

“ What's your vector, Victor? ”



Harshika Jain



Salil Parekh

## Enhancing Situational Awareness to increase Trust and Safety

Aerospace  
Design  
Challenge  
2017

Team : Hotel\_Sierra

National Institute of Design, Ahmedabad

# Brief

How might we design trustworthy & reassuring experiences towards enhancing Situational Awareness for Communication and Surveillance?

# Research

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Airlines, airports and air navigation service providers (ANSPs) employ 8.9 million people. The civil aerospace sector employs 512,000 people

Aviation transported approximately 5.1 billion passengers in 2015

3.6 billion passengers in 2015. 4.7 million jobs are induced through spending by industry employees

1.2 million regional flights in 2015

2.6 billion tonnes of freight in 2015

1.2 million tonnes of cargo in 2015

1.6 million tonnes of passenger aircraft movements in 2015

1.2 million tonnes of goods by value in 2015

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Aviation carried 51.2 million tonnes of freight in 2015

11.2 million indirect jobs are created via business and services from aviation

Almost 36.3 million direct and indirect jobs are supported by aviation

Aviation transported 3.6 billion passengers in 2015

Aviation provides the only worldwide rapid transportation system

Research conducted in the US suggests that every \$100 invested in aerospace yields an extra \$70 million in GDP

Modern aircraft achieve fuel efficiencies of 20% in 2015 and 25% by 2020

Aviation transported approximately 2.6 billion passengers in 2015

Travelling by air can save up to 1.5 litres of water from the body during a 3 hour flight

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The 747 fleet transports more than 51.2 million tonnes of goods by value

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Aviation transported approximately 3.6 billion passengers in 2015

Aviation carried 51.2 million tonnes of freight in 2015 and 35% of interregional exports of goods by value

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Airlines, airports and air navigation service providers (ANSPs) value

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Aviation supports 62.7 million jobs worldwide

Aviation transported 3.6 billion passengers in 2015

Aviation creates 9.9 million jobs worldwide

Aviation supports 11.2 million indirect jobs worldwide

Aviation transported 2.6 billion passengers in 2015

Aviation creates 36.3 million direct and indirect jobs worldwide

Aviation transported 1.5 billion tonnes of freight in 2015

Aviation creates 51.2 million tonnes of freight in 2015

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**THAT'S A LOT OF STATS**

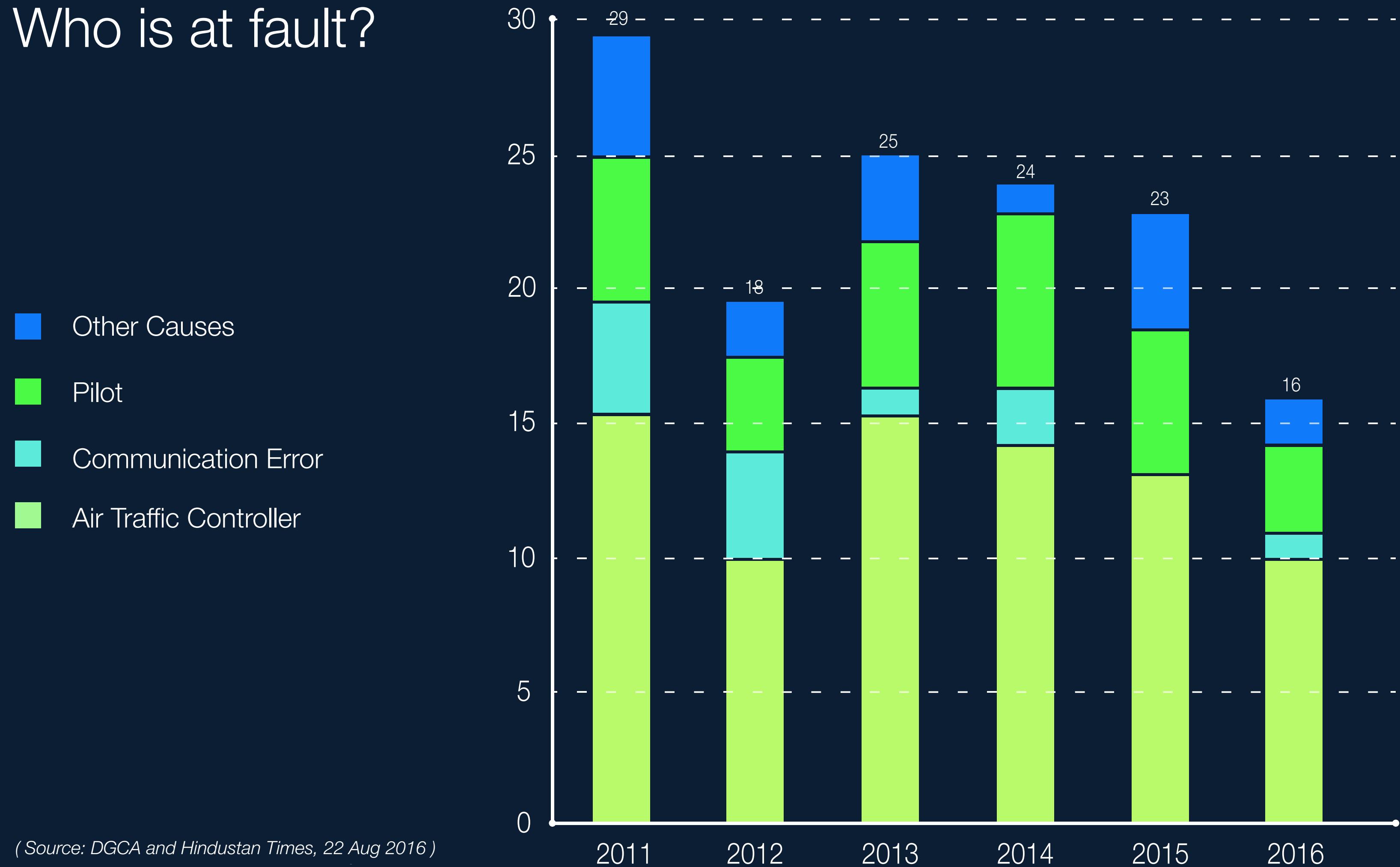
But this is what you need to know

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Who is at fault?

