Agenda

- Aim
- What have been done?
- ADS-B
- Simulators
- Gameplay
- Conclusion
- Future work

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Aim

- Why is it an important topic?

Aim

- Cybersecurity interest growing, but not in aviation

- Lack of security in air traffic communication

- Not encrypted

- Risk of attacks

- Prepare future ATCOs to handle attacks

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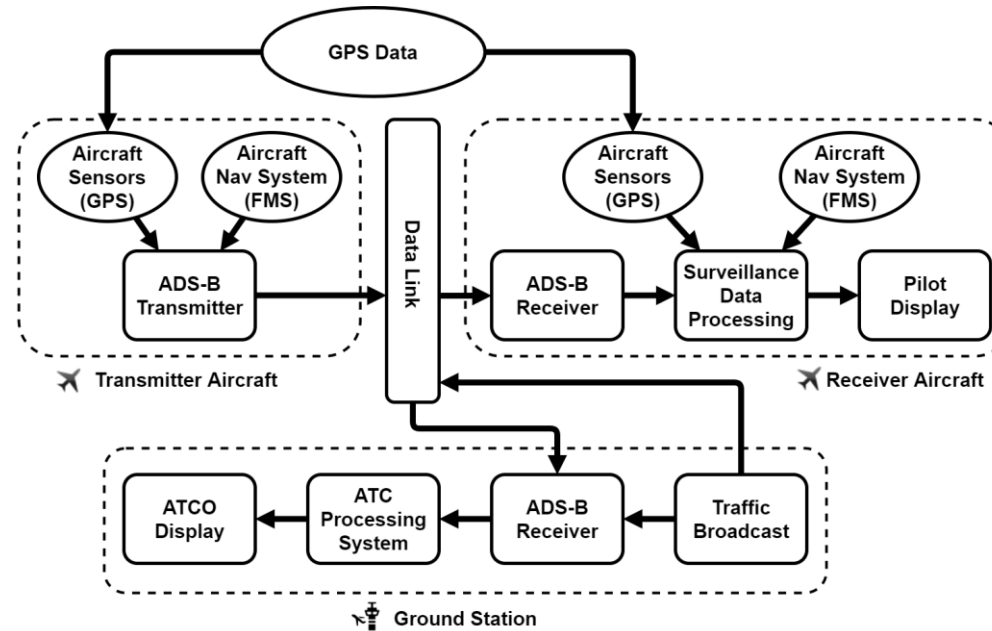UNIVERSITY

What have we done?

- Compared two different air traffic controller simulators

- Modified the chosen simulator to show attacks

- Feedback from real Air Traffic Controller

- Updated the simulator after feedback from test

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ADS-B

Automatic Dependent Surveillance – Broadcast (ADS-B)

