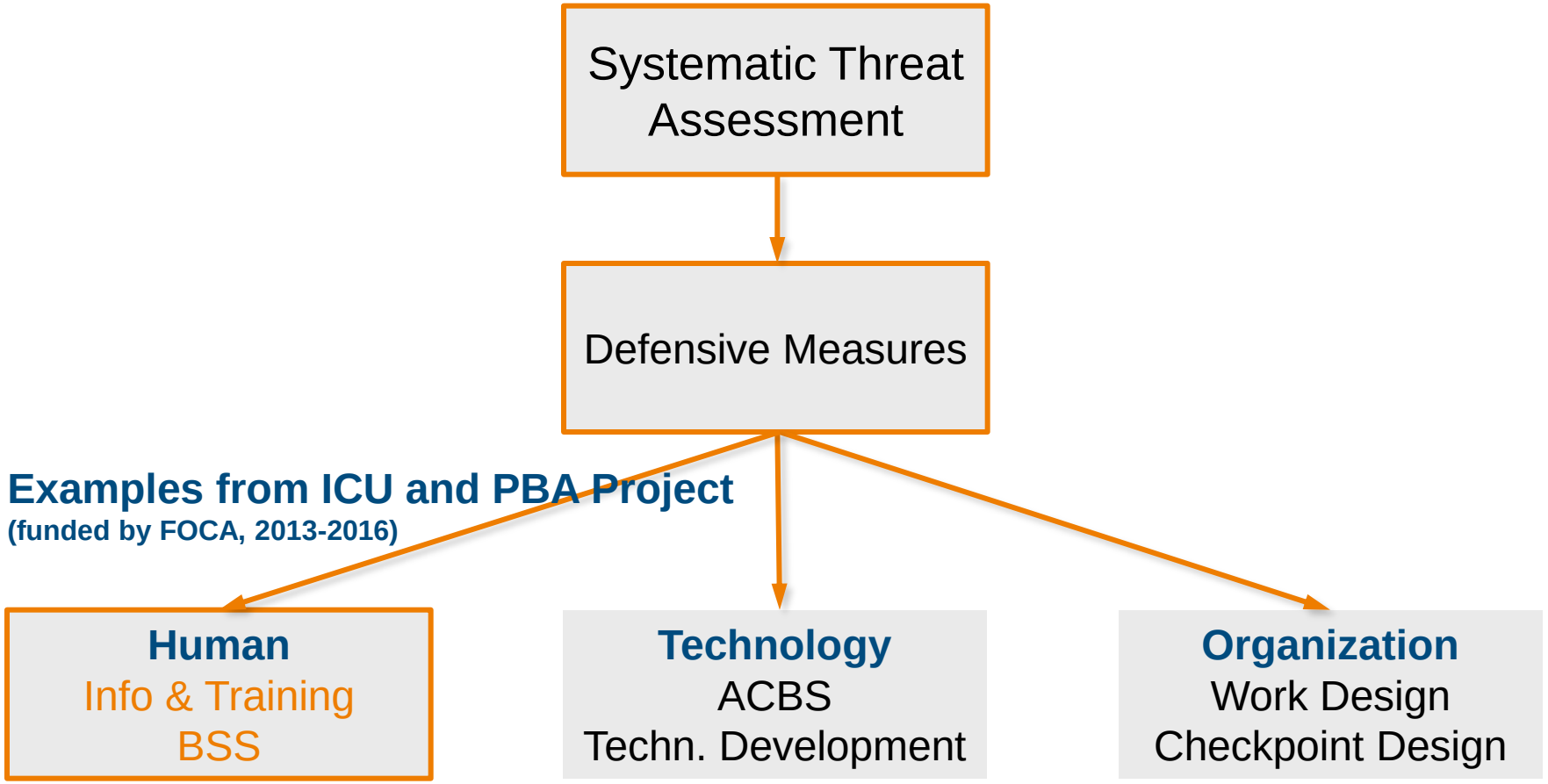
Examples from projects funded by:

- Swiss Federal Office of Civil Aviation (FOCA)
- Ministry of Security and Justice, The Netherlands
- CATSA
- European Airports
- EU FP7

Application to Aviation Security Screening



Application to Aviation Security Screening



Systematic Threat Assessment

Tennis ball filled with explosive material

May 2013 Pakistan
(Source: Internet and other non-public sources)

Systematic Threat Assessment

Detectability in X-ray images

Normal tennis ball (empty)

Tennis ball filled with TATP simulant

Tennis ball filled with ANFO simulant

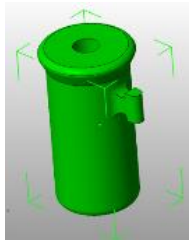
Tennis ball filled with ANFO simulant and screw nuts

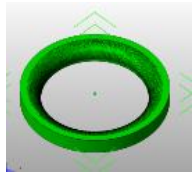
Systematic Threat Assessment

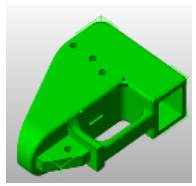
Liberator: 3D printed gun

May 2013
(Source: Internet)

- 380 Barrel (Threaded).stl
- 380 Barrel (Unthreaded).stl
- Bottom Cover.stl
- Firing Pin Bushing.stl
- Frame Pins (x3).stl
- -Frame.stl
- Grip Pin.stl
- Grip.stl
- Hammer Body.stl
- Hammer Pin.stl
- Hammer.stl
- Spring (x2).stl
- Spring Connecting Rod Bushing.stl
- Spring Connecting Rod.stl
- Trigger Spring.stl
- Trigger.stl

