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Midair Collision Involving US Army PAT25 and PSA Airlines Flight 5342 Washington, DC January 29, 2025

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Operations-Human Performance Group Chairman

Overview of Human Performance (Aircraft)

- Visual separation
- See-and-avoid
- Factors affecting see and avoid for each flight crew

Visual Separation

- Method for separating aircraft in terminal areas and enroute airspace
- Pilot sees other aircraft and, upon instructions from controller, provides own separation
- FAA does not define minimum separation standards during visual separation

See-and-Avoid

- Means by which visual separation is achieved
- Relies on
  - Visual perception
  - Attentional bandwidth
  - Collision avoidance technology

Factors Affecting See-and-Avoid in This Case

	Helicopter	Airplane
Radio communications	X	X
Perceptual limitations	X	X
Workload	X	X
Collision avoidance technology	X	X
Expectation bias	X	
Assumption about separation between Route 4 and arriving airplanes	X	

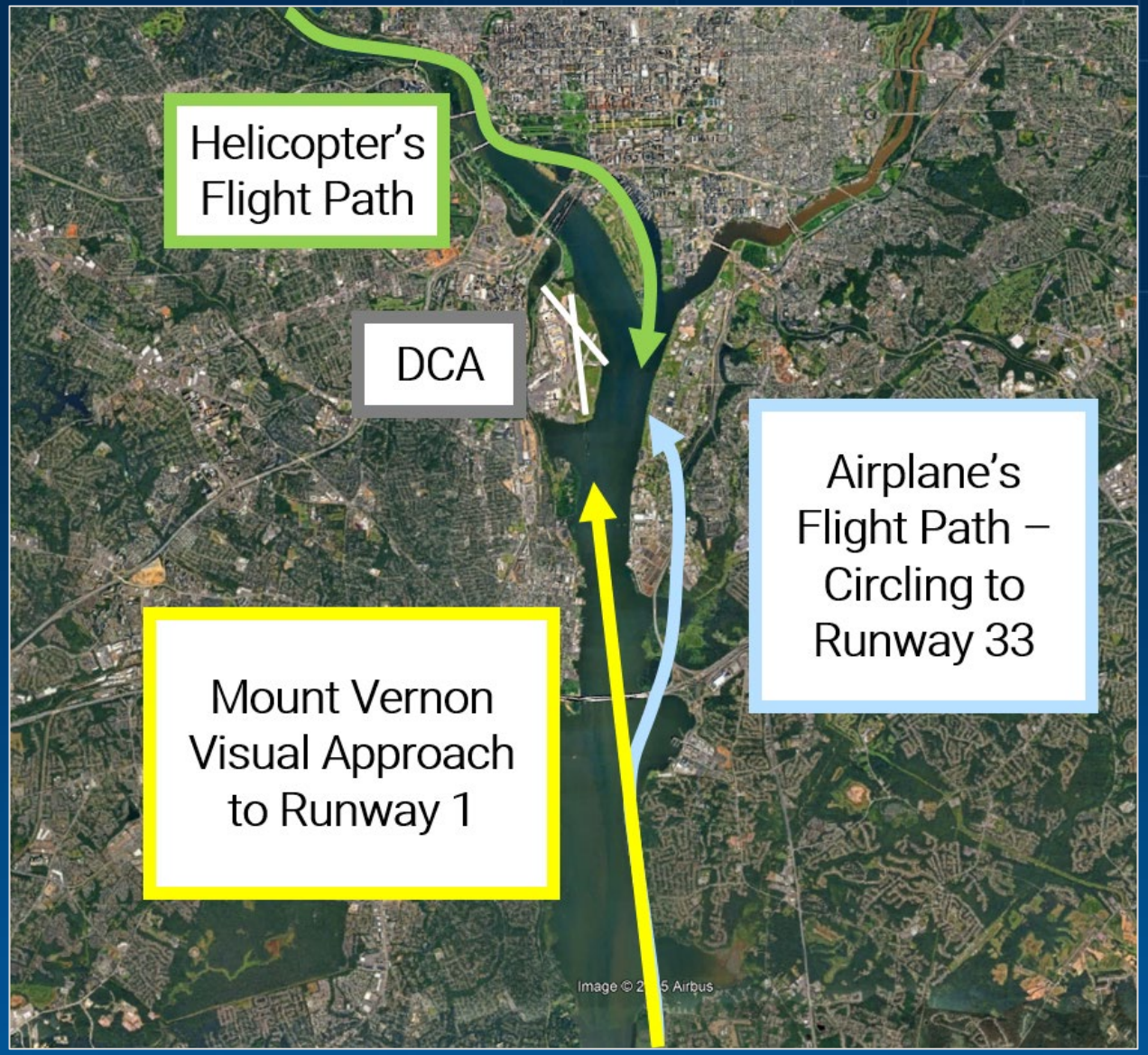
Helicopter: Perceptual Limitations

- Controller advised:
  - “PAT two five traffic just south of Wilson Bridge is a CRJ at 1,200 feet for runway 33”
- Several other aircraft were visible in same area
- Helicopter flight crew likely unable to identify “CRJ” in question

Exemplar airplanes approaching runway 1 at DCA viewed through NVGs from vantage point near helicopter’s flight path. (Not taken on night of accident.)

