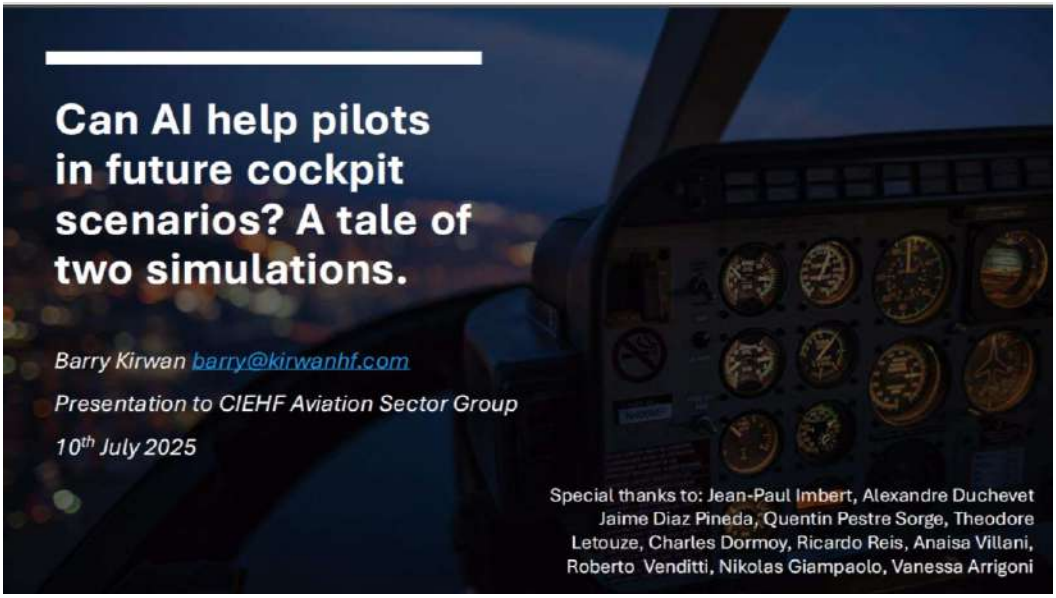


Flight briefing

- 3-year EU HAIKU Research Project looking at Human-AI Teaming in Aviation sector
- Two studies of cockpit AI-based pilot support
  - 'Startle Response' support following a lightning strike
  - Re-routing support during major weather pattern event
- 'Real' AI prototypes trained with pilot expertise
- Airline pilots as test subjects in fixed simulators
- Insights on accuracy, alignment, usability and desirability
- *What pilots said...*

Haiku
Human AI teaming Knowledge and Understanding for aviation safety

Home About Use Cases Products News & Events Contact Us

https://haikuproject.eu/

Our goal

is to pave the way for **human-centric-AI** via the exploration of interactive **AI prototypes** in a **range of aviation contexts**

HAIKU's focus is on **Intelligent Assistants** for the 2030+ timeframe.

Our challenge

is to deliver **truly *human-centric* Digital Assistants**, capable to **'fit' the way humans work**.

HAIKU aims to develop a **Human Factors Assurance toolset** that design teams of AI-based systems can work with.

Who we are

Haiku

Horizon Europe R&I Program (September 2022 - August 2025)

15 Partners from 10 different countries, bringing together **Human Factors expertise**, domain's key **end-users** and **technology** suppliers of excellence

deepblue PROJECT COORDINATOR · EUROCONTROL · CHPR · EMBRAER · ENAC · LFV · LU UNIVERSITY · skyway · THALES · BORDEAUX INP · CATIE · Suite5 · DFKI · ENGINEERING THE DIGITAL TRANSFORMATION COMPANY · CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

END-USERS

London Luton Airport

ADVISOR

EASA

This project has received funding by the European Union's Horizon Europe research and innovation programme HORIZON-CL5-2021-D6-01-13 under Grant Agreement no 101075332

Fasten your seat-belts (Reality check)

- Generally no AI in cockpits today.
- No LLMs allowed in cockpit (unless on your phone/EFB) because they hallucinate.
- No consideration of SPO until 2030+
- A great deal of the 'hype' about AI is exactly that.
- AI (ML) can perhaps help the flight crew. We (HAIKU) look at ways AI can augment human performance.