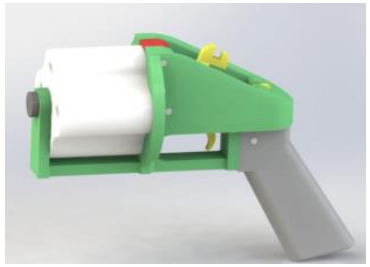


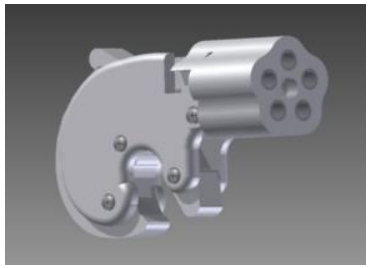




Systematic Threat Assessment

Detectability in X-ray images





Human: Info & Training

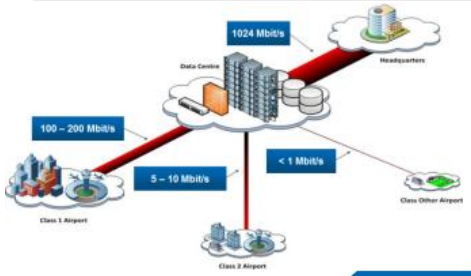
Implementation in different systems

Implemented June 21, 2013

Implemented December 17, 2013

X-Ray Training

XRT 3
X-RAY TUTOR



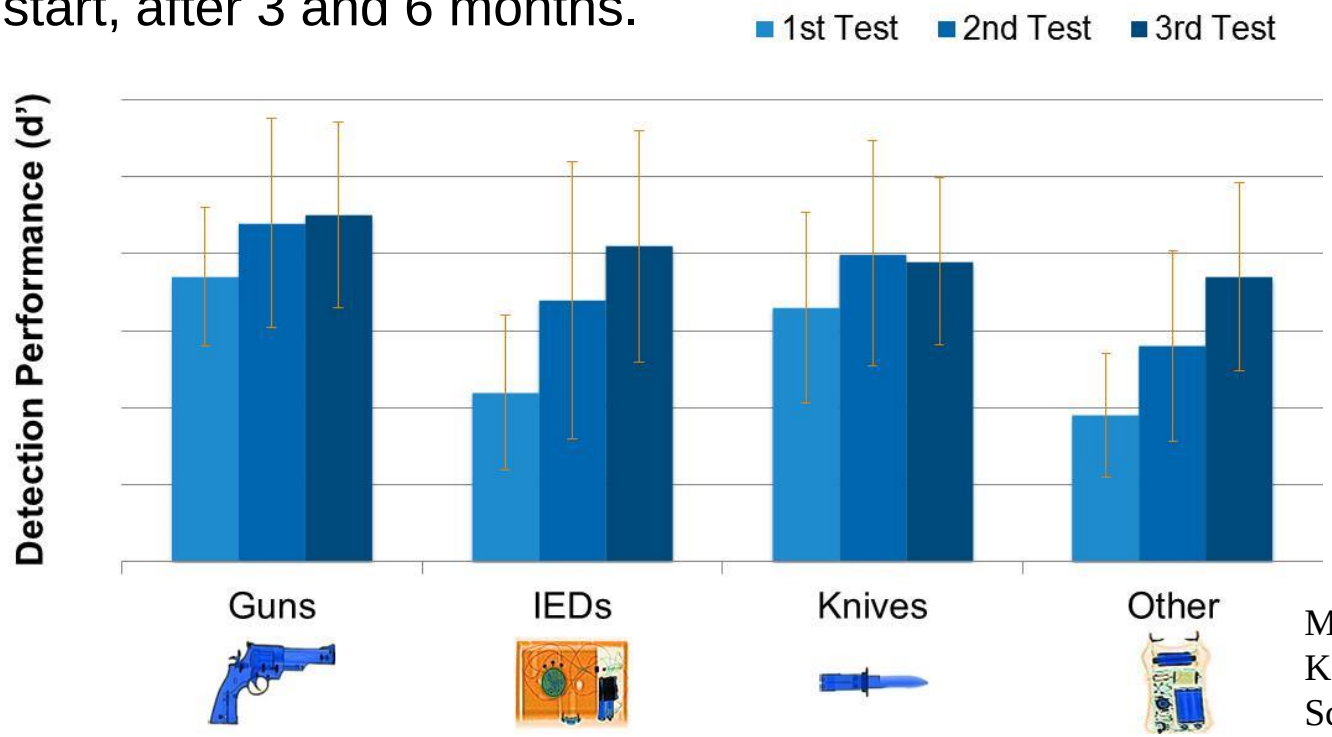
eLearning

CLS

Human: Info & Training

Detection performance can be increased if effective computer-based training is provided

2x20 min computer-based training with XRT during 9 months. Tests at start, after 3 and 6 months.



Michel, de Ruiter, Hogervorst, Koller, Moerland, & Schwaninger, A. (2007)

Human: BSS

IEDs

on the body

Umar Farouk Abdulmutallab

Dec 25, 2009

in the body

Terrorist attack against Assadullah Khalid, Head of the National Directorate of Security, Afghanistan