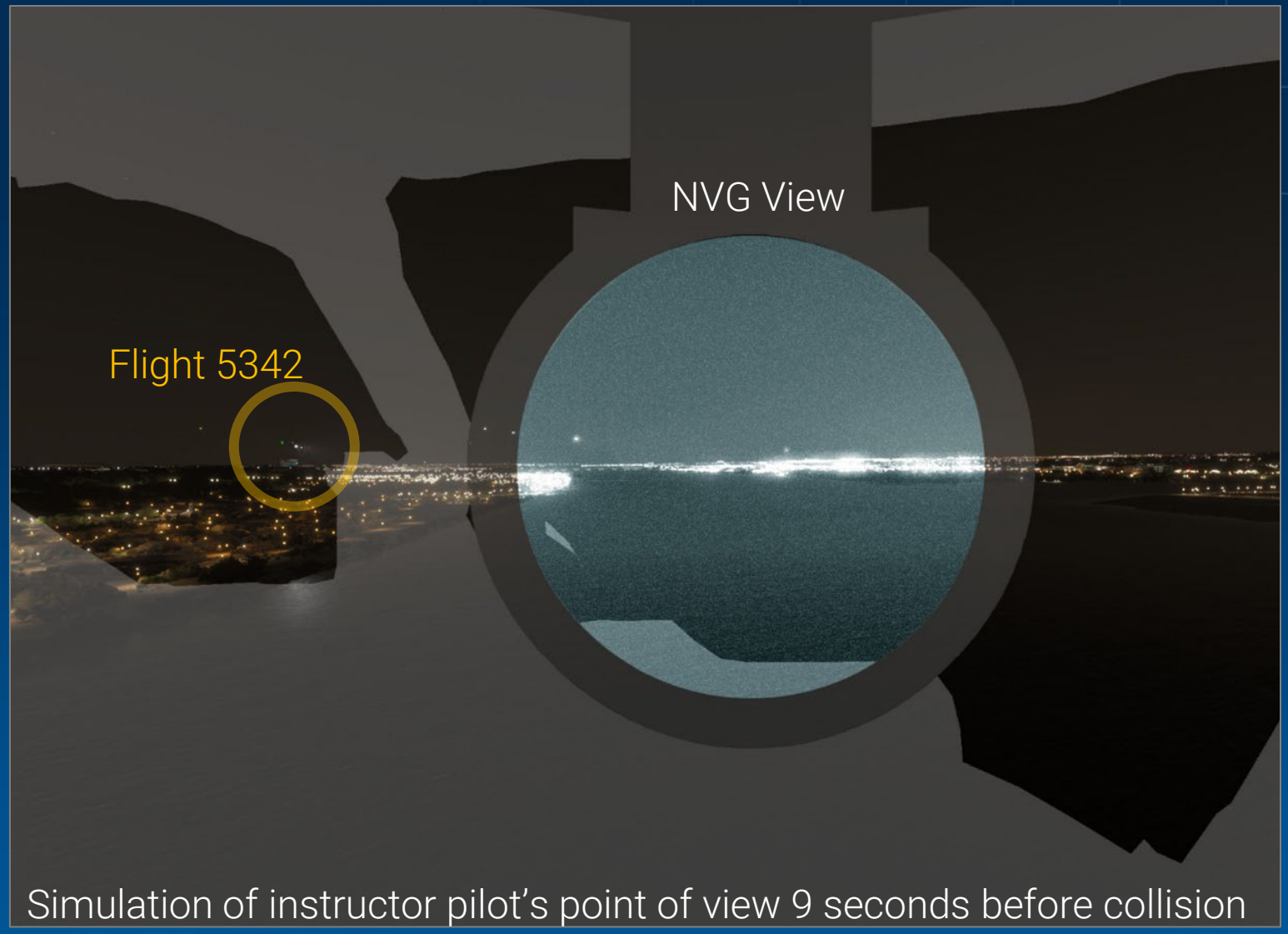
Helicopter: Radio Communications

- Controller's transmission that airplane was "circling" was inaudible due to static interference
- Crew's workload was high at that time
- Hearing "circling" might have helped crew better anticipate CRJ's flight path