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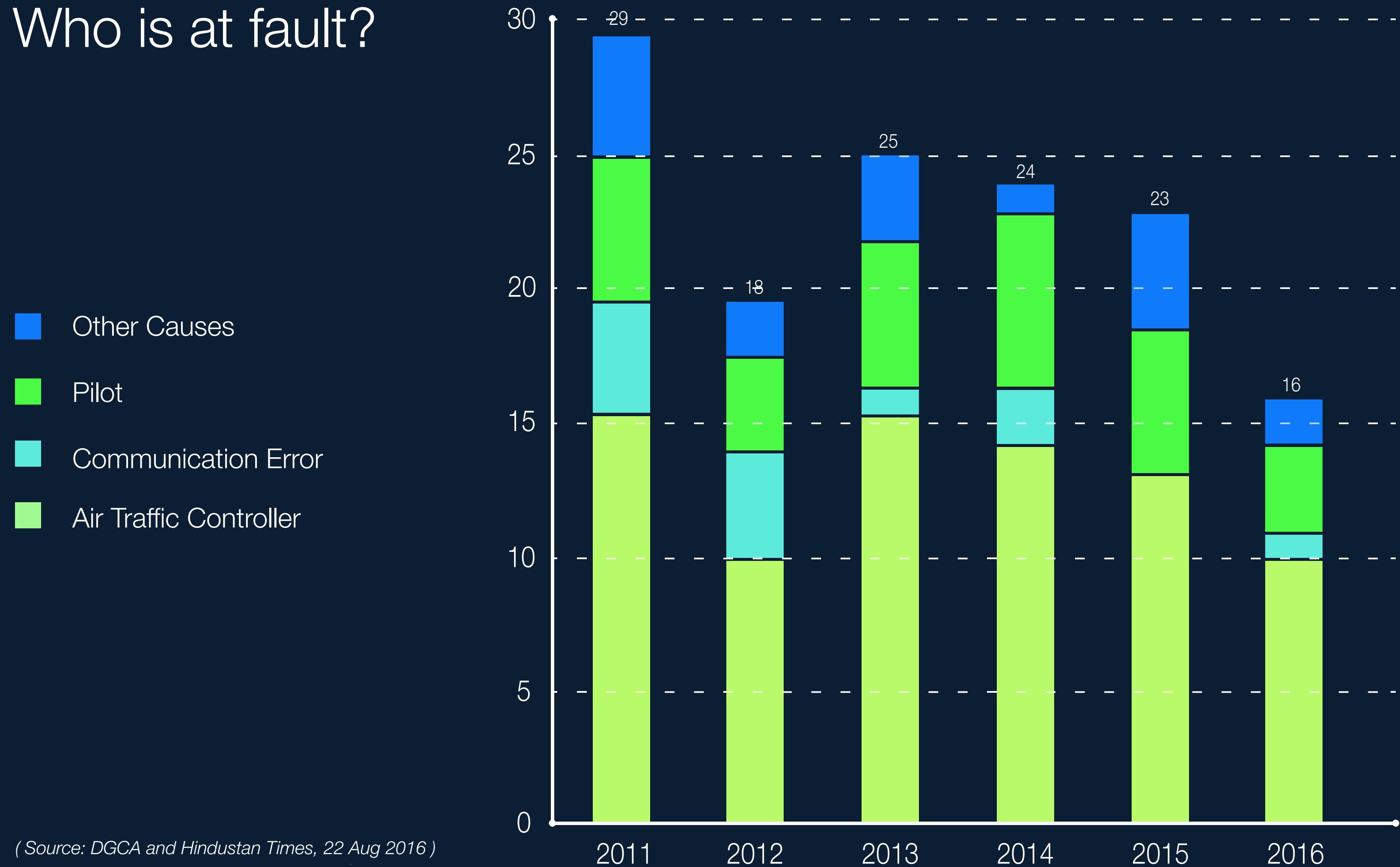
Who is at fault?



(Source: DGCA and Hindustan Times, 22 Aug 2016)

# But this is what you need to know

Who is at fault?



(Source: DGCA and Hindustan Times, 22 Aug 2016)

***"A shortage of ATCs compromises with the safety of thousands of fliers every day. We are waiting for a disaster to act."***

- S S Panesar, Former Head of flight safety training divisions, Indian Airlines

# What USERS have to say

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ATC

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ATC

In this high stress work environment, **visualising the high density of traffic** especially in adverse weather conditions could become better.

# Case Studies

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## Minutes to Death

2 September 2013

3 successive collisions missed  
due to miscommunication within  
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## Polish President Killed

Language problems between Russian ATC and Polish pilot aided by dense fog conditions

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# Case Studies



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## Emergency Landing

Baby suffered a heart problem mid-air, ATC had to clear airspace and reschedule landing of many flights to arrange for a **priority landing**.