Dec 06, 2012

in belts…

Afghanistan

Jan 2014

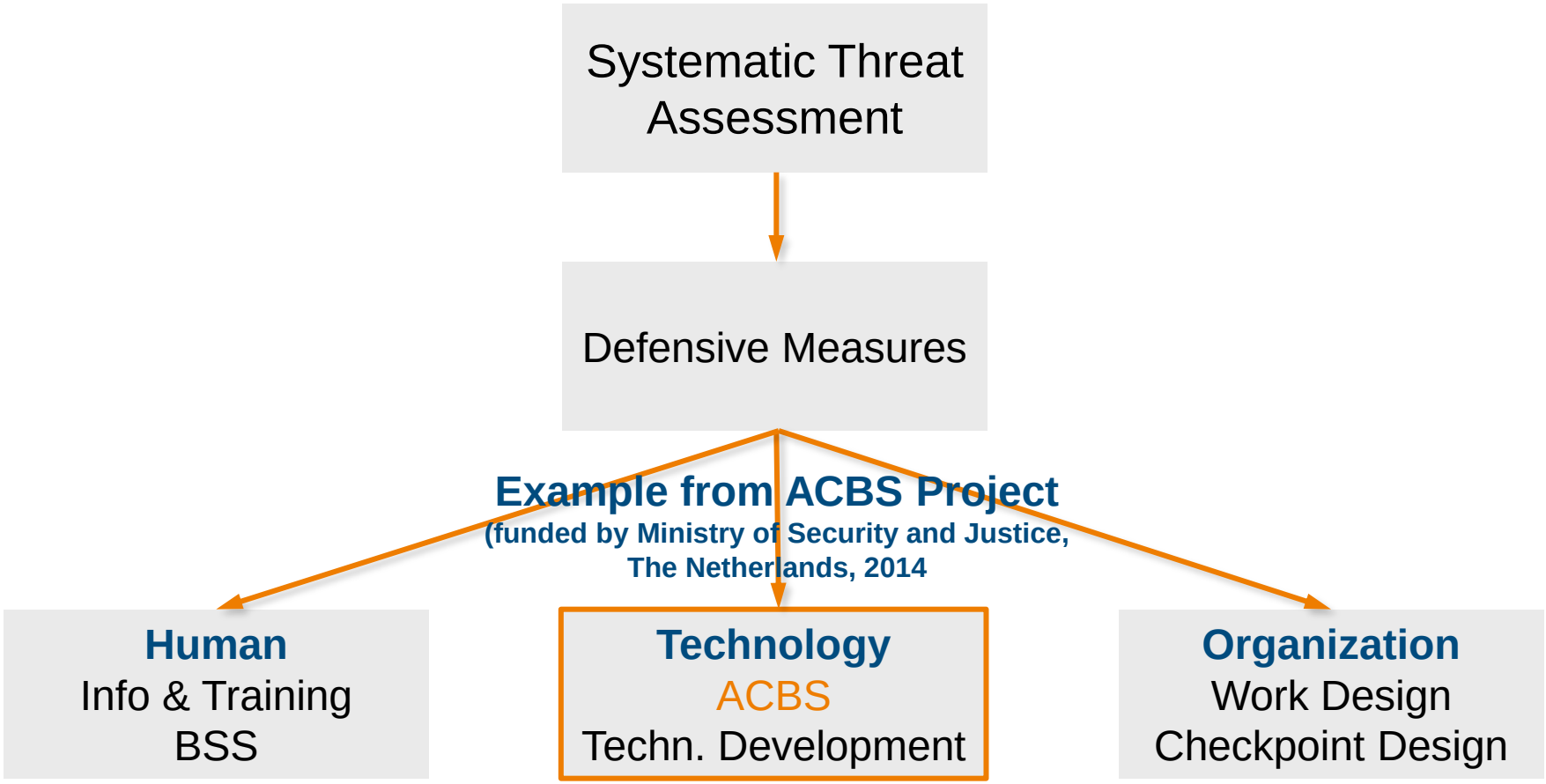
Human: BSS

Scoping Study on Behavioral Security Screening (BSS)

Behavioral Security Screening

- Useful against known and completely new threats
- Complementary to existing measures
- Fosters unpredictability and work motivation
- Can be combined with risk based approaches
- Challenges: Selection of personnel, training, implementation, evaluation

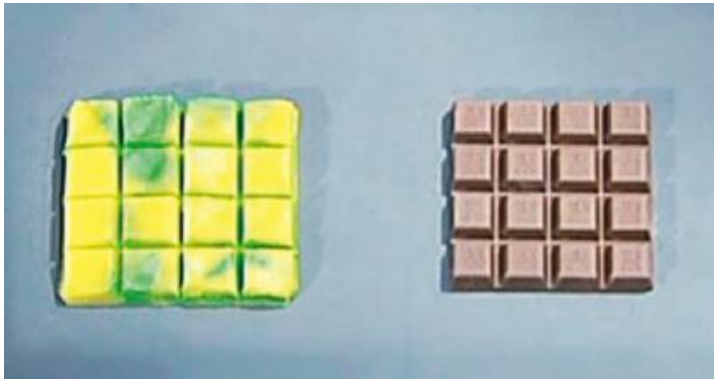
Application to Aviation Security Screening