Helicopter: Perceptual Limitations

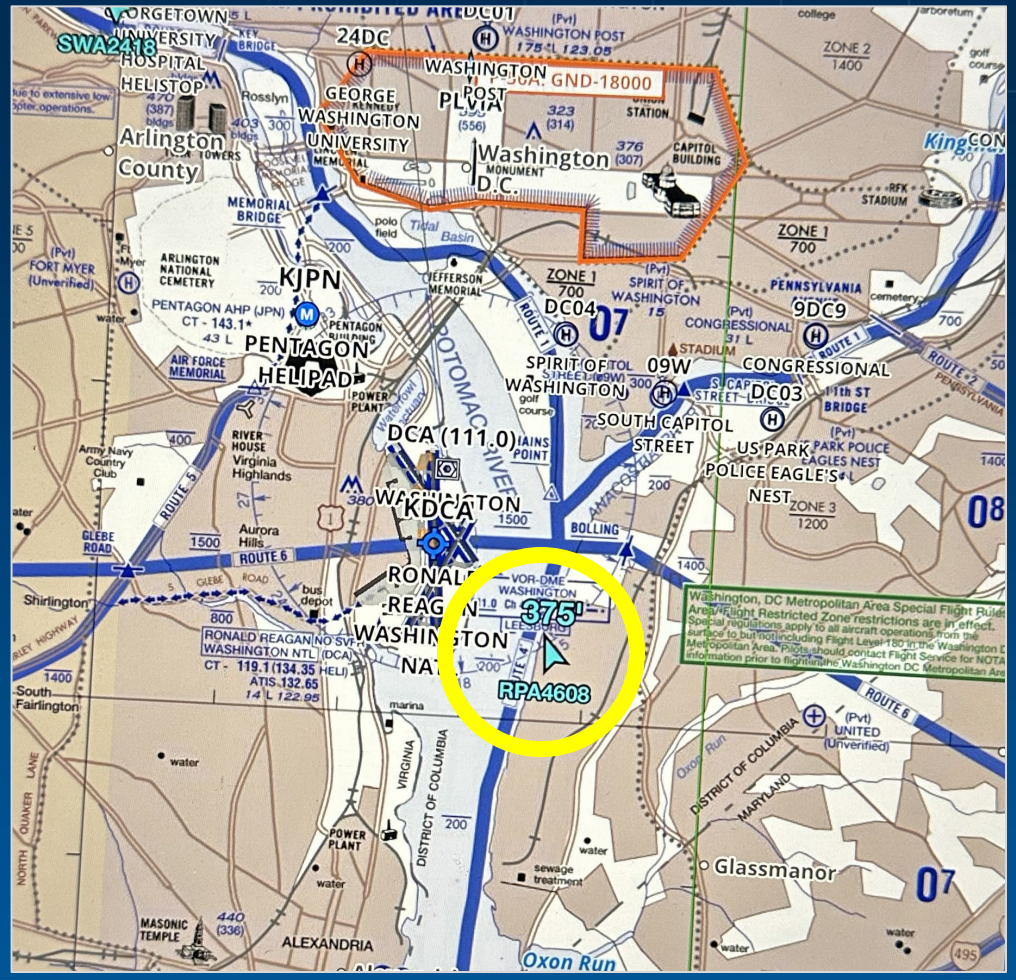
- Night vision goggle (NVG) narrow field of view
- Window post
- Complex array of adjacent city lights
- Workload
- Divided attention
- Lack of apparent motion



Simulation of instructor pilot's point of view 9 seconds before collision

Helicopter: Collision Avoidance Technology

- Pilots carried electronic tablets
- Tablets wirelessly connected to Stratus ADS-B receiver providing ADS-B In
- ForeFlight mobile application could display traffic symbols



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Helicopter: Collision Avoidance Technology

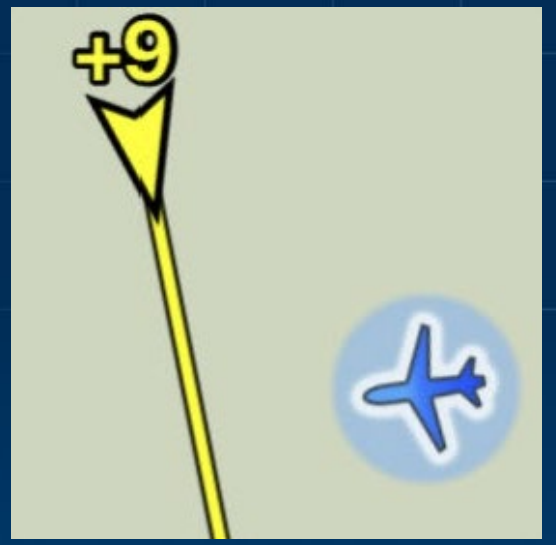
- Pilots strapped tablet to thigh, viewing required tilting heads down
- Pilots did not typically reference when flying low-level on DC helicopter routes
- Crew of PAT25 likely did not reference tablets when flying on route 4

Pilot shown with tablet in a UH-60L simulator.

Helicopter: Collision Avoidance Technology

- ForeFlight capable of visual and aural alerts
- Visual alerts unseen without visual inspection
- Aural alerts likely inaudible due to lack of integration with helicopter's intercom system
- Unknown if tablets were on and configured for alerting

