The History of Competency-Based Training in Aviation

Capt. Dr. Christian Norden

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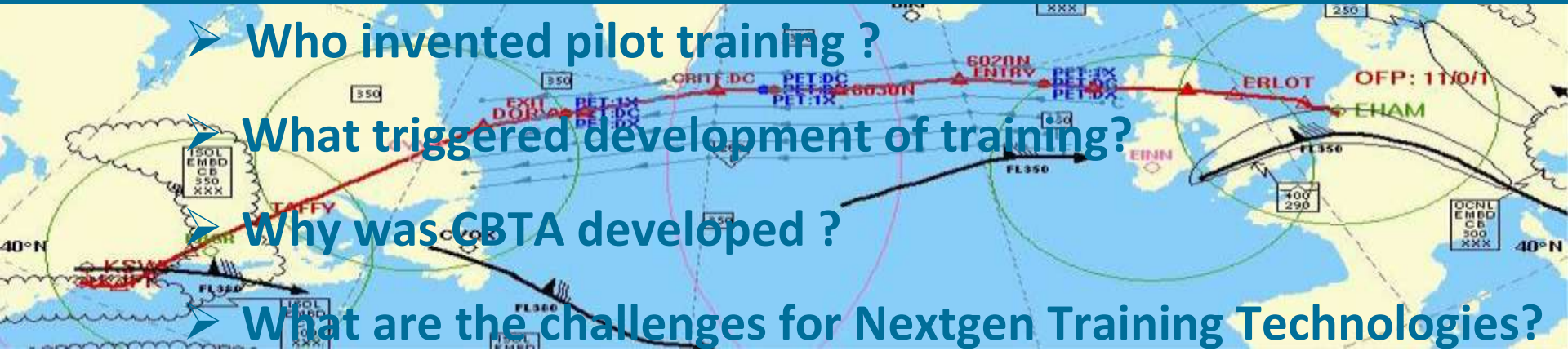
History of Competency-Based Training and Assessment (CBTA)

Our Flightplan



- Who invented pilot training ?
- What triggered development of training?
- Why was CBTA developed ?
- What are the challenges for Nextgen Training Technologies?

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Early Days of Flying

1903 Wright Brothers first motor-powered flight: Inventors and developers pass on their experience.

1909 First training of two US army officers by the Wright brothers.

1911 First pilot licencing - French military

Until end of WW I: no structured civil-aviation training.

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Evolution of Commercial Flying

1914 (US)
1918 (Europe) Commercial civil air transport commences

1920‘s Ex-military pilots are the first operators of commercial airlines. Structured Civil Aviation training starts

1930‘s More complex aircraft require bigger crew: e.g. two pilots, flight engineer, navigator, radio operator

1939-1945 Second WW triggers technological boost for the following boom of public air transport

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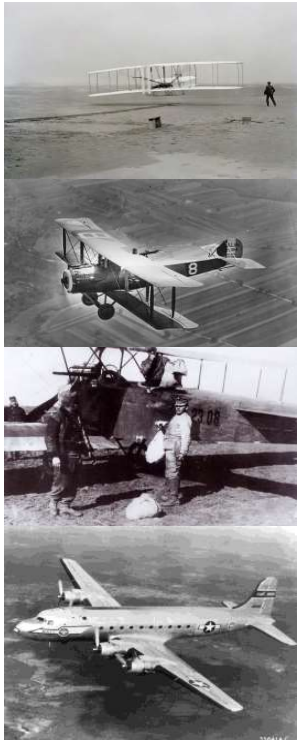
Creation of Training Targets



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HOW TO FLY YOUR AIRPLANE:

„Know the technical details and limits of your aircraft and your engine.

Control climb, descent, turn and landing. Watch your speed: not too slow (you crash), not too fast (aircraft disintegrates).

Use navigation technique to find your destination."

