

Reinventing the Familiar: Exploring an Augmented Reality Design Space for Air Traffic Control. Mackay, et al. CHI. 1998.

What are the core research questions addressed by the work?

- What is the design space of augmented flight strips?
- What are the advantages and disadvantages of different technical solutions to augmenting flight strips?

What motivates the work?

- Need for improving air traffic control systems due to increasing traffic and aging equipment
- While some degree of digitization is necessary, past attempts to introduce expensive new computer systems either reduced user productivity or were unusable
- Past works investigating new tools to replace flight strips tended to disregard controller interactions with the entity

How does the work understand the usage, capabilities, and limitations of paper?

- Paper flight strips are central to air traffic control
 - Reliable
 - Forms a core part of the controllers' mental representation of the traffic
 - Embedded in controllers' means of communication
 - Enables easy customization (e.g. for dealing with unusual situations)
- The act of writing on paper flight strips is equally as important to the practice
- Paper in general is flexible and its use provides tactile and visual memory benefits

What is the target application domain of the work?

- Air traffic control

What are some proposed extensions to paper proposed by the work?

- The entire work appears to tackle the problem of enabling greater synergy between the physical representation of information and the digital (e.g. RADAR representation and paper flight strip representation)
- Capture and digitalization of physical and written information to the need for repeated information input
- Support communication between controller sectors
- Supplement practice with presentation of external information

How are the proposed extensions implemented?

- The work experiments with multiple methods of implementing the proposed extensions
- For capturing information:
 - Graphics tablet with pen input
 - Touch-sensitive screen
 - Video camera
- For presenting information:
 - Video projection
 - Computer monitor display
 - Touch screen display
- For tracking information:

- Video camera
- Strip board detecting the resistance of strip holders

What findings have been obtained from either the implementation process or an evaluation of the proposed system?

- From experimenting with multiple methods of implementing the proposed extensions, the work identifies a set of tradeoffs between each method.
 - For capturing information:
 - Graphics tablet with pen input
 - Allows natural pen input
 - Best for precise data
 - Touch-sensitive screen
 - Allows natural pen input
 - Restricts movements to an extent because controllers could not rest their hands on the screen
 - Allows direct presentation of information on strips
 - Video camera
 - Allows capture of written input
 - Problem with resolution, occlusion
 - Best for capturing information in context
 - For presenting information:
 - Video projection
 - Issue with blocking the light source
 - Computer monitor
 - High resolution
 - Limitation of only being able to present information next to the strip
 - Touch screen
 - Using transparent strips, able to project high quality information from onto any part of the strip
 - For tracking information:
 - Video camera
 - Stripboard that detects resistance in strip holders
 - Focused on second approach as it allowed for a higher degree of precision
- For the application of air traffic control:
 - The problem of input/output should be separated from the content of the tools
 - Functionality that replaced part of the controllers' mental representation of the traffic was generally disliked
 - Paper flight strips should be taken advantage of given their rich, existing role in air traffic control, and this can be accomplished through augmentation without losing other benefits of automation