Traffic Caution



Traffic Warning

What We Found: Collision Avoidance Technology

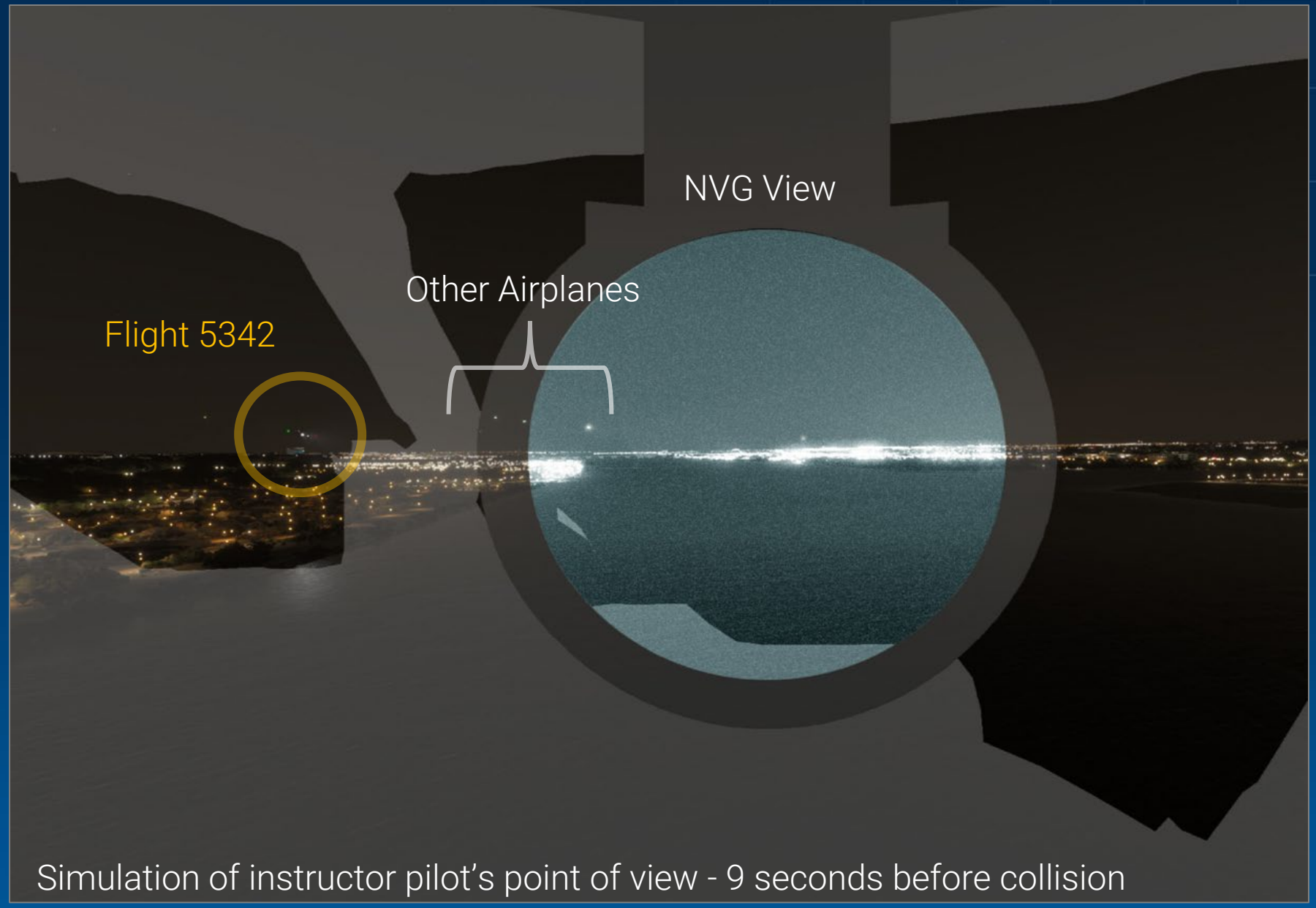
Collision avoidance system with audible aural alerting and traffic display could have drawn the pilots' attention to the developing conflict and the location of the airplane

What we propose:

- One recommendation to FAA
- One recommendation to Department of War

Helicopter Radio Communications

- Local controller asked, “PAT two five you have the CRJ in sight?”
- Did not provide clock direction or distance



Simulation of instructor pilot’s point of view - 9 seconds before collision

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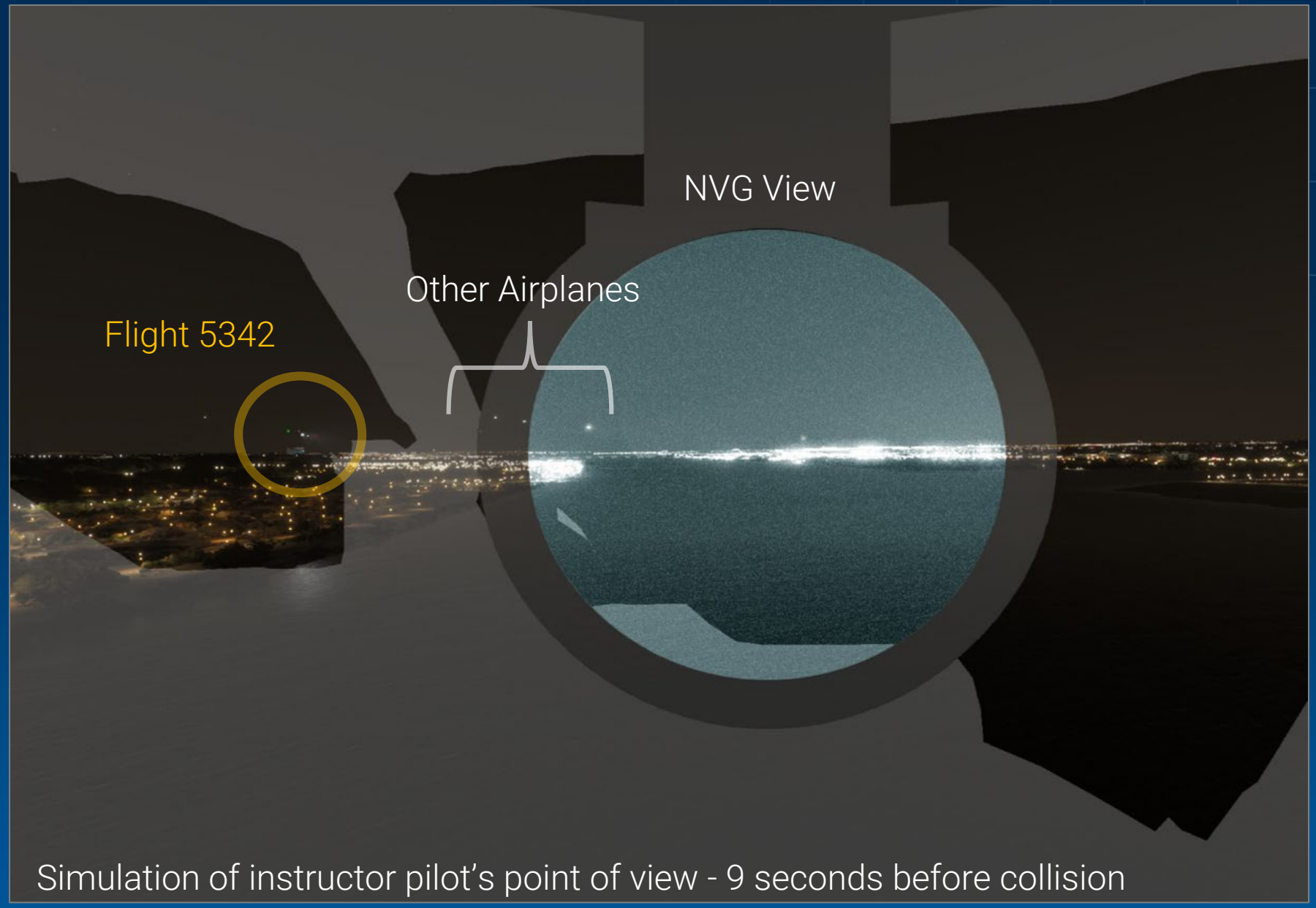
Helicopter Radio Communications