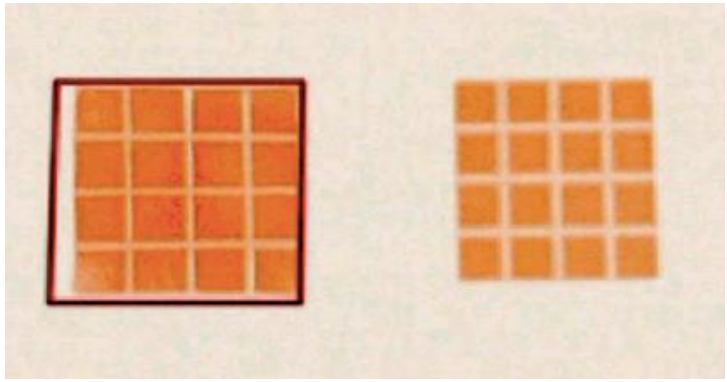
Technology: ACBS

The human needs the machine to distinguish material

Example from the publicly available brochure of the Smiths aTiX



Real image:
Explosive substance / chocolate



X-ray image:
Explosive substance / chocolate

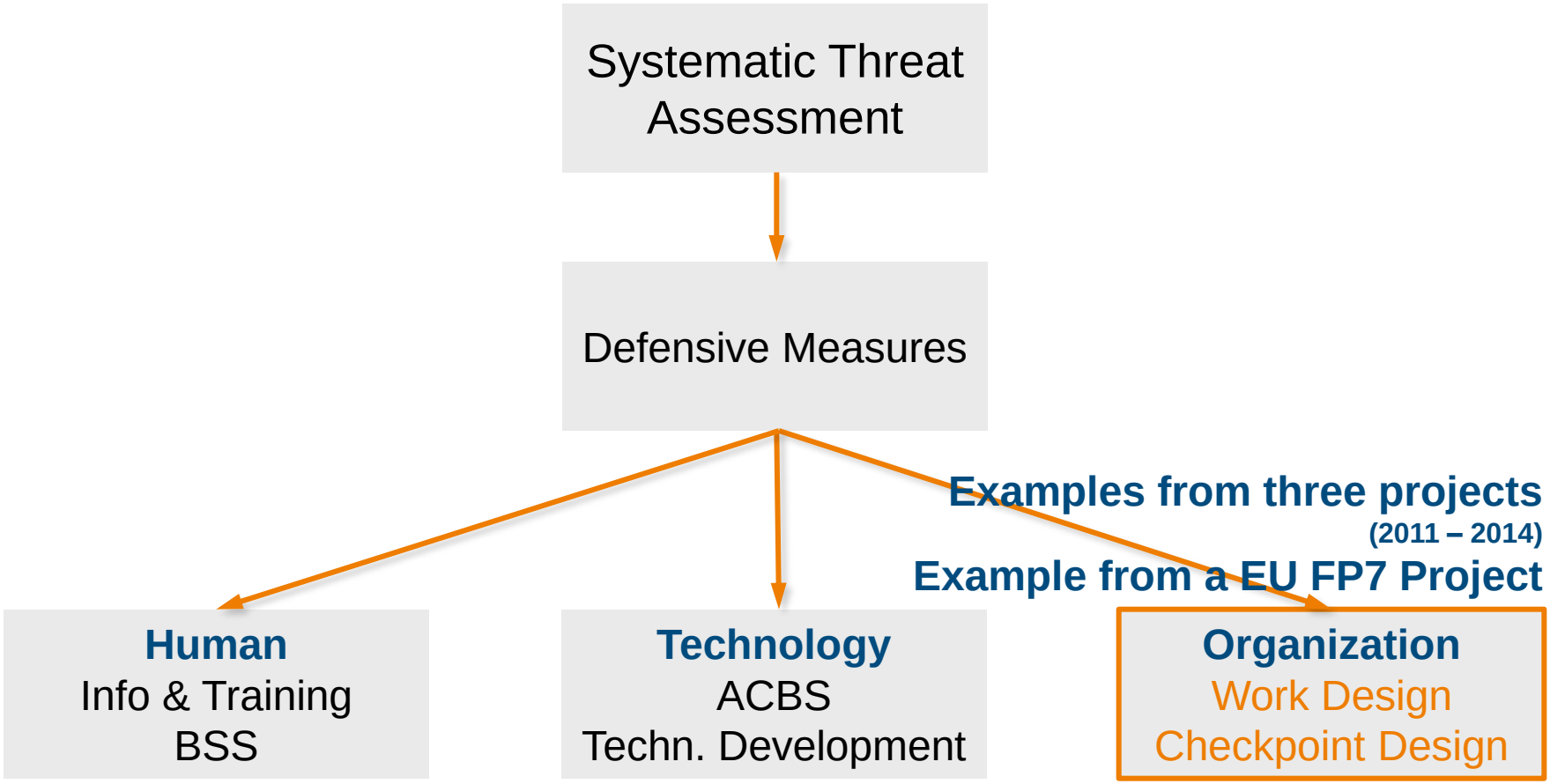
Source:
http://www.siemens.ch/sbt/Sicherheit2011/Smiths_Detection_Bodyscanner/HI_SCAN_Brochure_Englisch.pdf