22 September 2016

# Process



A usual day in the ATC tower, Ahmedabad

Hotel\_Sierra

# Process



# Process

06:20:32

Directing and Planning flights over Ahmedabad airspace

Hotel\_Sierra

# Process



Delhi ATC Tower

# Process



Delhi ATC Approach

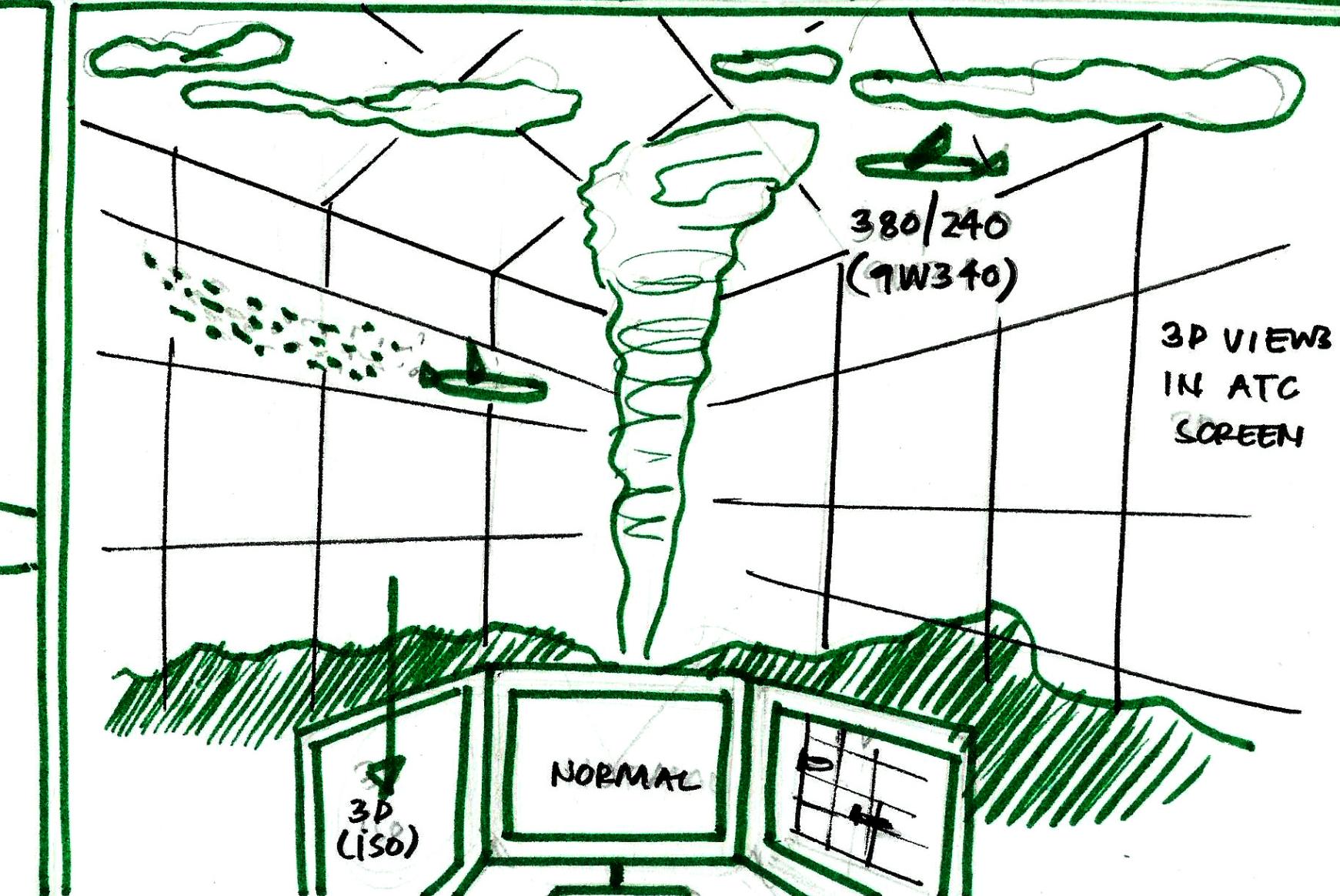
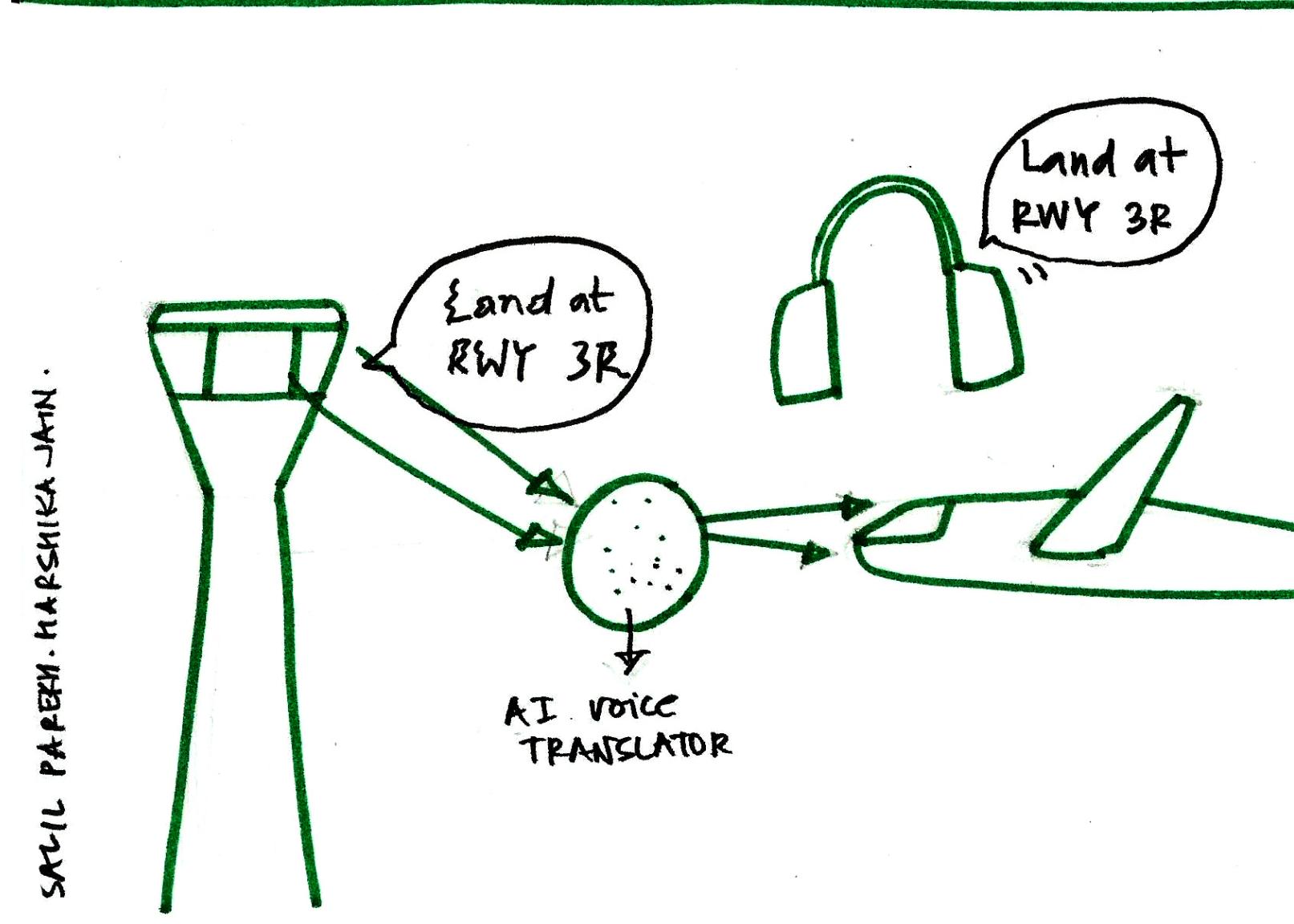
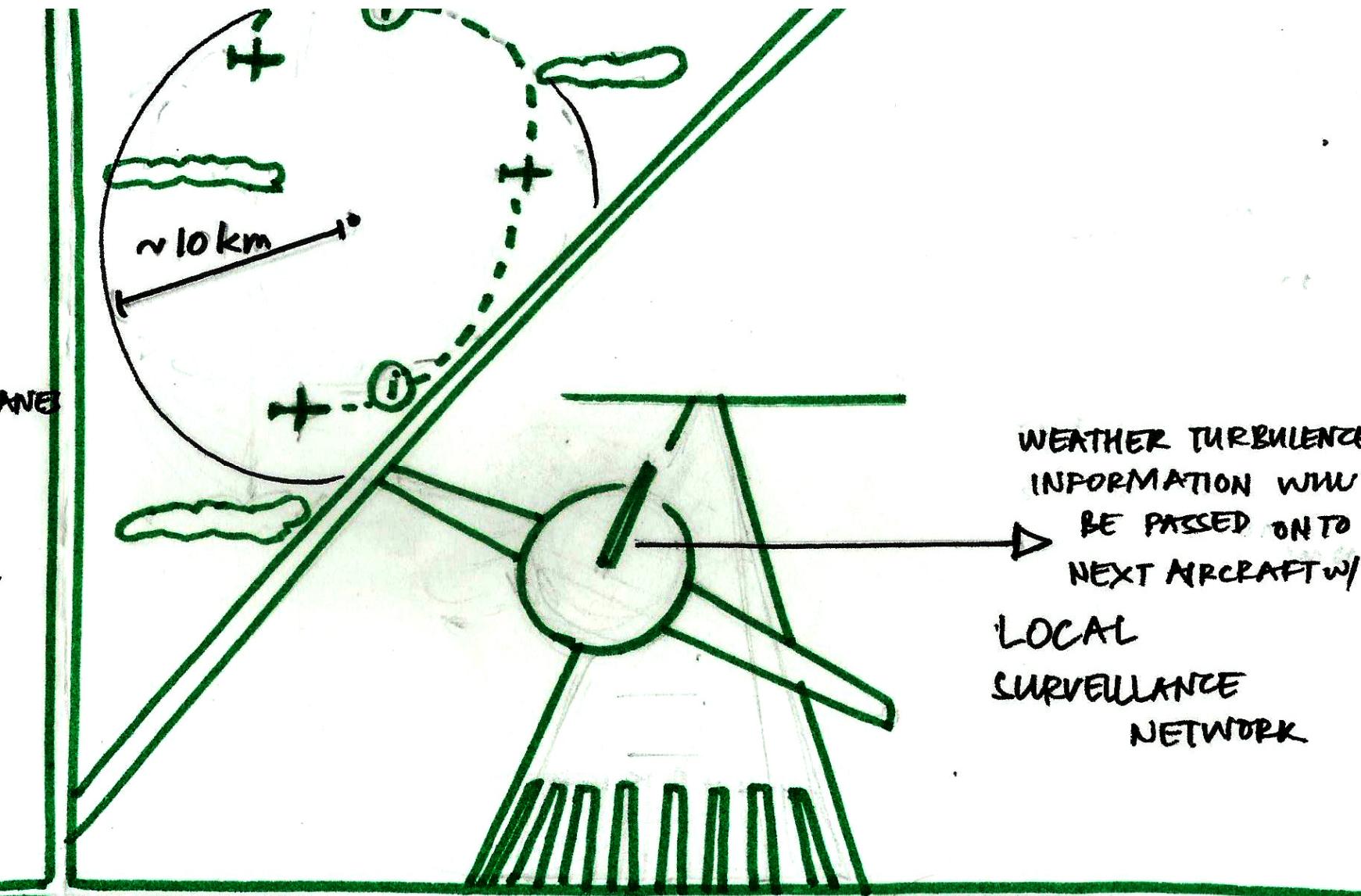
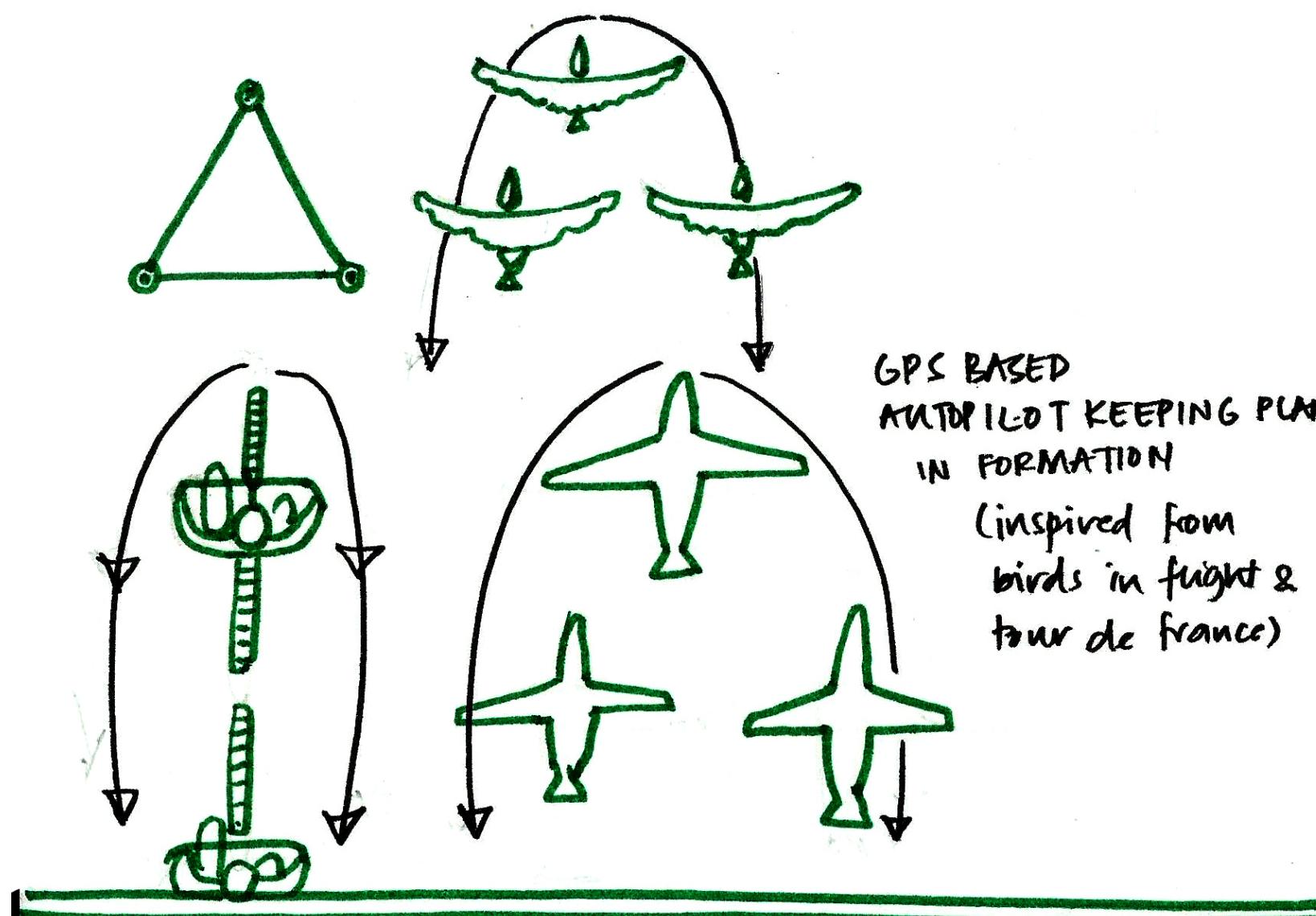
# Process