- Helicopter crew did not know where to look for the target
- Multiple other airplanes in view that could have been mistaken for the “CRJ”



Simulation of instructor pilot’s point of view - 9 seconds before collision

Helicopter Radio Communications

- Local controller transmitted: “PAT two five pass behind the CRJ”
- Helicopter crew could not hear “two five pass behind the” due to partially blocked transmission
- Controller unaware his transmission was partially blocked
- Message audible to helicopter crew was: “PAT…CRJ”
- Instructor pilot responded: “PAT two five has uh- aircraft in sight request visual separation”
- Controller approved the request

What We Found: Helicopter Radio Communications

- Hearing “pass behind” might have prompted helicopter flight crew to ask question or broaden their visual search
- Staff concerned blocked transmissions can lead to miscommunication and reduce flight crew and controller awareness of potential hazards

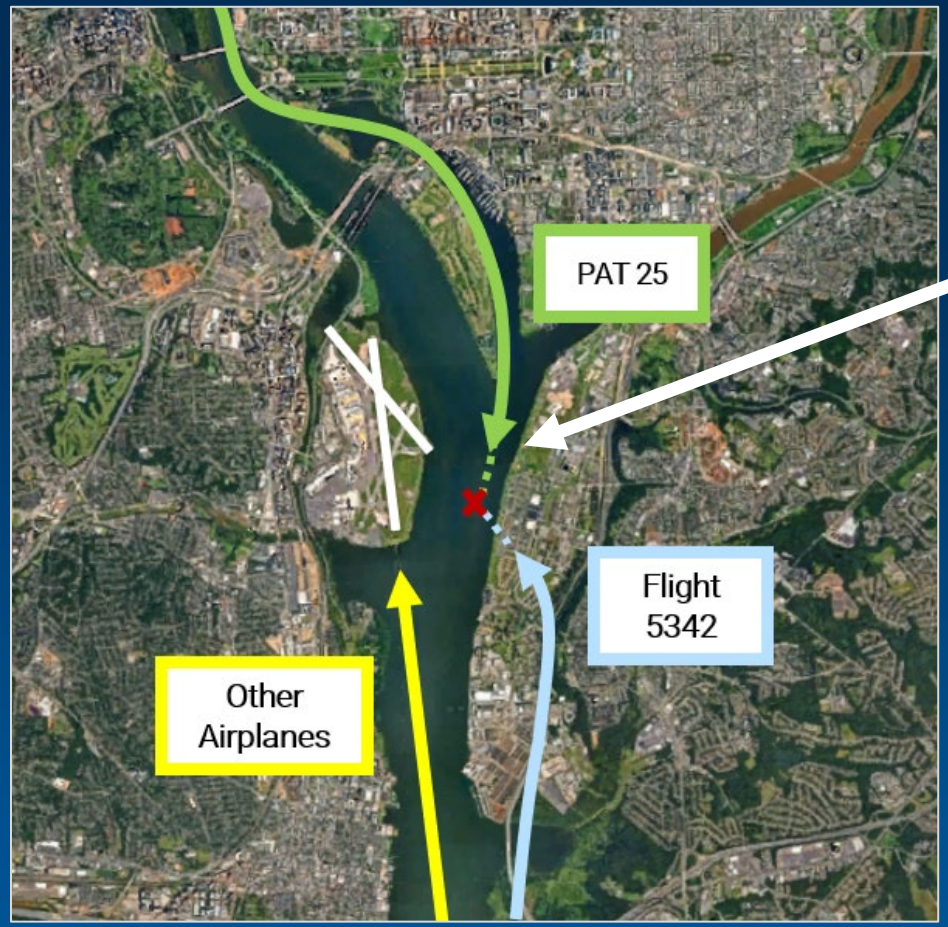
What we propose:

- One recommendation to FAA
- Two recommendations to Department of War

Helicopter: Expectation Bias

- Flight crew lacked an accurate mental model of CRJ's location and intended flight path
- Baseline expectations likely drove the instructor pilot's visual search
- Only 5 to 7% of northbound arrivals landed on runway 33
- Instructor pilot likely concluded "CRJ" was approaching runway 1

Helicopter: Expectation Bias



- Instructor pilot: "…Kinda come left for me… I think that's why he's asking"
  - No avoidance maneuver
  - No vocalization of concern

Airplane: Radio Communications

- Local controller never provided flight 5342 crew a traffic advisory about PAT25
- Separate frequencies prevented flight 5342 crew from hearing PAT25's transmissions
  - Reduced crew's awareness of PAT25's location and intentions
  - Reduced crew's ability to anticipate a potential conflict

Airplane: Pilot Guidance and Training on TCAS

- FAA guidance on traffic advisory response (adopted by PSA Airlines)
  - Attempt to see reported traffic
  - Prohibited from maneuvering based solely on a traffic advisory
- FAA guidance on resolution advisory response (adopted by PSA Airlines)
  - Respond immediately to resolution advisory displays
  - Maneuver as indicated, even if it conflicts with air traffic control instructions

Airplane: Pilot Knowledge of Inhibit Altitudes

- Airplane below resolution advisory inhibit altitudes – TCAS switches to "TA ONLY" mode
- PSA flight operations manual listed inhibit altitudes
- Five PSA pilots were asked about inhibit altitudes
- Only one could correctly state the inhibit altitude that applied to accident scenario

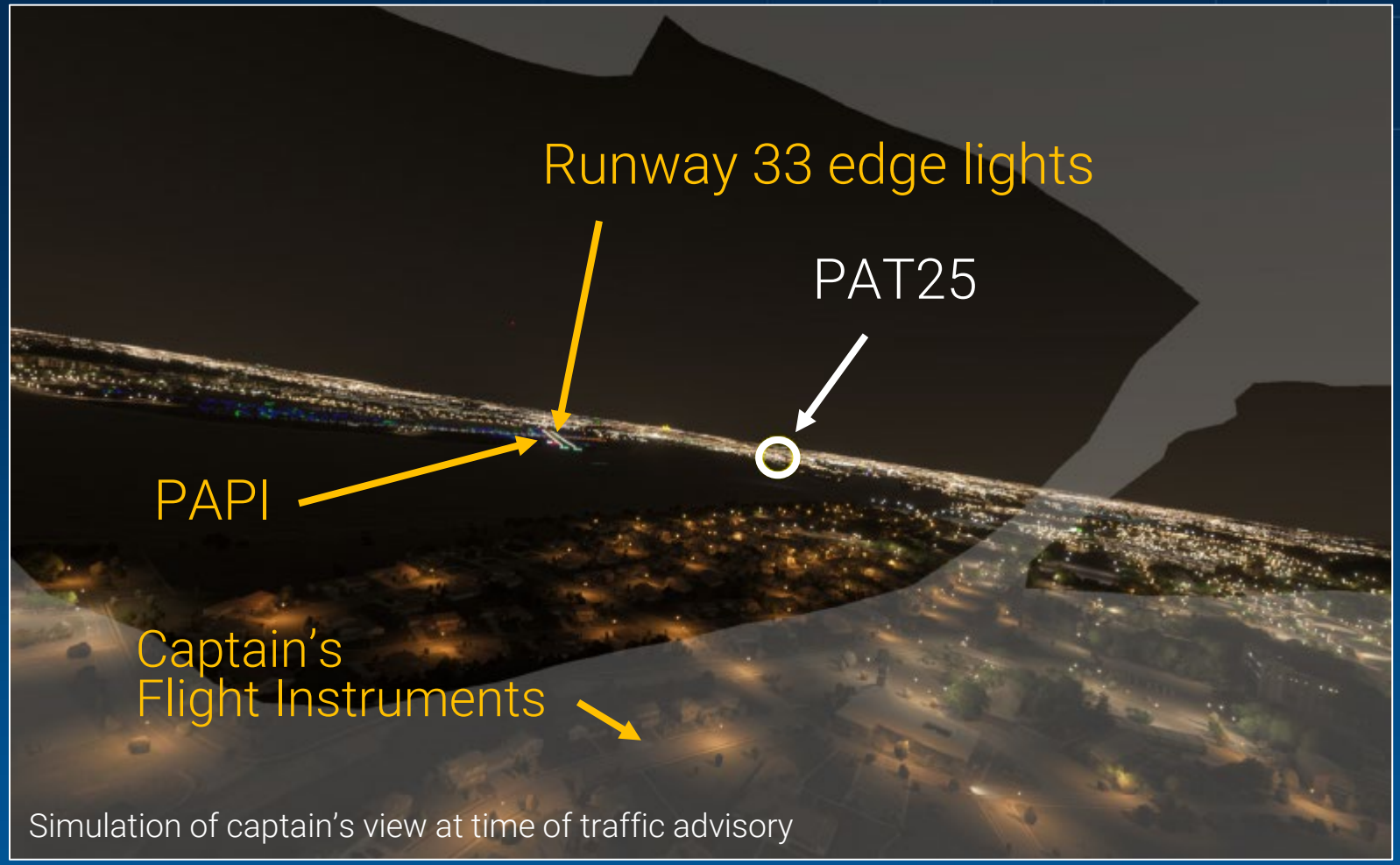
Airplane: TCAS II Traffic Advisory

- Flight crew workload was high
- Pilots did not see helicopter until it was too late to avoid
- Pilots likely would have performed avoidance maneuver earlier if resolution advisory had occurred
- Flight crew likely unaware of severity of conflict until just before impact

Note: This is a simplified view of TCAS display at time of traffic advisory. (Does not depict airport symbol, course overlay, extended runway centerline, or terrain that would have been visible to pilots.)