Technology: ACBS

Which condition results in the best human-machine performance?

Condition	Technology	Process
Baseline	Standard X-ray machine (without automated detection)	Human analyses all X-ray images of bags, decides without any help by automated detection technology
ACBS 1 (Assist-Function)	Very high probability of detection - medium false alarm rate -	Human analyses all X-ray images of bags, decides with the help of automated detection technology (red frames marking areas which may contain explosive material)
ACBS 2 (Automation)	Lower detection probability - almost no false alarms -	If the machine alarms, the bag is sent to manual search automatically, else the human analysis the X-ray image and decides

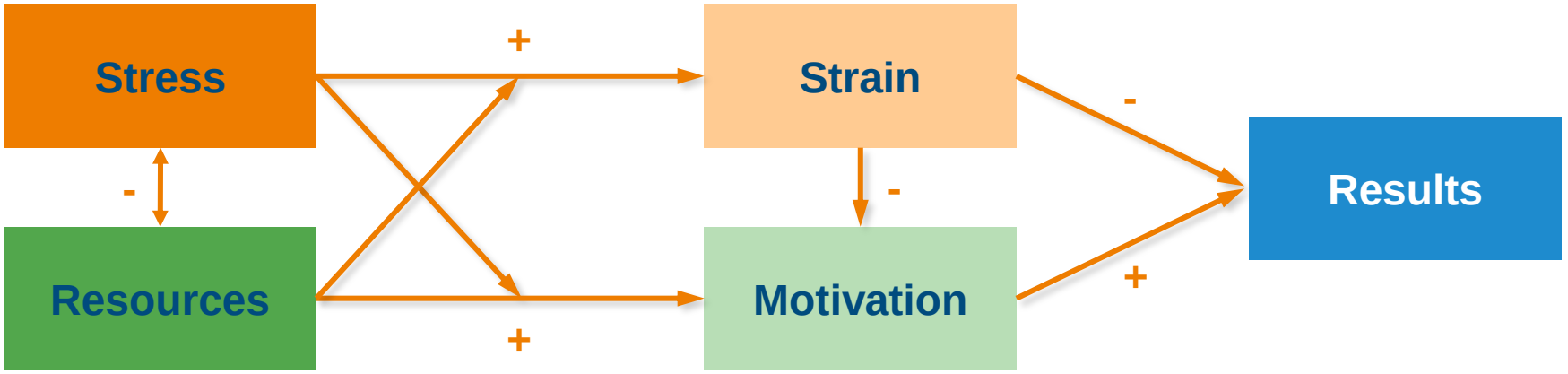
Application to Aviation Security Screening