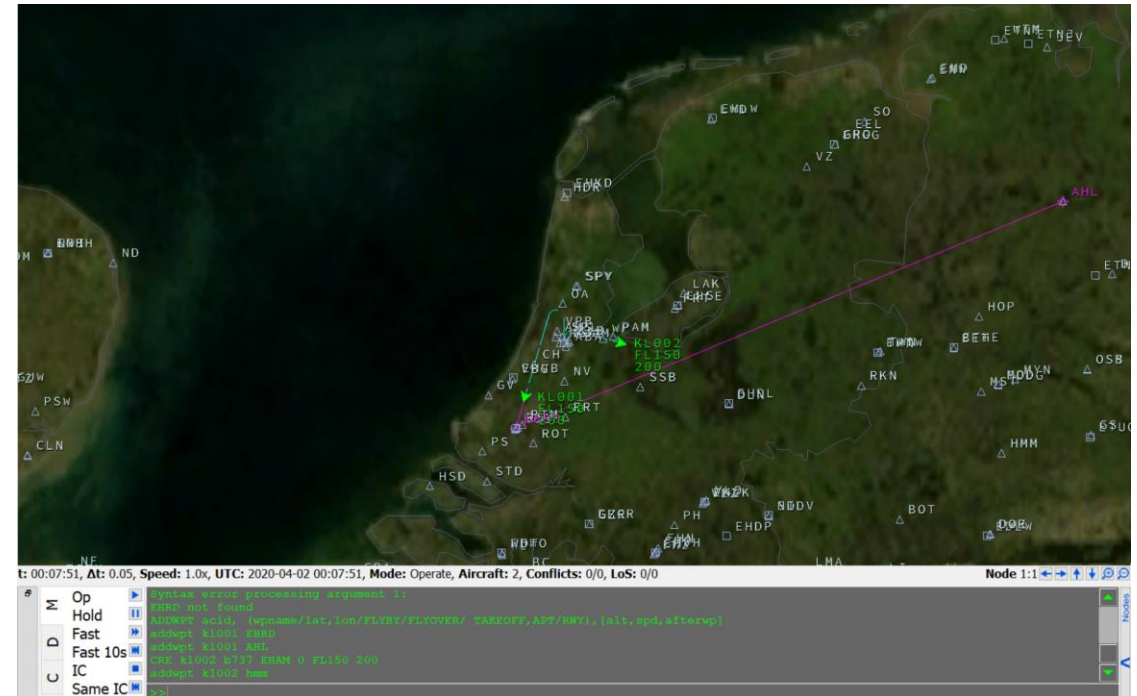| Segment	Downlink Format	Capability	Aircraft Address	ADS-B Data	Parity Check
Bits	5	3	24	56	24

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Simulators

Choosing a simulator

- **Open source project**

- Popular and well developed

- Smooth installation process for developers and users

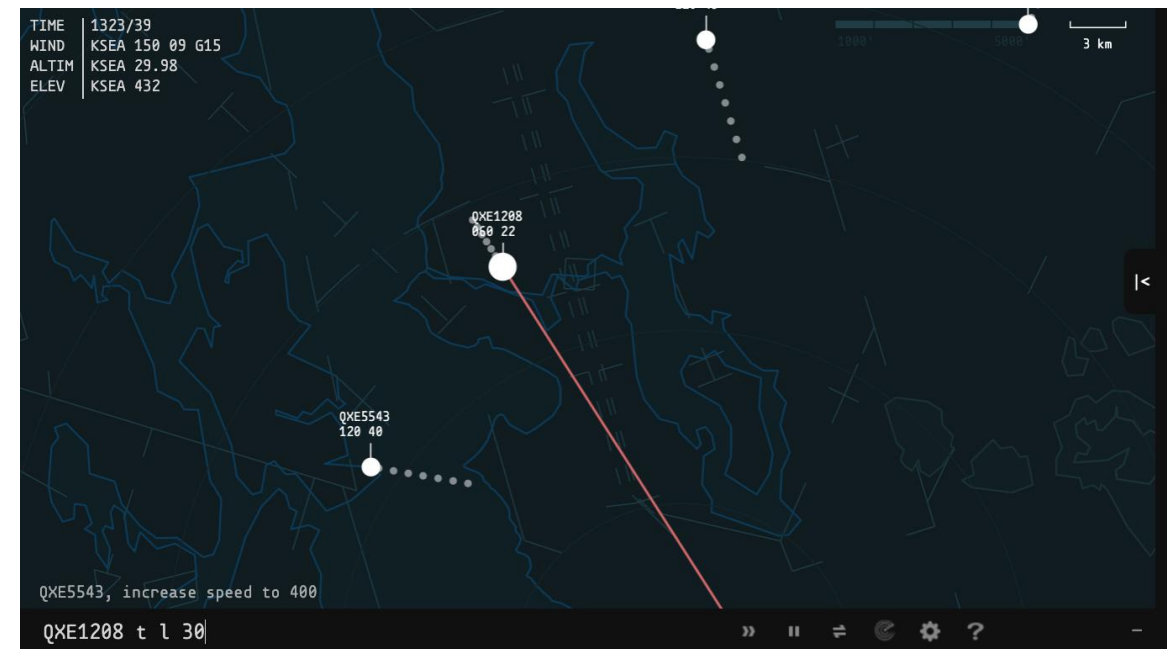LINKÖPING
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BlueSky