A Tale of two AI Cockpit Studies

Startle Response Support (single pilot)

Re-routing Support (two-pilot flight crew)

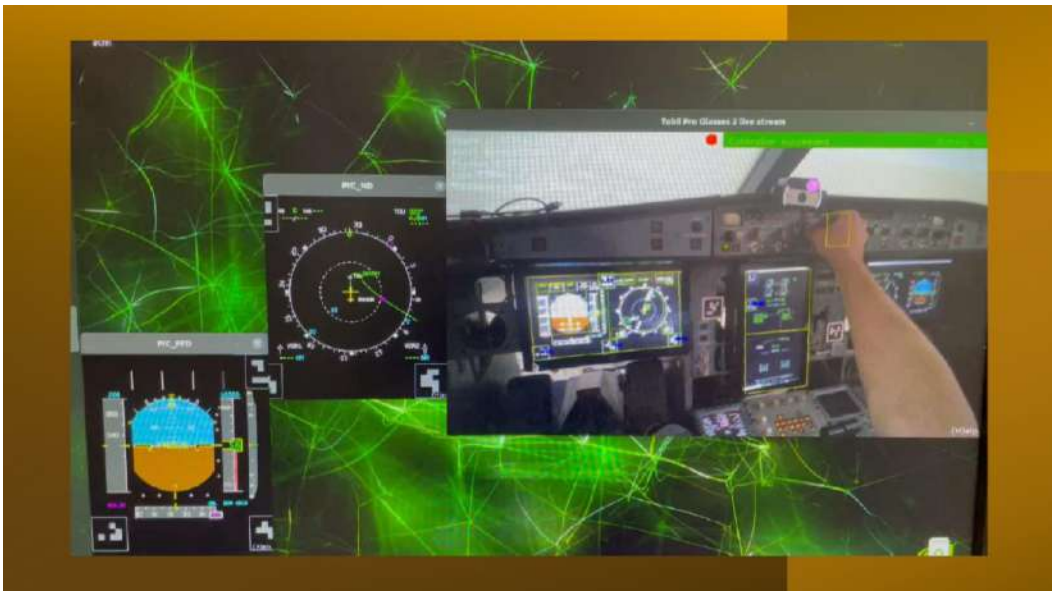
Can AI assist pilots experiencing 'startle response'?

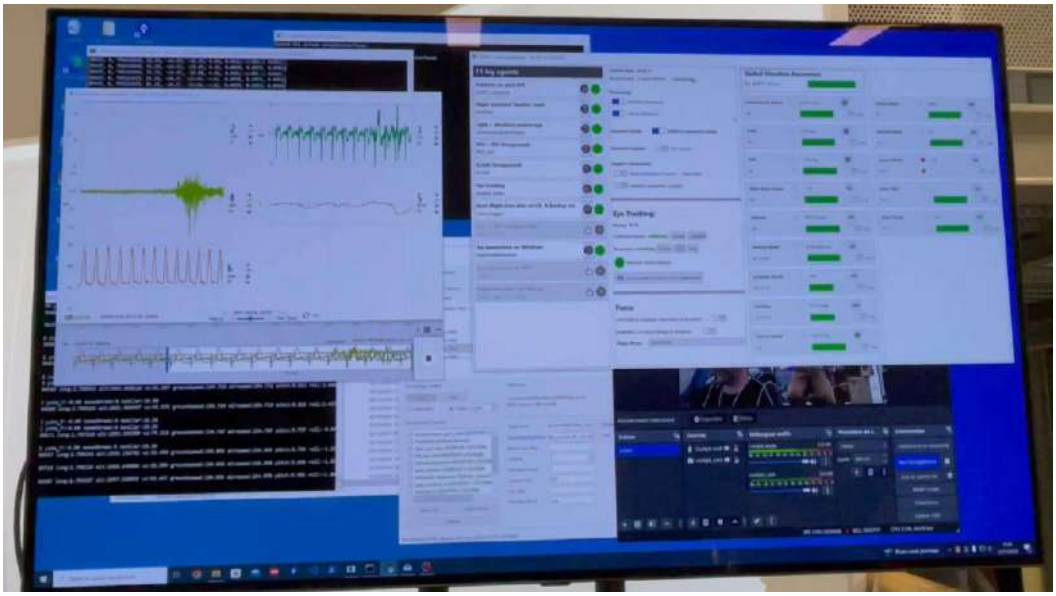
Sudden, unexpected event.