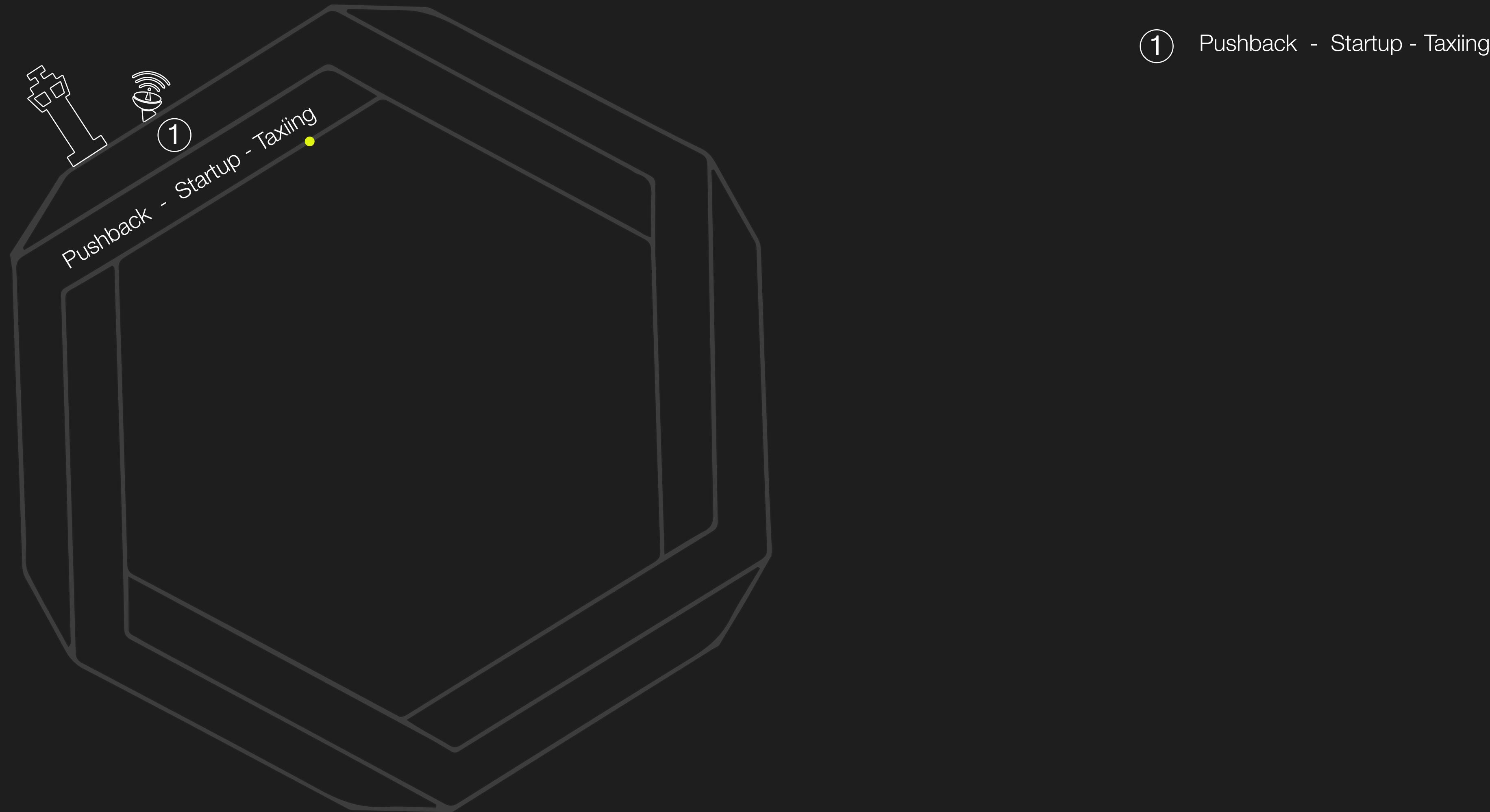
Delhi ATC Approach



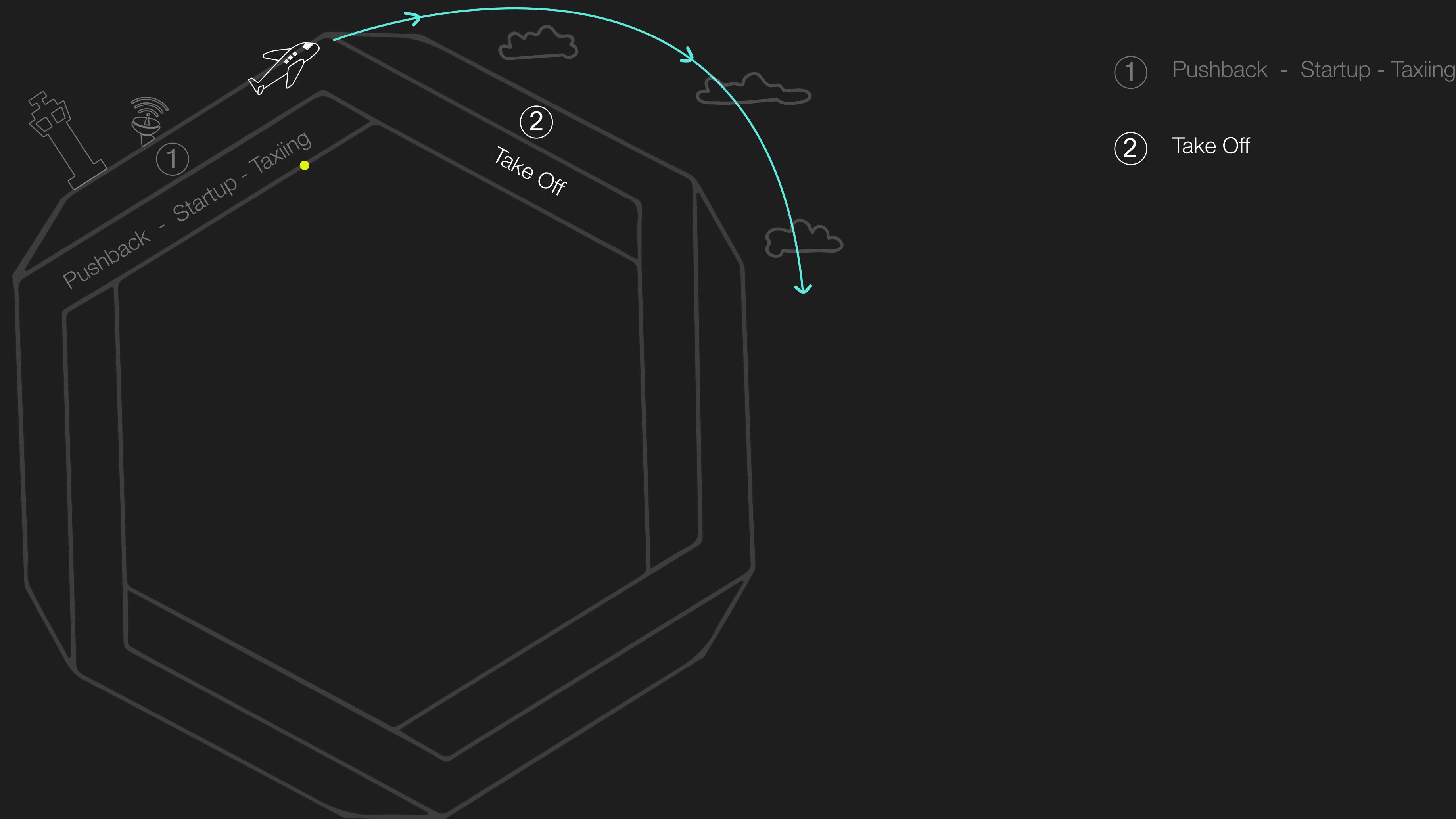
# Exploration