- Open sourced

- Not so popular

- Played locally on computer

openScope

- Open sourced

- Popular and flourishing community

- Played through the browser

Comparision

Comparison		
Simulator	openScope	BlueSky
Main programming language	JavaScript	Python
Installation time in seconds	210	680
Contributors	75	18
Active branches	15	2
GitHub stars	304	110
LOC (Main language)	15861	21044
LOC (Total)	400399	34437

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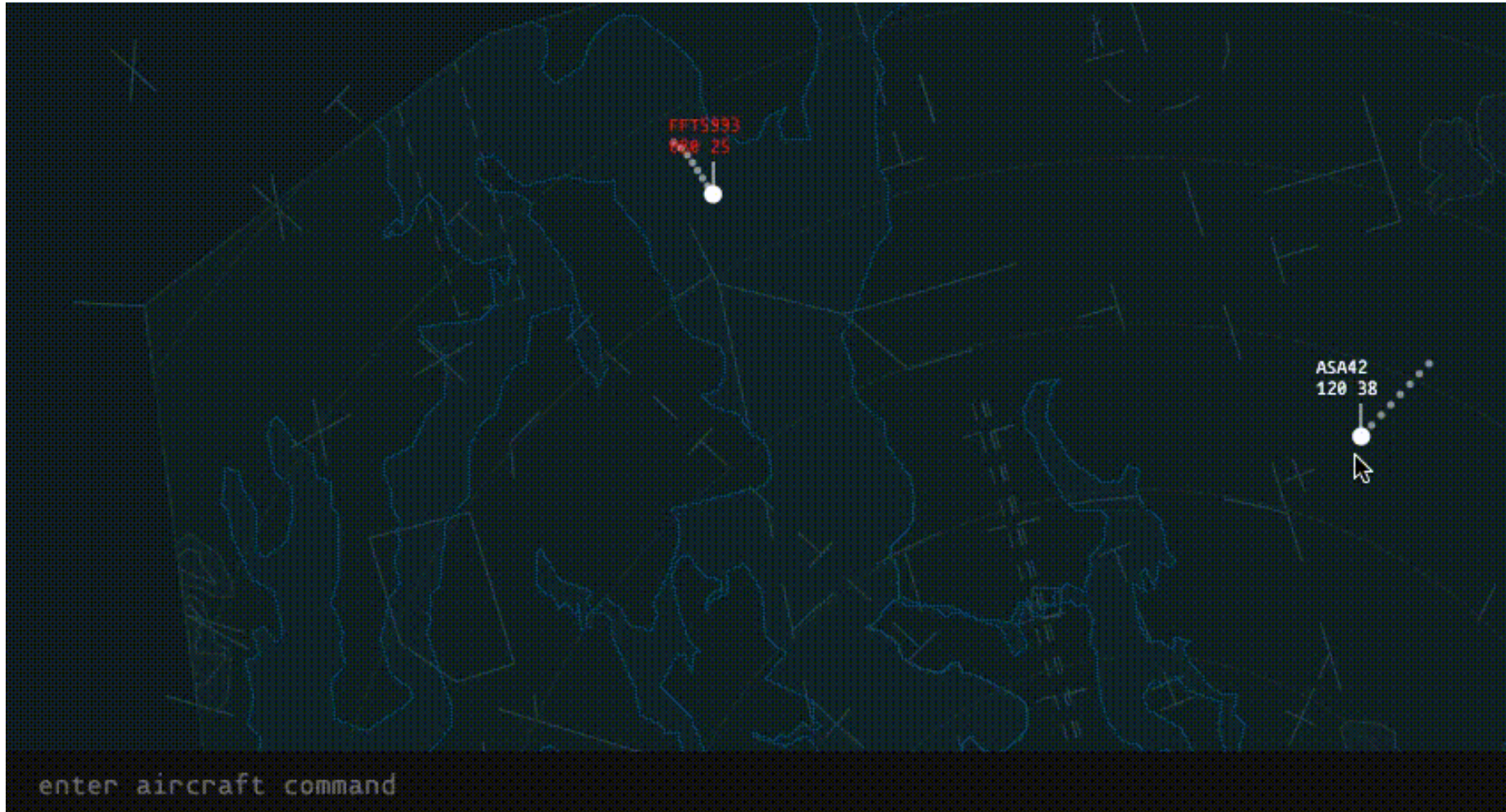
Gameplay