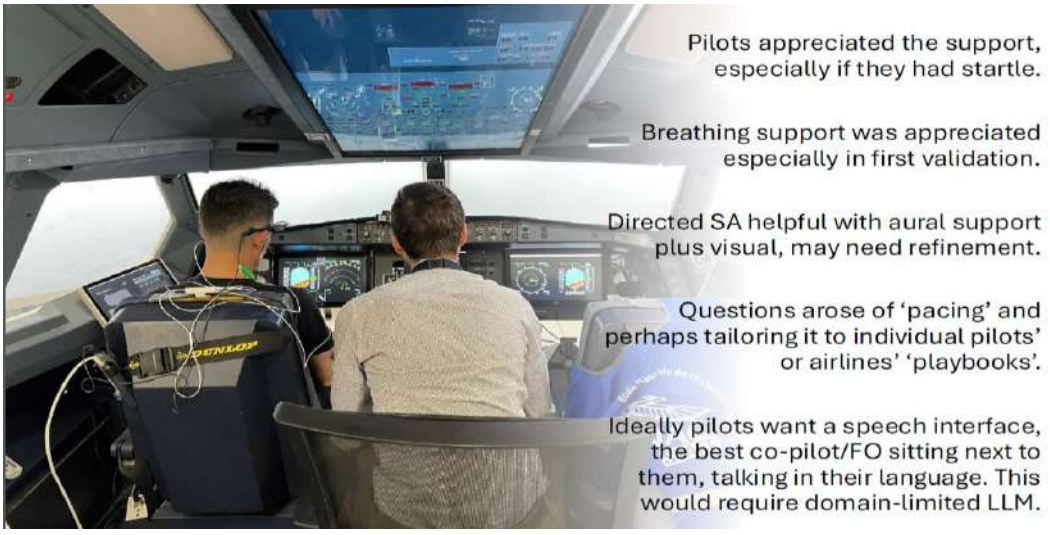
Psychophysiological response, cognitive performance impaired for 20s


HAIKU UC1 (led by ENAC, AI by DFKI)
Single Pilot in Startle Response Emergencies
AI-based Startle Detection (physiological measures) Recovery, and Directed Situation Awareness (eye tracking, highlighting key display elements)
DUNLOP
FOCUS: Flight Operational Companion for Unexpected Situations


Global Situation Awareness
SA: 0.744
Indicated Air Speed
193.25 knot
SA: 0.994
Log
Pitch
-3.42 deg
SA: 1
Log
Roll
-8.62 deg
SA: 1
Log
Glide slope deviat.
0.01
SA: 1
Log
Altitude
2627.48 feet
SA: 1
Log
Vertical Speed
-1597.83 feet/min
SA: 1
Log
Localizer deviat.
0.05
SA: 0.054
Log







Pilots appreciated the support, especially if they had startle.

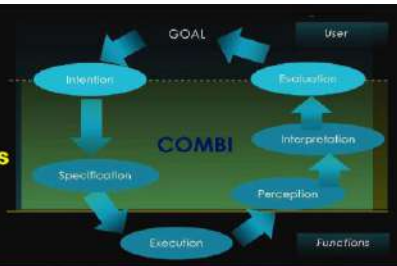
Breathing support was appreciated especially in first validation.

Directed SA helpful with aural support plus visual, may need refinement.

Questions arose of 'pacing' and perhaps tailoring it to individual pilots' or airlines' 'playbooks'.

Ideally pilots want a speech interface, the best co-pilot/FO sitting next to them, talking in their language. This would require domain-limited LLM.