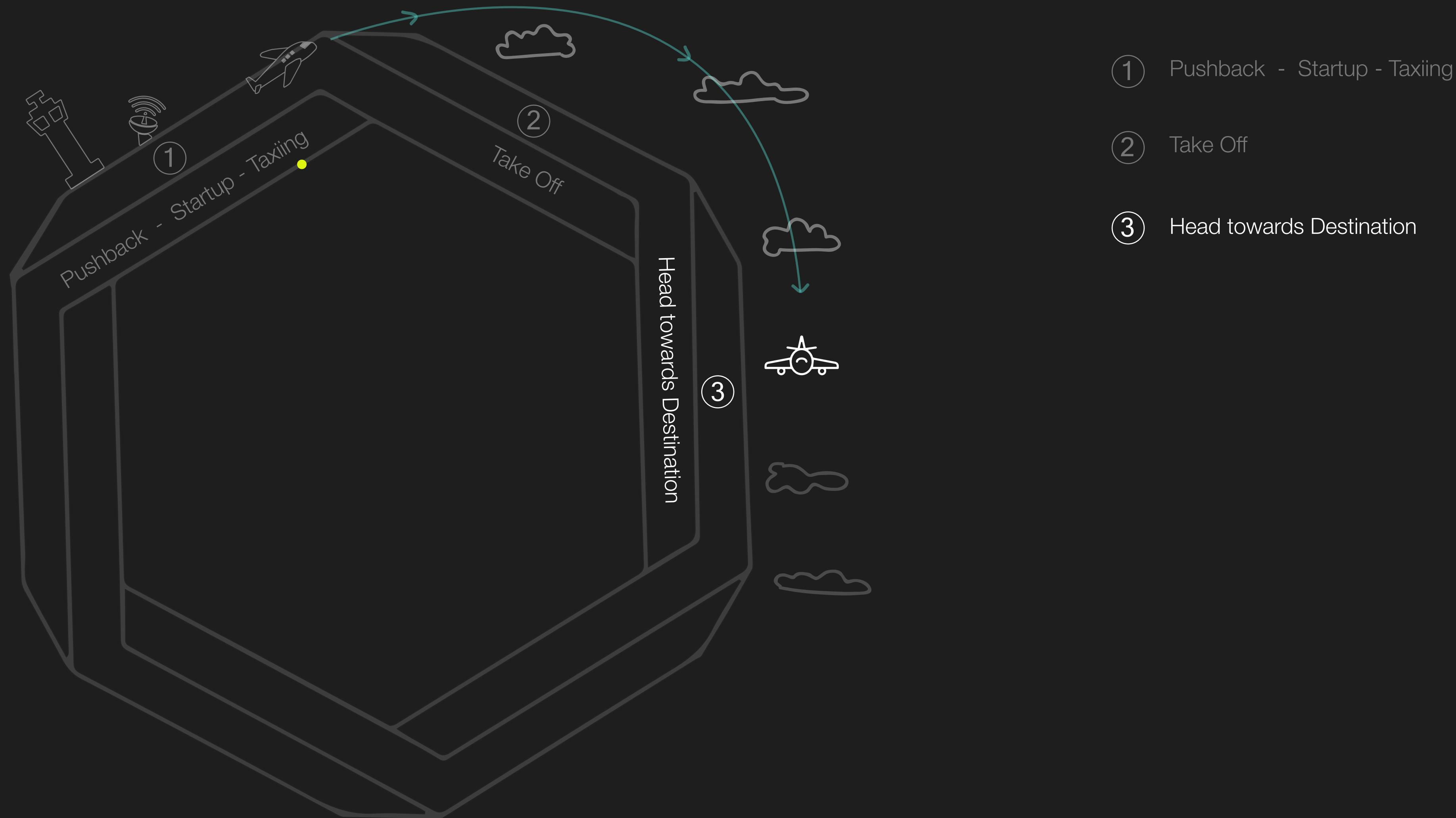
# Task Flow



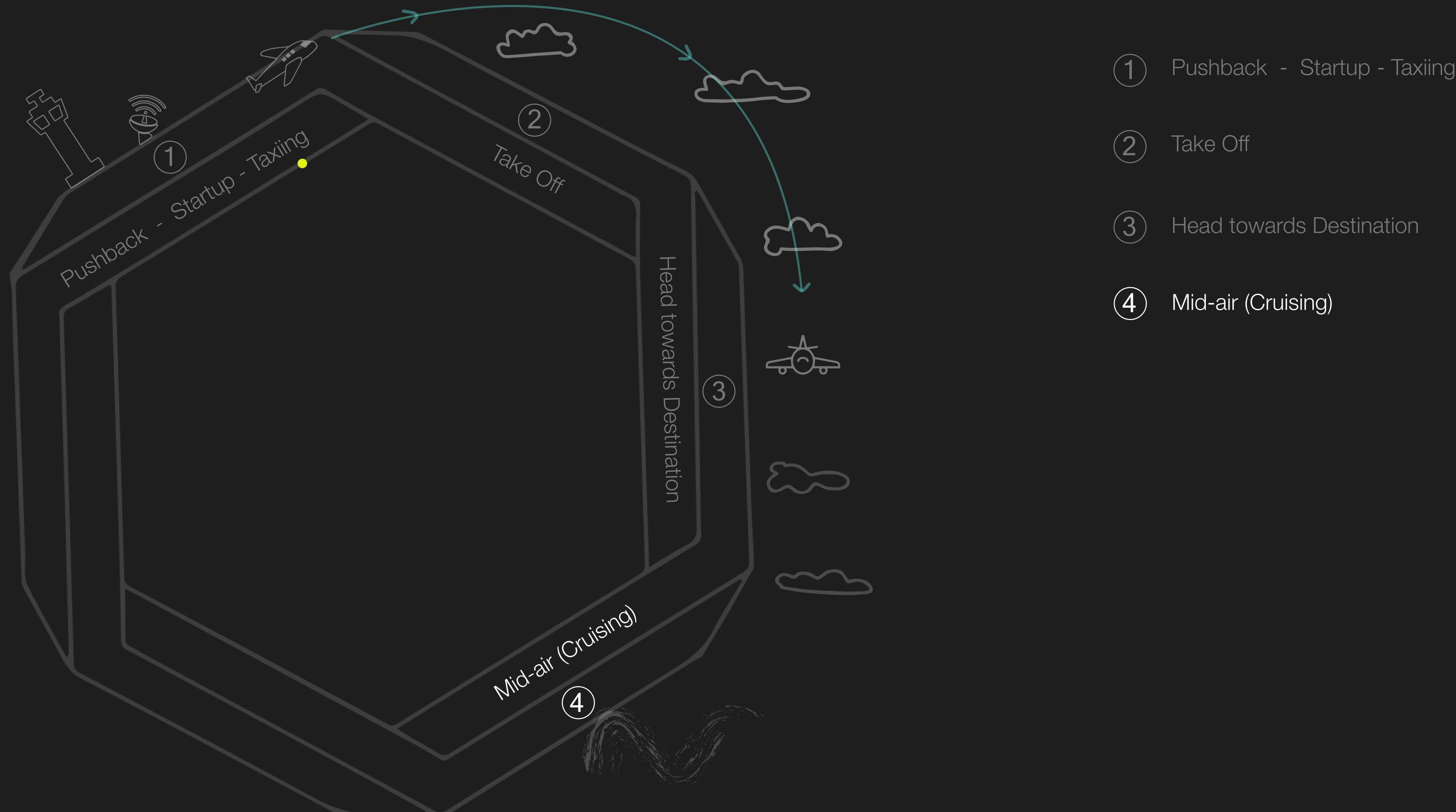
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