Organization: Work Design

Influence of organizational factors on detection, throughput, passenger satisfaction and absenteeism

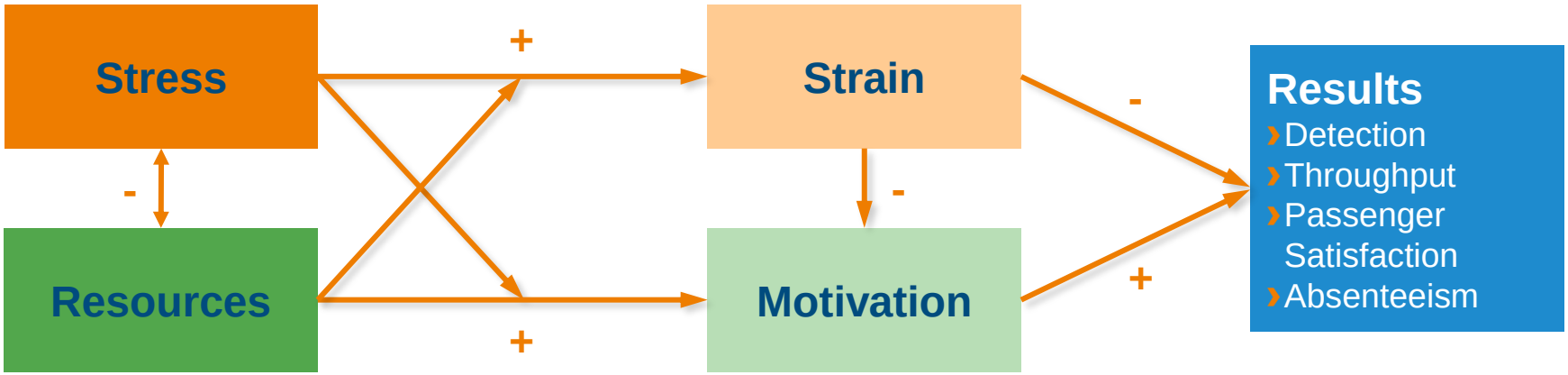
› At all three airports the core model was confirmed (Bakker & Demerouti, 2007)



Organization: Work Design

Influence of organizational factors on detection, throughput, passenger satisfaction and absenteeism

- External working conditions (e.g. noise)
- Work-privacy conflict, shift work
- Monotonous tasks
- Fear of failure



- Social interactions
- Clear roles
- Leadership
- Recovery, breaks

Differences regarding intensity of factors and work motivation

Organization: Checkpoint Design

XP-Dite (EU FP7 Project)

- Passenger-centered, outcome-focused, system-level approach to the design and evaluation of airport security checkpoints
- Design tool to design innovative new checkpoints
- Evaluation tool to evaluate performance of checkpoints
- Aligned with IATA Checkpoint of the Future
- Aligned with US TSA risk-based security
- Aligned with UK DFT's outcome-focused risk-based regulation initiative

TNO innovation for life
Fraunhofer ICT
Fraunhofer EMI
smiths detection
SAFRAN Morpho
FOI
CASRA
UNI FREIBURG
iconal
CASCADE TECHNOLOGIES
Schiphol Amsterdam Airport
IMAGING

Trends and work design

The system change has already started in certain countries…

Current System	Future System?
› Security controls the same for all passengers “one size fits all“	› Based on systematic threat and risk assessment, featuring unpredictability
› Very detailed standard operating procedures (rule-based security) and little feedback	› Focused on results (outcome-focused security) and regular feedback to security officers / team
› Humans as extensions of the machines, technology defines the process	› Machines help humans to define processes “socio-technical approach“
› Work motivation is not taken into account appropriately	› Work motivation is taken into account as a crucial factor for overall system performance

CASRA

Thank you for your attention