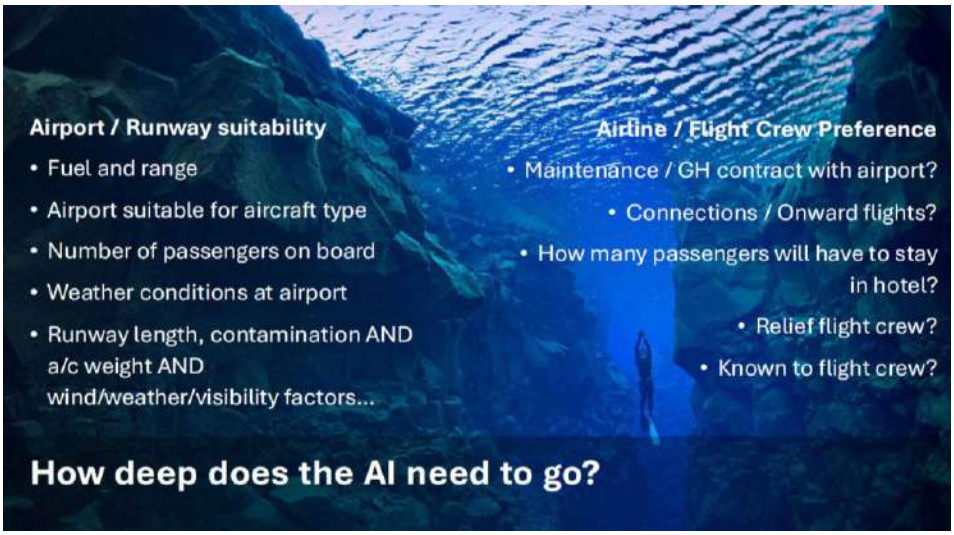
HAIKU UC2: Assist route replanning after a meteorological degradation:
Identifies 3 viable airports
Flight crew choose one.



- **HAT Architecture:**
  - Communication
  - Collaborative Situation Awareness
  - Negotiation
  - Work-Sharing and Task Delegation
  - Integrated HMI

AI (COMBI)
- Trained using expert-labelled data
- Pilot decision criteria analysed and prioritized (KPIs)
- AI model developed & tested with pilots

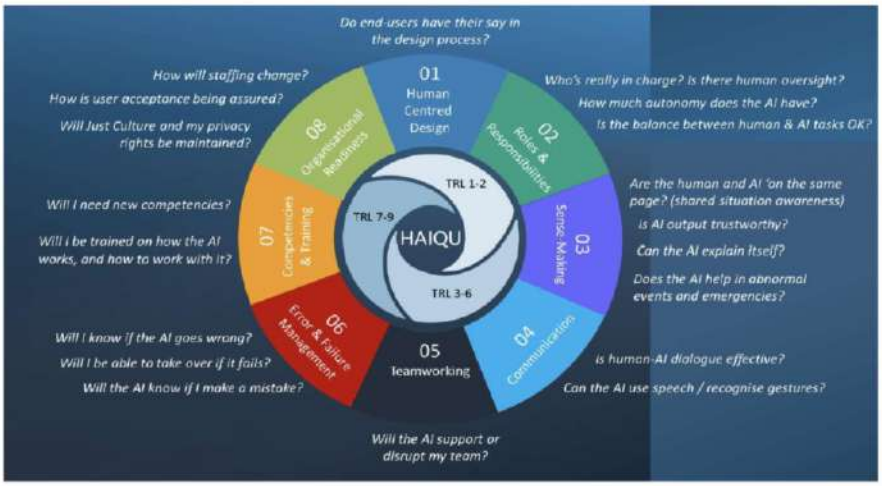
- Accelerates alternatives generation
- Accelerates situation assessment
- Reduces workload: a 12-15 minute task now takes 2-3 minutes