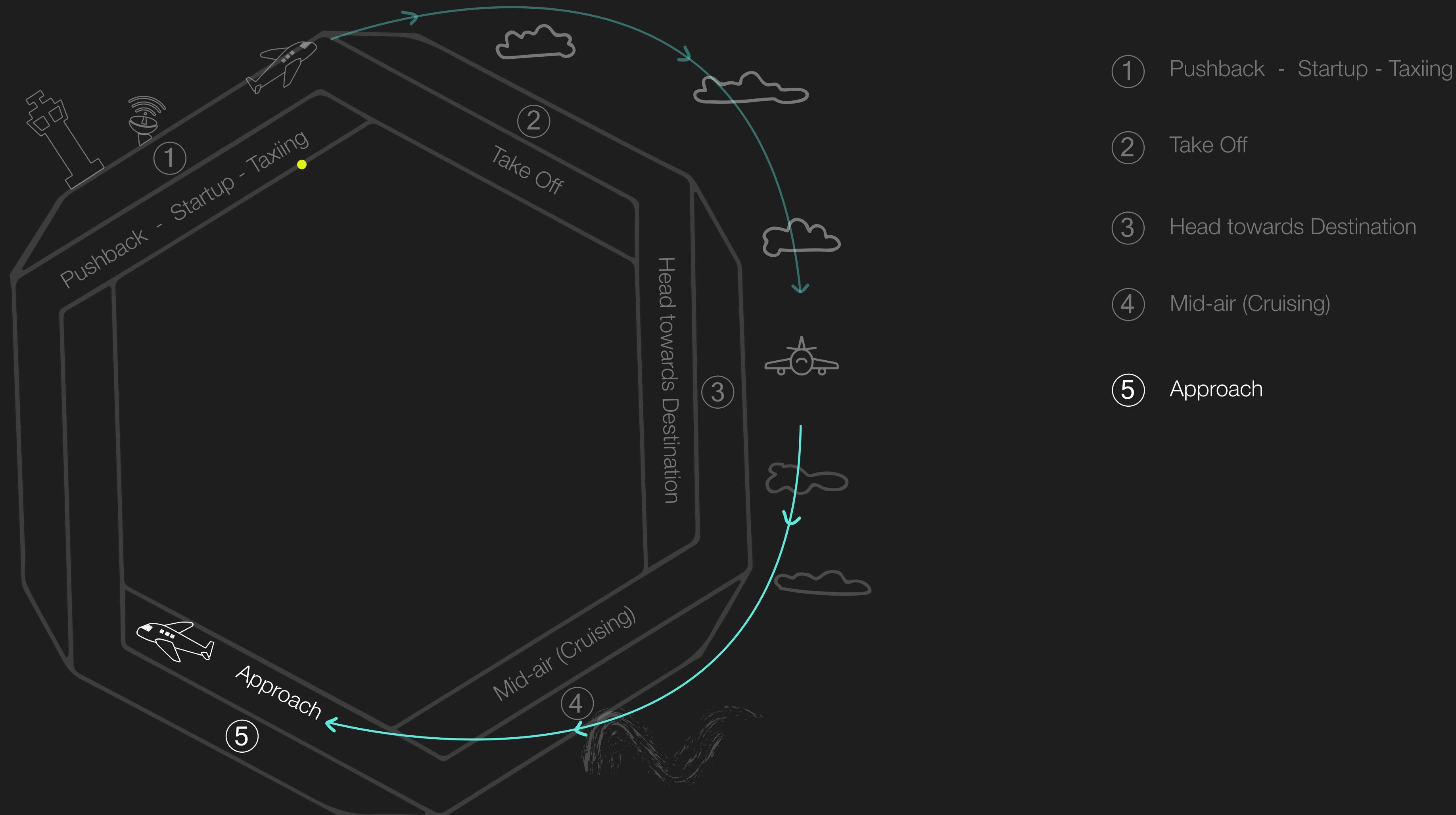
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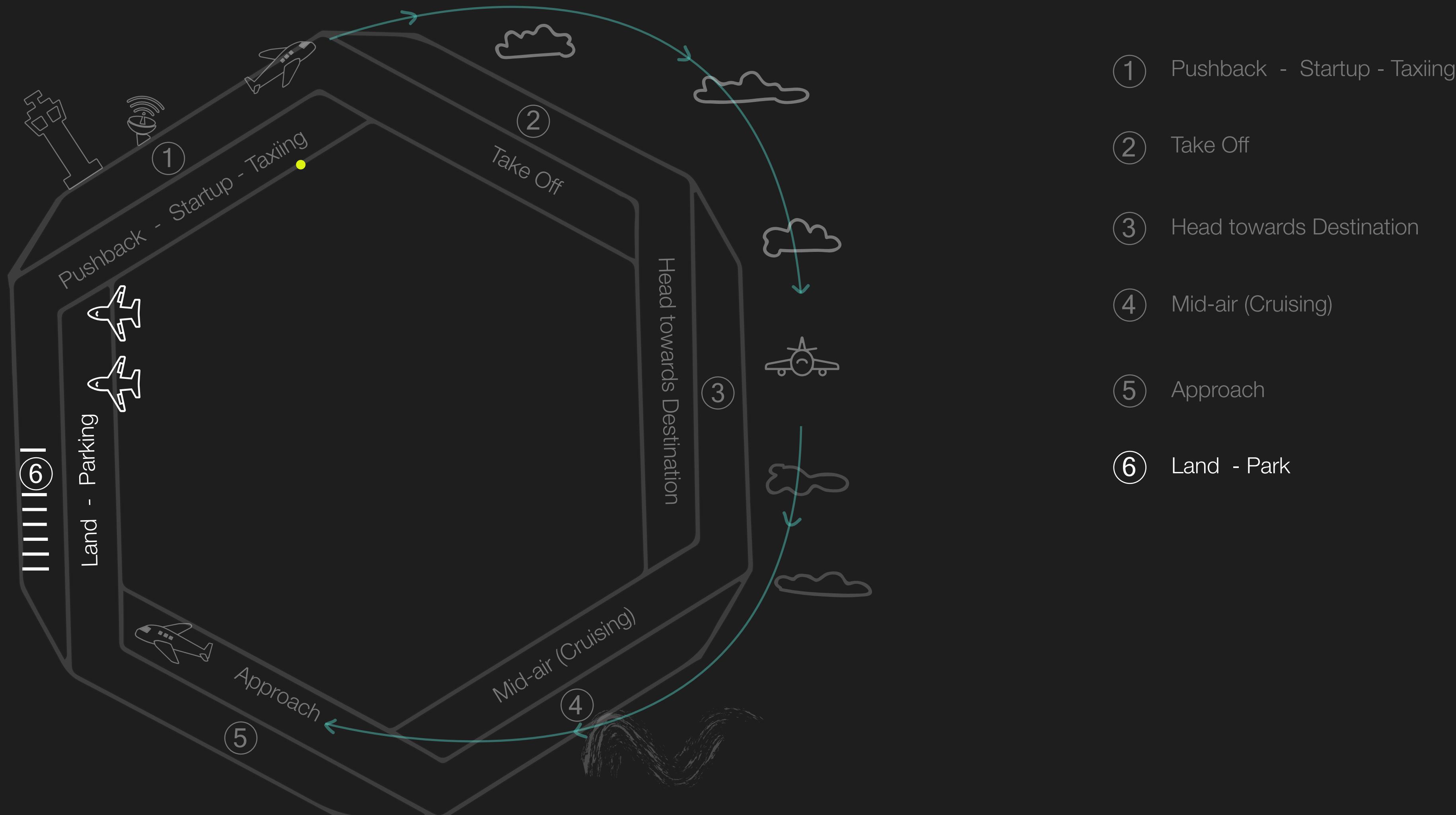