Airplane: Captain's Tasks at Time of Traffic Advisory

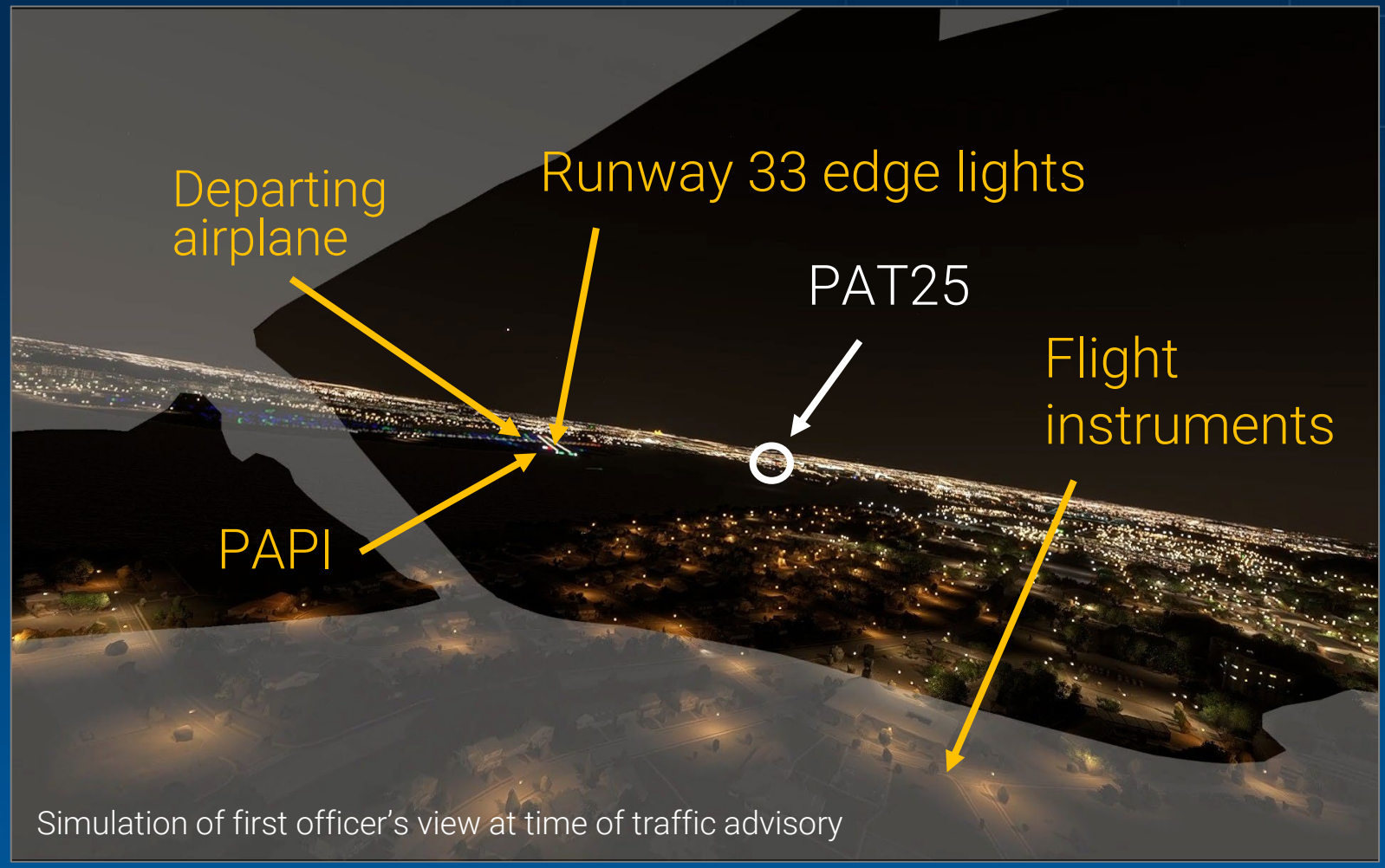
- Captain turning left on final approach to runway 33 when TCAS traffic advisory occurred
- Required control of thrust, airspeed, lateral path, and vertical path
- Referencing flight instruments, runway edge lights, PAPI
- Lacked capacity for extensive visual traffic search