Following WW II

1945 Casualities of aviation personnel in WWII: > 12.000 compared to 3.618 killed in enemy action *

1945+ Ex-military trained pilots continue piloting (and training future pilots) in commercial airlines

1944 Convention on International Civil Aviation: The International Civil Aviation Organization (ICAO), a specialized agency of the UN is founded – leading to worldwide standarisation of aviation

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* Leeds, J.R. (2020)

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Standardisation of Training Targets after 1945

- Training: Knowledge acquisition, repetition of tasks and manouvers until proficient
- Evaluation: „Tick-Box“ process
- Criteria: Adhearance to predefined values and limits: e.g. maintain speed +/- 5kts, maintain altitude +/- 100 ft

- Knowledge and skills to be trained:

APPLICATION OF PROCEDURES	FLIGHT PATH MANAGEMENT - AUTOMATION
APPLICATION OF KNOWLEDGE	FLIGHT PATH MANAGEMENT - MANUAL

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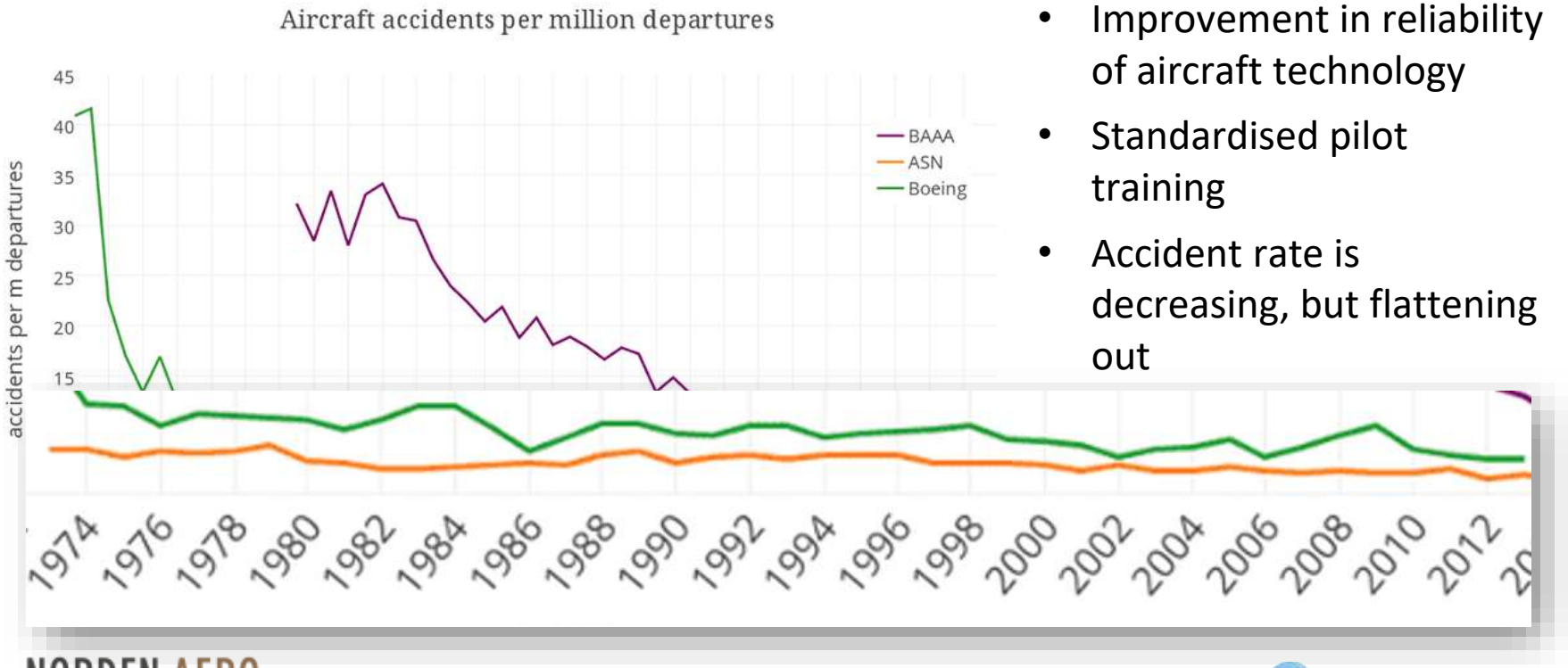
Evolution of Safety in Commercial Aviation



