

FLIGHT SAFETY DATA STORYTELLING:

CONTINUOUS LEARNING FROM WHAT WENT RIGHT

Taking IASMS to the flight deck

Barth Baron, Jr

San José State University San José, California

Melissa Peterson

San José State University San José, California



- 1) Background: IASMS
- 2) The Goal: Supporting Resilient Human Performance
- 3) The Opportunity: ML Analysis of Latent Safety Data
- 4) The Idea: Bring IASMS Capacities Into the Flight Deck
- 5) The Design: Interactive Flight Deck Interface
- 6) The Challenge: Supporting ML Functionality in Flight



- 1) Background: IASMS
- 2) The Goal: Supporting Resilient Human Performance
- 3) The Opportunity: ML Analysis of Latent Safety Data
- 4) The Idea: Bring IASMS Capacities Into the Flight Deck
- 5) The Design: Interactive Flight Deck Interface
- 6) The Challenge: Supporting ML Functionality in Flight



In-Time Aviation Safety Management System *IASMS*

- Synthesize large and diverse data sets
- Predictive safety capabilities
- Ellis et al., 2022
- Flight Safety Foundation, 2023



- 1) Background: IASMS
- 2) The Goal: Support Resilient Human Performance
- 3) The Opportunity: ML Analysis of Latent Safety Data
- 4) The Idea: Bring IASMS Capacities Into the Flight Deck
- 5) The Design: Interactive Flight Deck Interface
- 6) The Challenge: Supporting ML Functionality in Flight



Support Resilient Human Performance

- From Hollnagel: Anticipate, monitor, respond, learn...
- How might we...
- Help pilots anticipate in real-time by accessing IASMS analyses?



- 1) Background: IASMS
- 2) The Goal: Supporting Resilient Human Performance
- 3) The Opportunity: ML Analysis of Latent Safety Data
- 4) The Idea: Bring IASMS Capacities Into the Flight Deck
- 5) The Design: Interactive Flight Deck Interface
- 6) The Challenge: Supporting ML Functionality in Flight



ML Analysis of Latent Safety Data

- ML might extract skilled performance from existing data sources (Matthews et al., 2023)
- Consider expanding to other data sources, e.g. FOQA
- Develop an integrated system to automatically analyze disparate data, compile into a form accessible to crews in real time



ML Analysis of Latent Safety Data

- ASAP or FOQA event triggers the system
- Find patterns of adaptation in the same environmental and operational conditions
- Learn what makes things go right in the same conditions



ML Analysis of Latent Safety Data







- 1) Background: IASMS
- 2) The Goal: Supporting Resilient Human Performance
- 3) The Opportunity: ML Analysis of Latent Safety Data
- 4) The Idea: Bring IASMS Capacities Into the Flight Deck
- 5) The Design: Interactive Flight Deck Interface
- 6) The Challenge: Supporting ML Functionality in Flight



Bring IASMS – Designed Data to the Flight Deck

- <u>Pushed</u> when system detects a threat
- *Pulled* when crew requests an analysis of upcoming phase of flight





- 1) Background: IASMS
- 2) The Goal: Supporting Resilient Human Performance
- 3) The Opportunity: ML Analysis of Latent Safety Data
- 4) The Idea: Bring IASMS Capacities Into the Flight Deck
- 5) The Design: Interactive Flight Deck Interface
- 6) The Challenge: Supporting ML Functionality in Flight



Interface Design

- Ecological Interface Design (EID) → Vicente & Rasmussen, 1992
- Tell a story in an interactive visual form, using data
- Support formative work goals



Interface Design





- 1) Background: IASMS
- 2) The Goal: Supporting Resilient Human Performance
- 3) The Opportunity: ML Analysis of Latent Safety Data
- 4) The Idea: Bring IASMS Capacities Into the Flight Deck
- 5) The Design: Interactive Flight Deck Interface
- 6) The Challenge: Supporting ML Functionality in Flight



Challenges in the Way

ML output over Satcom

Real-Time ML Training

Access to datasets



Intermediate Steps

Subset Training

Batched training on new data

On-board flight-planscoped ML



A Bigger Hurdle

3D rendering of ML predictions and recommendations

SJSU SAN JOSÉ STATE UNIVERSITY

Thank You

Barth Baron, JR

San José State University San José, California Barth.baron@sjsu@edu

Melissa Peterson

San José State University San José, California melissa.peterson@sjsu.edu