Types of attacks in the paper

- Aircraft not responding to commands

- Aircraft randomly changing position

- Aircraft displaying false data

Aircraft not responding to commands

Aircraft randomly changing position

Aircraft displaying false data

Test with feedback from real ATCO

- Improvements to existing attacks

- New attacks

- New QoL changes

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Types of attacks today

- Aircraft not responding to commands

- Aircraft randomly changing position

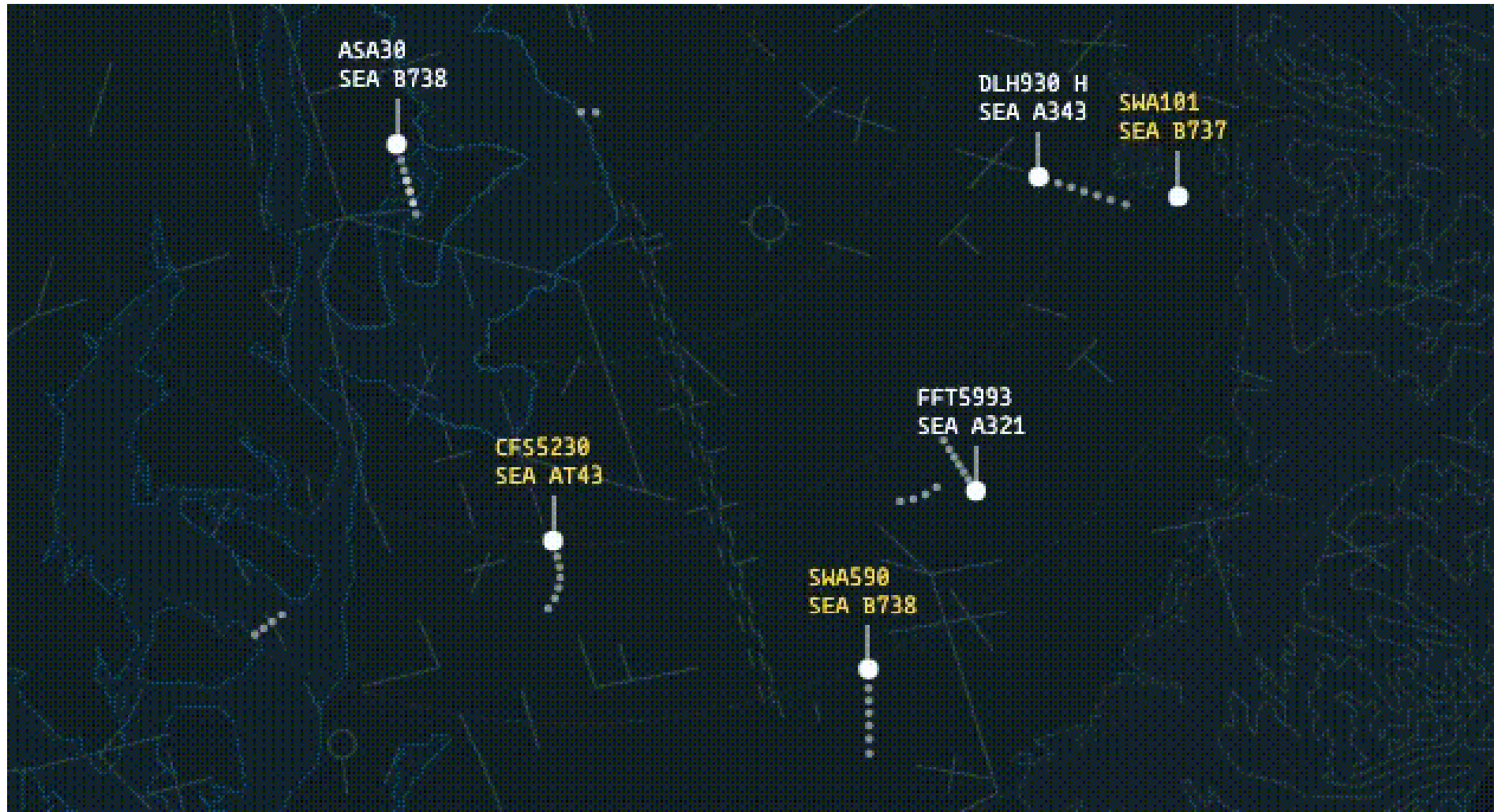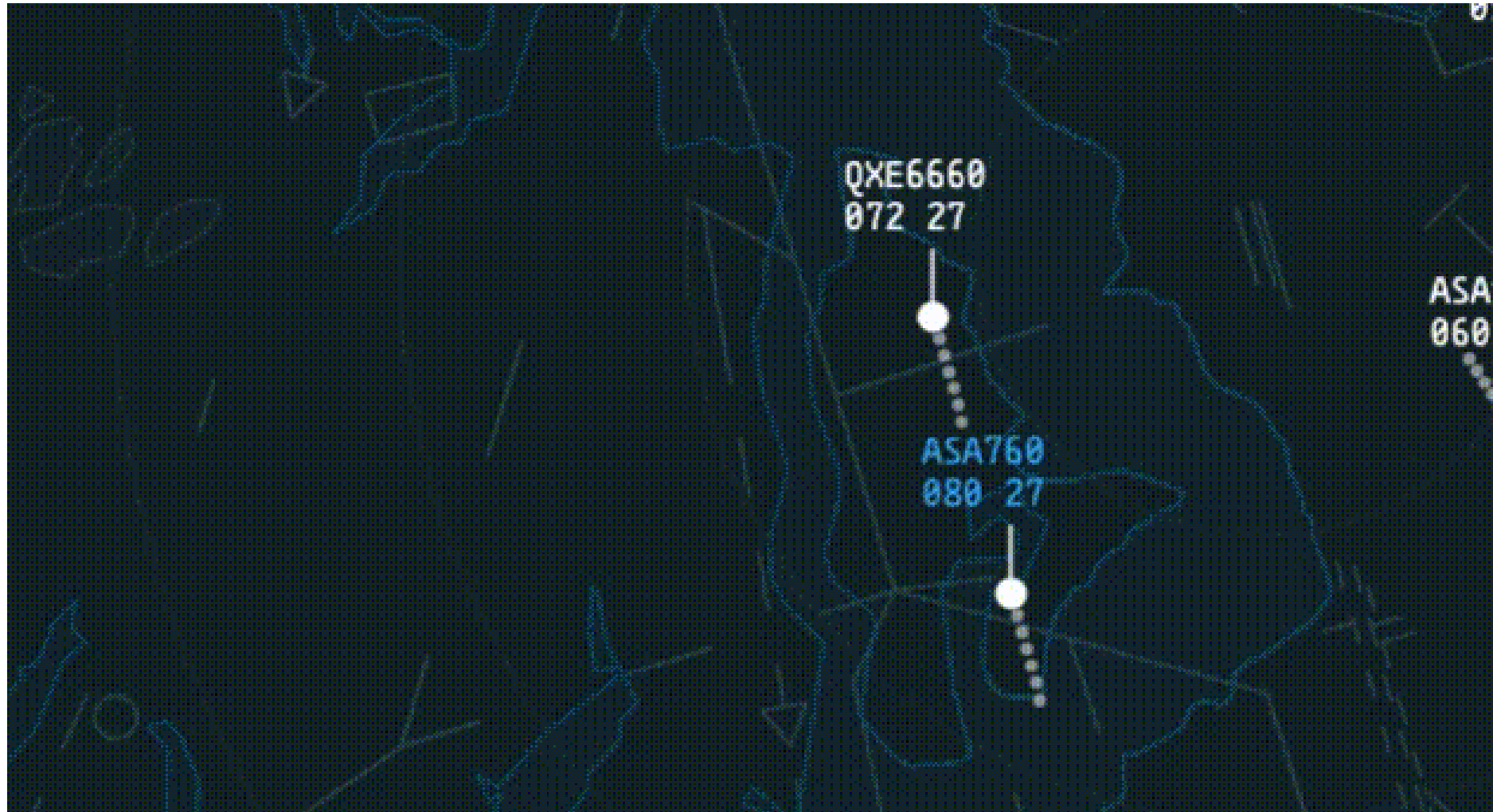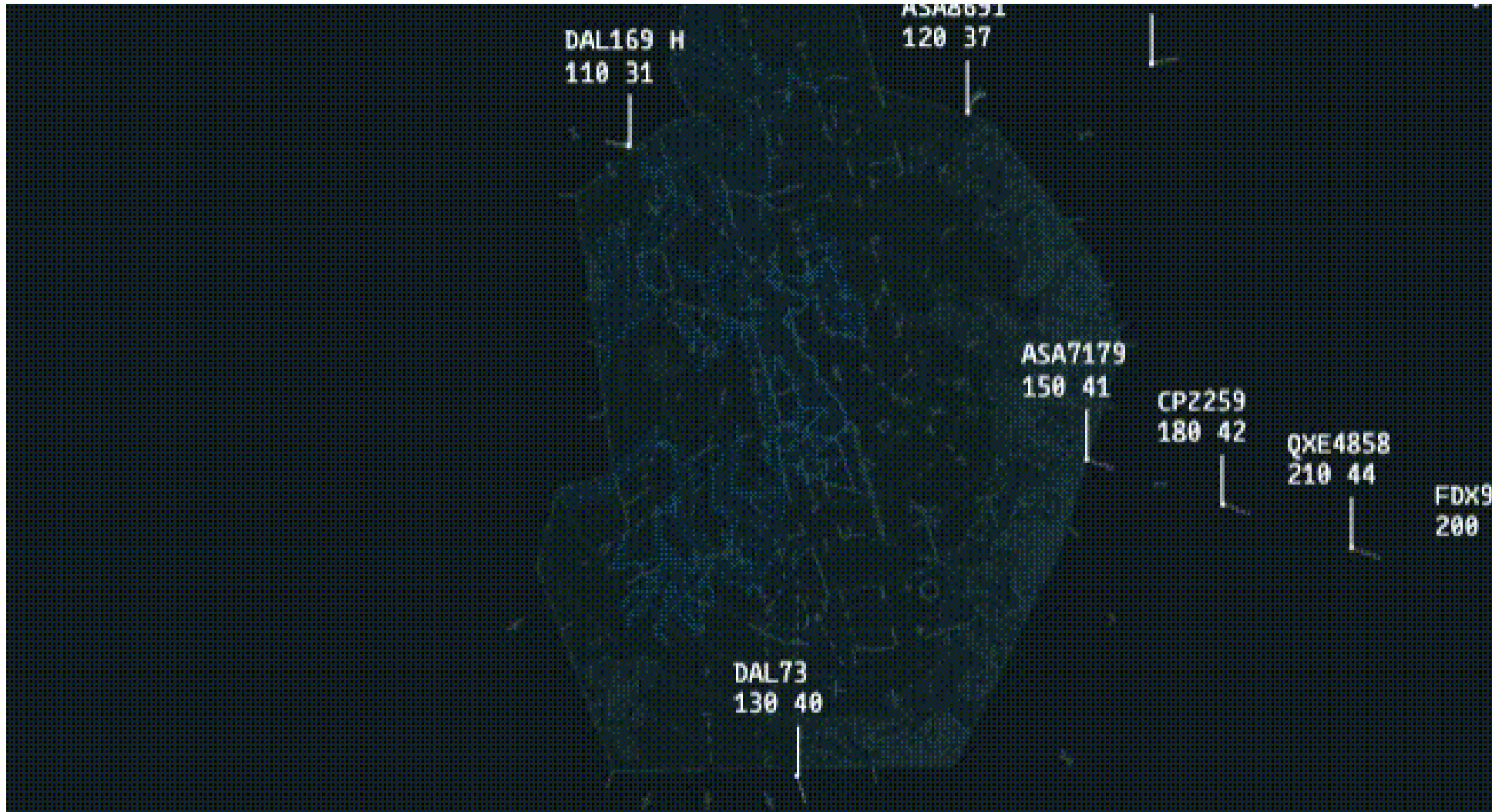- Aircraft displaying false data