- Improvement in reliability of aircraft technology
- Standardised pilot training
- Accident rate is decreasing, but flattening out

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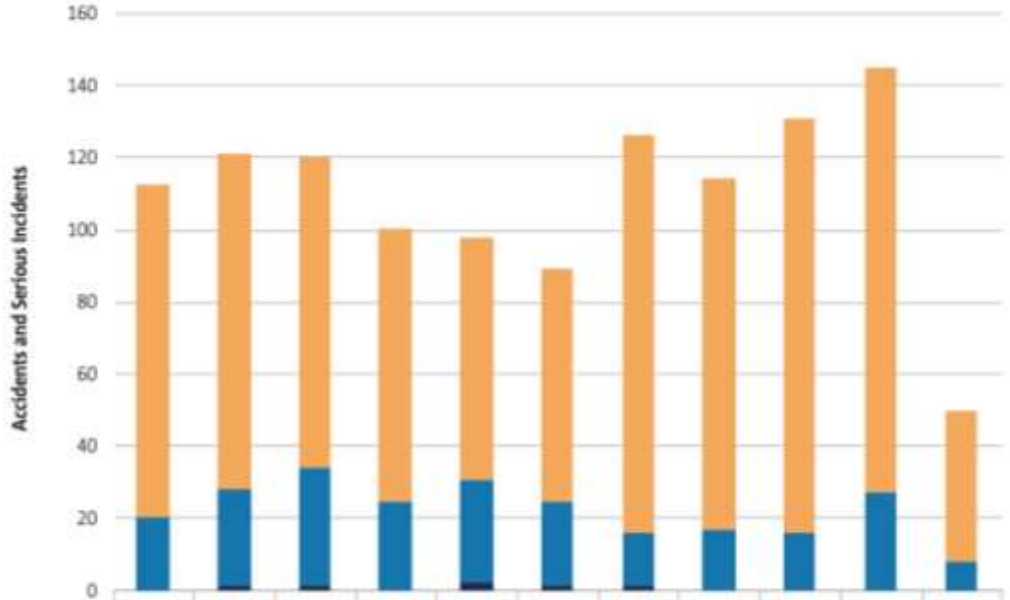
Stagnation of Accidents and Serious Incidents in Europe



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Serious Incidents	93	93	86	75	67	64	110	97	115	118	42
Non-Fatal Accidents	20	27	33	25	29	24	15	17	16	27	8
Fatal Accidents	0	1	1	0	2	1	1	0	0	0	0

Why?