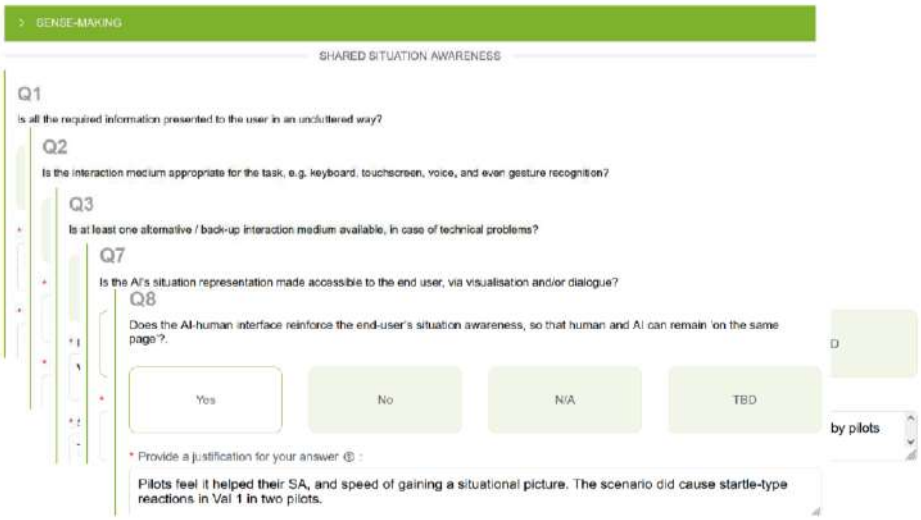

Airport / Runway suitability
• Fuel and range
• Airport suitable for aircraft type
• Number of passengers on board
• Weather conditions at airport
• Runway length, contamination AND a/c weight AND wind/weather/visibility factors...
Airline / Flight Crew Preference
• Maintenance / GH contract with airport?
• Connections / Onward flights?
• How many passengers will have to stay in hotel?
• Relief flight crew?
• Known to flight crew?
How deep does the AI need to go?

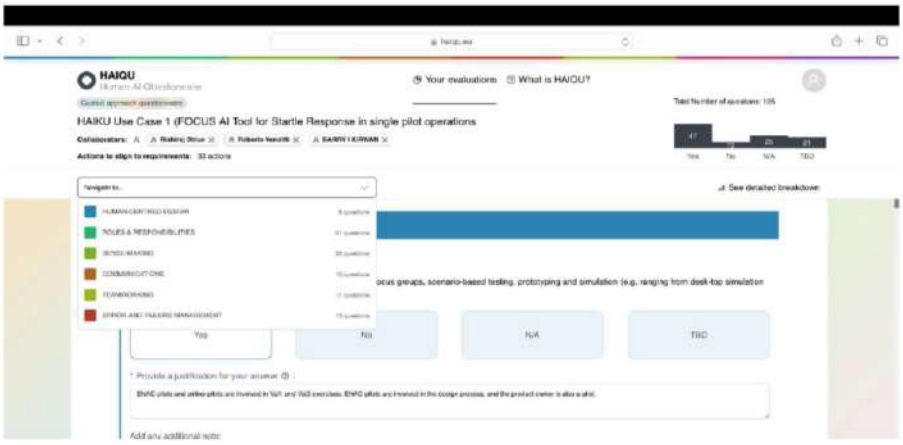

Do all Pilots Want the Choice?
"Just give me the best/preferred solution."


Usability: Is the AI...
Fit for purpose
Fit for cockpit
Fit for flight crew...
Human Factors Requirements


HAIQU
Human-AI Questionnaire
Sign-in
Sign-up
Get the Human Factors right in your AI-based system
Move closer to compliance with aviation Human Factors regulations
Start now


Do end-users have their say in the design process?
01 Human Centred Design
How will staffing change?
How is user acceptance being assured?
Will Just Culture and my privacy rights be maintained?
02 Roles & Responsibilities
Who's really in charge? Is there human oversight?
How much autonomy does the AI have?
Is the balance between human & AI tasks OK?
03 Sense-Making
Are the human and AI 'on the same page? (shared situation awareness)
Is AI output trustworthy?
Can the AI explain itself?
Does the AI help in abnormal events and emergencies?
04 Communications
Is human-AI dialogue effective?
Can the AI use speech / recognise gestures?
05 Teamworking
Will the AI support or disrupt my team?
06 Error & Failure Management
Will I know if the AI goes wrong?
Will I be able to take over if it fails?
Will the AI know if I make a mistake?
07 Competencies & Training
Will I need new competencies?
Will I be trained on how the AI works, and how to work with it?
08 Organisational Readiness
TRL 1-2
TRL 7-9
TRL 3-6
HAIQU