- Stationary aircraft

- Flooding of non-responsive aircraft

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Stationary aircraft

Flooding of non-responsive aircraft

GUI

ADS-B Attacks Information

Attack Aircraft Color Scheme

Non-responsive	Position-altering	False Information	Non-moving
1	2	3	4

Welcome to openScope simulator with cyberattacks from ADS-B.
In the settings menu, you may also toggle the visibility of attacking aircraft by the color code above.
If you want to add a note to an aircraft use the command "at" for AddText.
This note has a maximum size of 20 letters.
Example: 'SBI654 at prob fake'. To remove: 'SBI654 at'
You can also guess the color of an aircraft yourself, when you think you know what attack type it is. To guess an aircraft's attack type please use the "g" command for Guess.
Example: 'SBI654 g 1' (for attack type 1). To remove: 'SBI654 g 0'

To save your actions from this session, please hover the "?" button in the bottom right corner and press "Download logfile".

openScope: ADS-B Attacks by Gustav Lindahl and Anton Blåberg

ADS-B Attacks

Percentage of aircraft affected	No aircraft affected ▼
Aircraft not responding to commands	0 ▼
Aircraft changing postion	0 ▼
Aircraft showing false data	0 ▼
Aircraft will stand still	0 ▼
Flooding of non-responsive aircraft	None ▼
Probability of jumps	Very Low ▼
Distance of jumps	Moderate radius ▼
Color code attack aircraft	No ▼

For more information about attacks please hover "?" and press information.

openScope: ADS-B Attacks by Gustav Lindahl and Anton Blåberg

Starting Settings:
Percentage of aircraft affected: No aircraft affected
Aircraft not responding to commands: 0
Aircraft changing postion: 0
Aircraft showing false data: 0
Aircraft will stand still: 0
Flooding of non-responsive aircraft: None
Probability of jumps: Medium
Distance of jumps: Moderate radius
Color code attack aircraft: No

Changes made through the game
Timestamp (s): Changes made:
22.6: Created 60 new non-responsive aircraft
25.2: Changed attack aircraft visibility to "Yes"
57.9: Created 0 new non-responsive aircraft
60.8: Changed attack aircraft visibility to "Yes"

Commands used while playing
Timestamp (s):Aircraft:Command:Attacktype:
43.6:SJY748:showType, :Non listen
48.8:SJY748:heading, left,90,true:Non listen

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Discussion and conclusion

Discussion

- All attacks stem from real weaknesses of ADS-B

- Feedback from ATCO, and the improvements we did

- Impact on the aviation community

- Ethical dilemma?

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Conclusion

- Does not bring up new flaws with ADS-B, rather a reminder of the flaws

- Great tool to get an understanding of how ATCOs react to attacks

- Future systems like LDACS are far away

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Future Work

- Further testing with real ATCOs

- New and improved system to analyze the logfile

- Try the simulator at zebraland.ida.liu.se

- Email comments and queries to gurtov@acm.org

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Thank you for listening!

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