Source: EASA Annual Safety Review 2021

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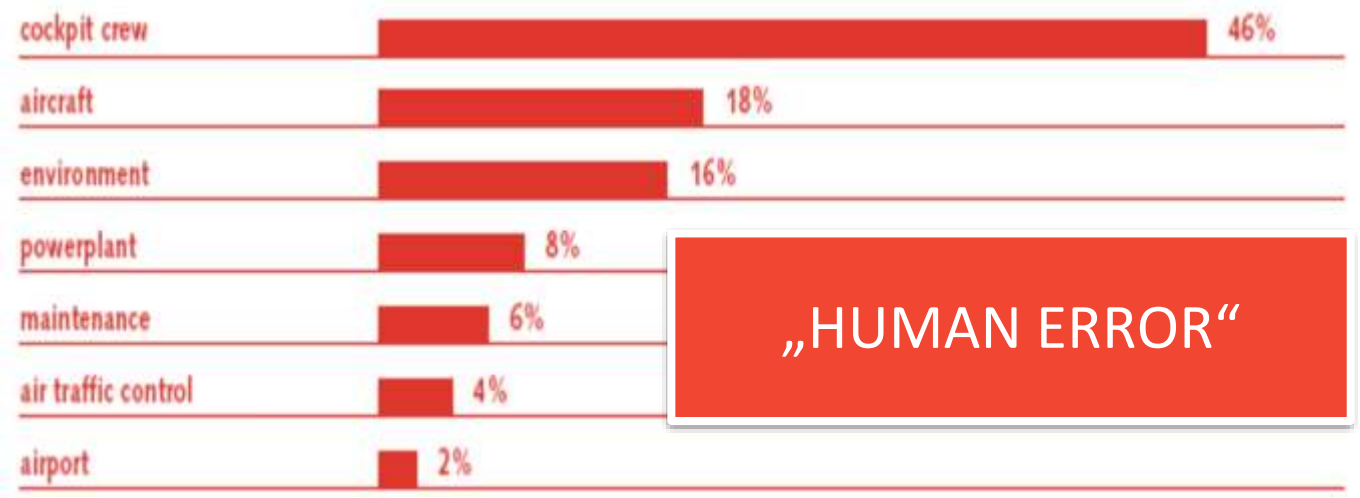
Contributing factors to fatal accidents, 1980-2003



Source: EEMCS Final Report for the Causal Modeling for Air Transport Safety (CATS) – Delft University

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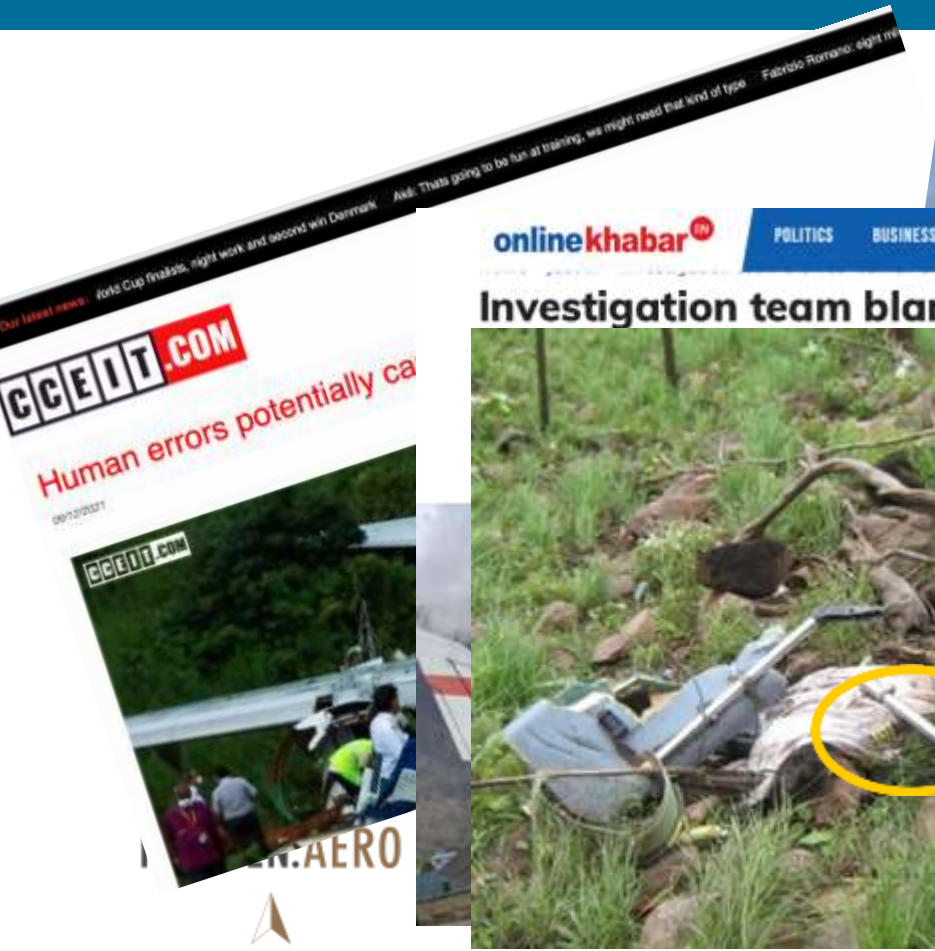
”Human Error” ?