SENSE-MAKING
SHARED SITUATION AWARENESS
Q1
Is all the required information presented to the user in an uncluttered way?
Q2
Is the interaction medium appropriate for the task, e.g. keyboard, touchscreen, voice, and even gesture recognition?
Q3
Is at least one alternative / back-up interaction medium available, in case of technical problems?
Q7
Is the AI's situation representation made accessible to the end user, via visualisation and/or dialogue?
Q8
Does the AI-human interface reinforce the end-user's situation awareness, so that human and AI can remain 'on the same page'?.
Yes
No
N/A
TBD
by pilots
* Provide a justification for your answer :
Pilots feel it helped their SA, and speed of gaining a situational picture. The scenario did cause startle-type reactions in Val 1 in two pilots.



Exporting design issues to be resolved

Actions identified to satisfy requirements

HAIKU Use Case 1 (FOCUS AI Tool for Startle Response in single pilot operations / Actions identified

ROLES & RESPONSIBILITIES

BALANCE OF HUMAN & AI TASKS

Q5 Is it ensured that the human will be able to take on a new task with enough time to think and react accordingly?
→ Evaluate the pacing of the directed guidance, to see if it is too quick/slow for pilots, or judged adequate.

Q6 Is the human kept aware of who is doing what, and the need for, or imminence of switching?
→ Need equivalent icon to tell pilot that smart agent (FOCUS) is stopped.

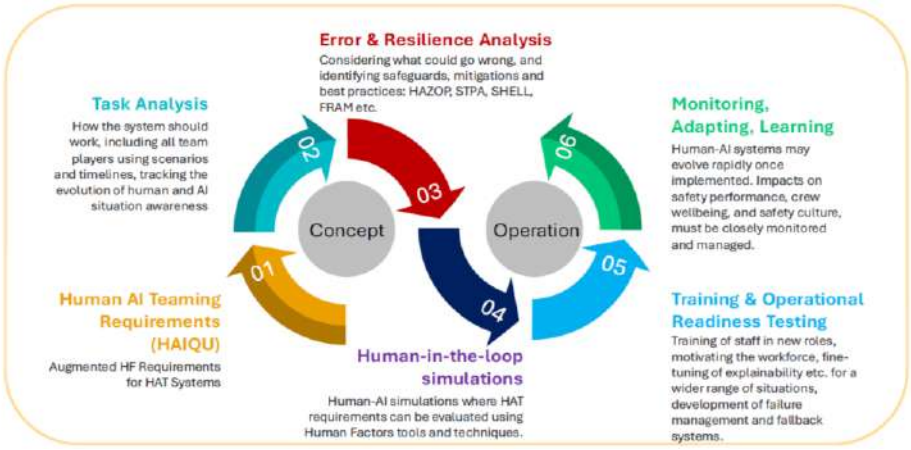
Q9 Is the 'handoff' of tasks between AI and end user (i.e. when the AI submits its response or finishes its task) clear?
→ Test the adequacy of the 'AI no longer operating' icon in Val 2.