Simulation of captain's view at time of traffic advisory

Airplane: First Officer's Tasks at Time of Traffic Advisory

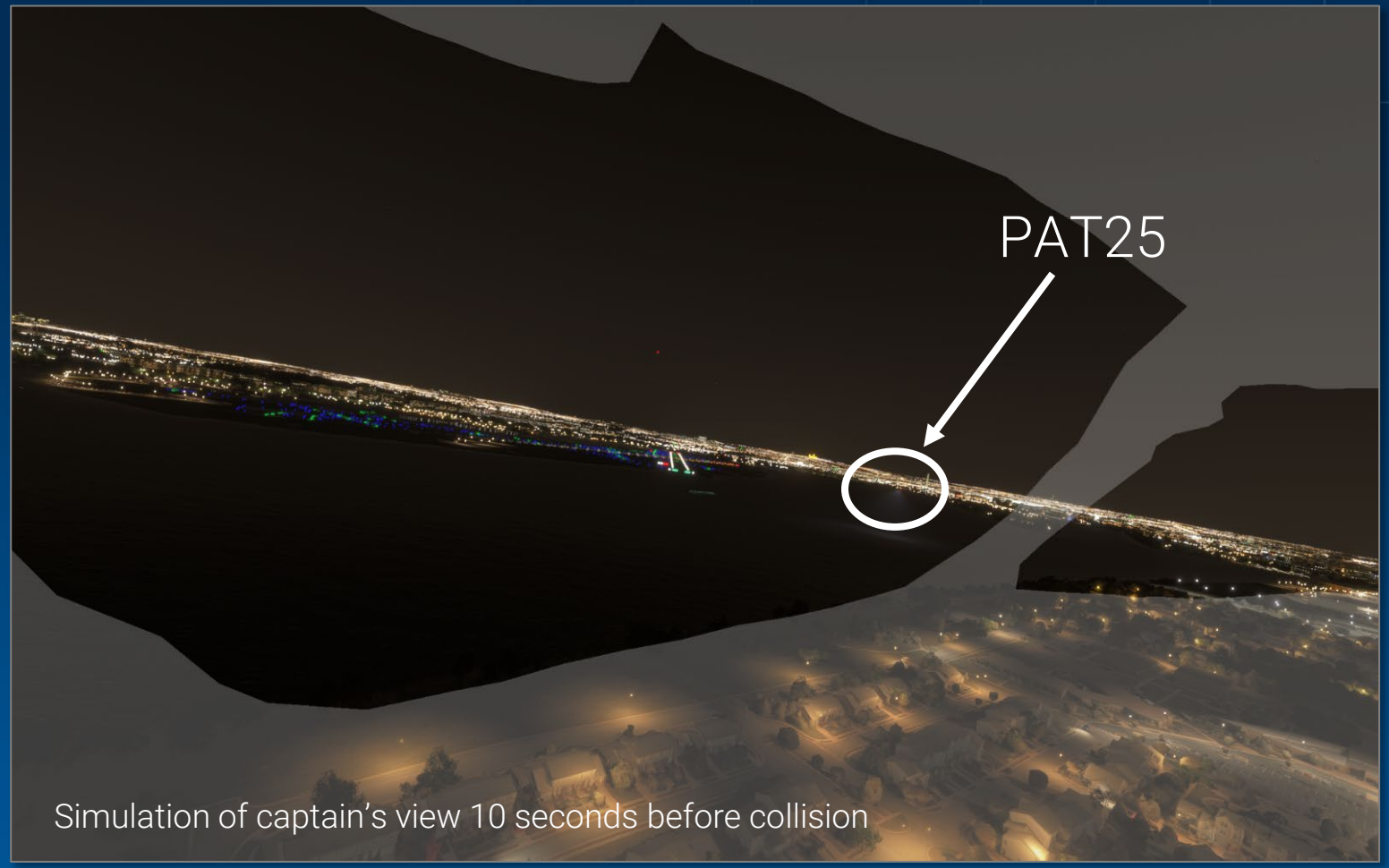
- FO responsible for ensuring approach remained stable
- Watching the flight instruments, runway edge lights, PAPI
- Likely also monitoring airplane taking off on intersecting runway
- Ability to search for traffic also constrained



Simulation of first officer's view at time of traffic advisory

Airplane: Flight Crew Perceptual Limitations

- Helicopter's low conspicuity
- Complex background
- Helicopter's lack of apparent motion



Simulation of captain's view 10 seconds before collision

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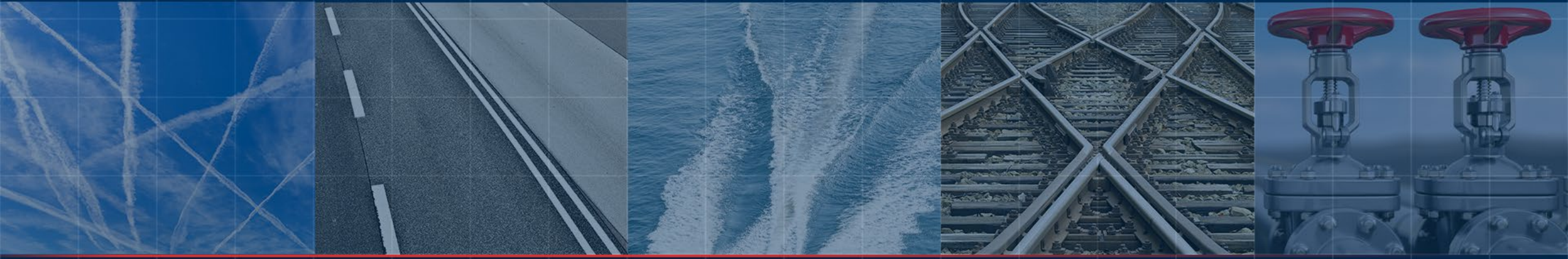

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