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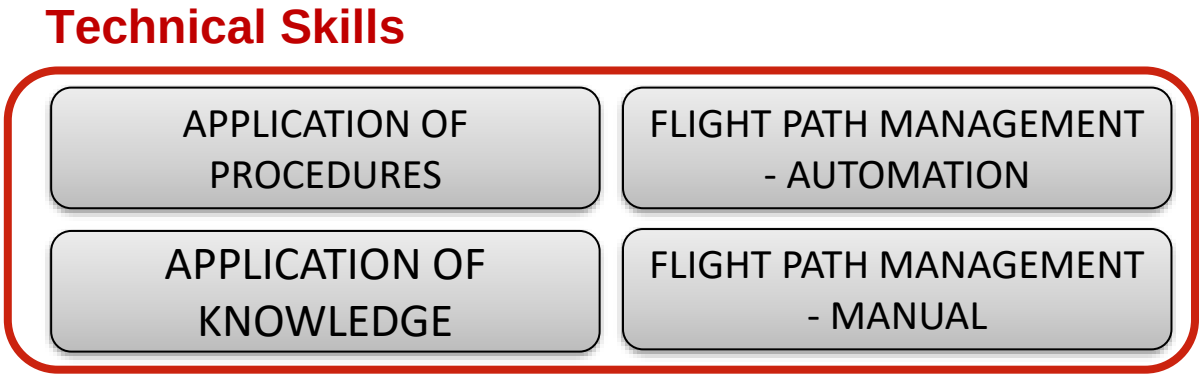
Are the Training Targets sufficient?



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Root Causes for “Human Error”

Technical Skills

APPLICATION OF PROCEDURES	FLIGHT PATH MANAGEMENT - AUTOMATION
APPLICATION OF KNOWLEDGE	FLIGHT PATH MANAGEMENT - MANUAL

Non-Technical Skills

e.g. Leadership, Communication, Decision making …

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The Trigger for Changes

27. 3. 1977 Teneriffe

- Collision of two B747 aircraft
- 583 people died
- The worst aviation accident in history till today

Deficient **NON-TECHNICAL SKILLS** (i.a. Communication, Leadership and Teamwork) were identified as the root cause of the accident

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Evolution in the 1980s

PILOT LICENCE
Technical Skills Training

- APPLICATION OF PROCEDURES
- APPLICATION OF KNOWLEDGE
- FLIGHT PATH MANAGEMENT - AUTOMATION
- FLIGHT PATH MANAGEMENT - MANUAL

OPERATORS TRAINING
Crew Resource Management

Effective use of resources like (e.g.)

- Human error
- Stress management
- Situation awareness
- Workload management
- Decision making
- Communication
- Leadership, team behaviour

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Evolution towards CBTA in the 2000s

„Competency is a dimension of human performance that is used to reliably predict successful performance on the job.

A competency is manifested and observed through **behaviours that mobilize relevant knowledge, skills and attitudes** to carry out activities or tasks under specified conditions.“

ICAO Standards and Recommended Practices:
Annex 1 Personnel Licencing

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The Competencies – Toolbox for Pilots

LEADERSHIP & TEAMWORK

PROBLEM SOLVING & DECISION MAKING

COMMUNICATION

WORKLOAD MANAGEMENT

SITUATION AWARENESS

APPLICATION OF PROCEDURES

FLIGHT PATH MANAGEMENT - AUTOMATION

FLIGHT PATH MANAGEMENT - MANUAL

APPLICATION OF KNOWLEDGE

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The Pilot Competency Framework Today