Tracking HF Requirements Progress

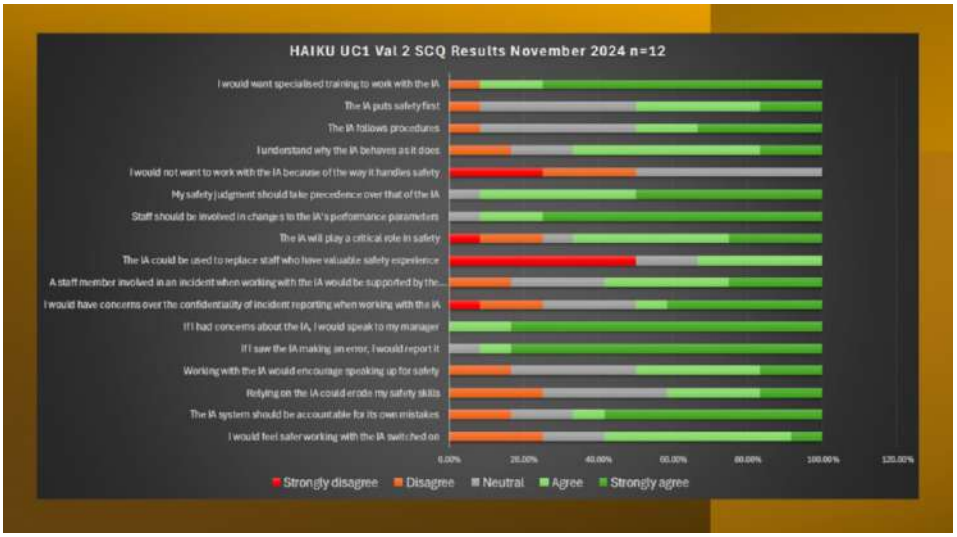
2023

2027

Human-AI Teaming Human Factors Assurance Process



Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
CC1 I would feel safer working with the AI switched on.					
CC2 The AI system should be accountable for its own mistakes.					
CC3 Relying on the AI could erode my safety skills.					
JC1 Working with the AI would encourage speaking up for safety.					
JC2 If I saw the AI making an error, I would report it.					
JC3 If I had concerns about the AI, I would speak to my manager.					



Strongly Desirable	Intermediate	Undesirable
If I had concerns about the IA, I would speak to my manager	The IA puts safety first	The IA could be used to replace staff who have valuable safety experience
If I saw the IA making an error, I would report it	The IA follows procedures	I would not want to work with the IA because of the way it handles safety
Staff should be involved in changes to the IA's parameters	I understand why the IA behaves as it does	I would have concerns over the confidentiality of incident reporting when working with the IA
My safety judgement should take preference over that of the IA	A staff member involved in an incident when working with the IA would be supported by management.	The IA will play a critical role in safety
I would want specialised training to work with the IA	Working with the iA would encourage speaking up for safety.	Relying on the IA could erode my safety skills
	The IA system should be accountable for its mistakes	
	I would feel safer working with the IA switched on.	

Comments from Interviews

High-Level

- AI might have a positive impact on Safety Culture, but only if properly regulated.
- Pilots' openness to adopting AI onboard may depend on the aircraft type they fly.

What Pilots would say to airline companies

- Don't ask me if I would feel safer with AI - It is impossible to say right now.
- Involve me in its design and introduce it gradually.
- Start with AI handling the tasks I find boring.
- Start training us on AI literacy today.
- The introduction of AI could actually help increase reporting…

What Pilots would ask AI Experts

As *Pilot Monitoring* I wonder how to perform safely when AI becomes another "crew member" to oversee and cross-check actions with?

What Pilots would say to Manufacturers

What matters is that:

- The AI gives me a true sense of control
- It does not override my intentions and decisions
- It can be switched off whenever I deem it necessary

Design & Development Safeguards

SAFETY NETS FOR STAFF
Just Culture protections & practices
No loss of critical human safety expertise

HUMAN-CENTRED DESIGN
User-centred development
Pilot in decision loop

GRADUAL IMPLEMENTATION
Gradual rather than sudden implementation, allowing learning & adaptation
Extensive testing and evaluation.

SHARED SA
Awareness of key AI parameters
Operational explainability

TRAINING & COMPETENCE
Training on the AI and how to master its use
Strategies for skill retention

H-AI INTERACTION QUALITY
High quality Human-AI interaction: relevant, contextual, helpful, timely

Conclusions

21 Pilots experienced AI assistance in realistic HAIKU simulations.

They are generally not averse to AI and think it could be beneficial.

But it needs to be robust, fit their way of working, and be introduced gradually.

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