KNO	Application of Knowledge. (EASA only)
PRO	Application of Procedures and compliance with regulations
COM	Communication
FPA	Aeroplane Flight Path Management, automation
FPM	Aeroplane Flight Path Management, manual control
LTW	Leadership and Teamwork
PSD	Problem Solving and Decision Making
SAW	Situation awareness and management of information
WLM	Workload Management

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Competency Description and Observable Behaviours

Communication (COM)	
Description:	Communicates through appropriate means in the operational environment, in both normal and non-normal situations
OB 2.1	Determines that the recipient is ready and able to receive information
OB 2.2	Selects appropriately what, when, how and with whom to communicate
OB 2.3	Conveys messages clearly, accurately and concisely
OB 2.4	Confirms that the recipient demonstrates understanding of important information
OB 2.5	Listens actively and demonstrates understanding when receiving information
OB 2.6	Asks relevant and effective questions
OB 2.7	Uses appropriate escalation in communication to resolve identified deviations
OB 2.8	Uses and interprets non-verbal communication in a manner appropriate to the organisational and social culture
OB 2.9	Adheres to standard radiotelephone phraseology and procedures
OB 2.10	Accurately reads, interprets, constructs and responds to datalink messages in English

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Competency Description and Observable Behaviours

Abbreviated word picture VENN model				
	TEM	Observable behaviours		
Grading	OUTCOME (1)	HOW WELL (2) =	HOW MANY (i)+	HOW OFTEN (ii)
1	unsafe situation	ineffectively	few, hardly any	rarely
2	not an unsafe situation	minimally acceptable	some	occasionally
3	safe situation	adequately	many	regularly
4	safe situation	effectively	most	regularly
5	enhanced safety, effectiveness and efficiency	in an exemplary manner	all, almost all	always

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Grading and Assessment

Traditional Training Criteria

Based mainly on (technical) limitations.

Further performance criteria use subjective wording e.g. „Exercise good judgement, communicate effectively, exercise airmanship“

No structured assessment process

CBTA Criteria

Based on three performance criteria,

- Observable Behaviors (identified as root-cause for decreased/increased safety margin)
- Competency standard
- Conditions

Assessment follows a structured process

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Current Status

ICAO

Pilots

- Multi-Crew Pilot Licence (MPL)
- Recurrent Training for Airline Pilots (Evidence-based Training)
- Aircraft Type Rating
- Remote Pilot Licence

+ Aircraft Maintenance Personnel, Air Traffic Controllers…

+ Current ICAO Panel (PTLP): enable CBTA for all licenses

EASA

Pilots

- Multi-Crew Pilot Licence (MPL)
- Recurrent Training for Airline Pilots (Evidence-based Training)

+ European Safety Plan (EPAS): CBTA is priority for 2022-2026

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Trends of the Future

Data-Driven Training

Virtual Reality Training

Remote Training

* Sources: vrm-switzerland.ch L3Harris

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Challenges of the Future

As long as there is a man-machine interaction while operating in the aviation environment:

Training and selection of devices must remain (must become even more) human competency focused;

Not a Task-to-tool concept for aviation training, but a

COMPETENCY-TO-TOOL TRAINING CONCEPT

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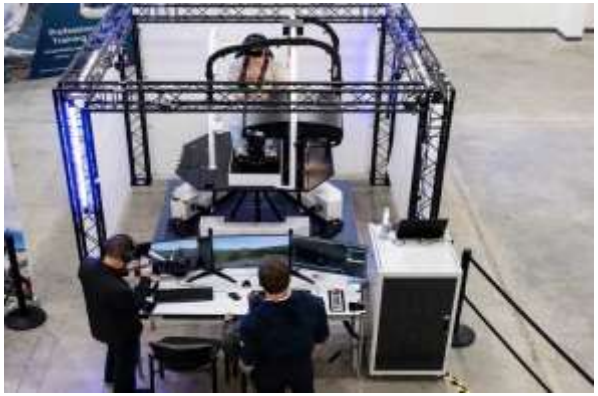

Thank you

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