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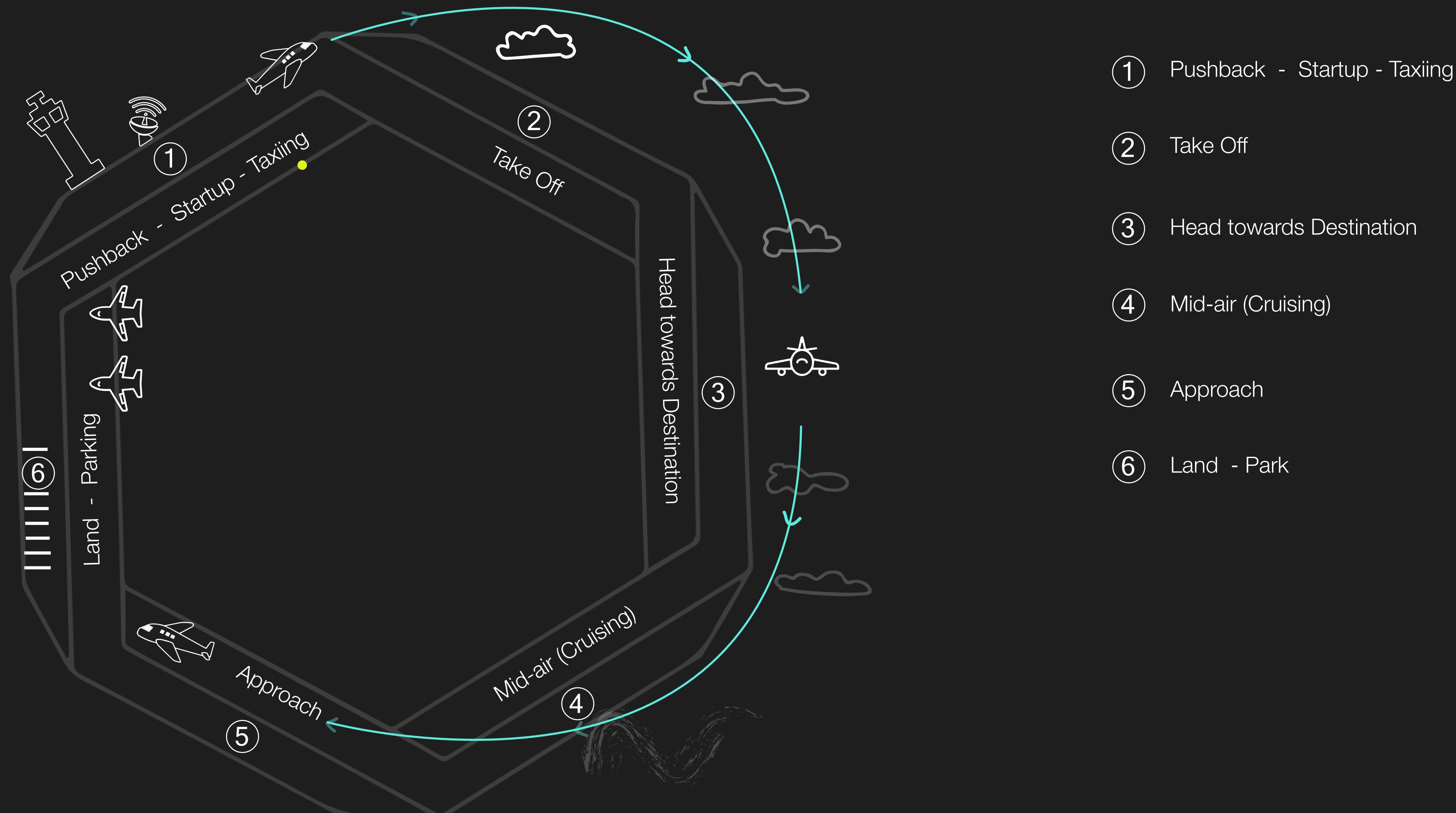
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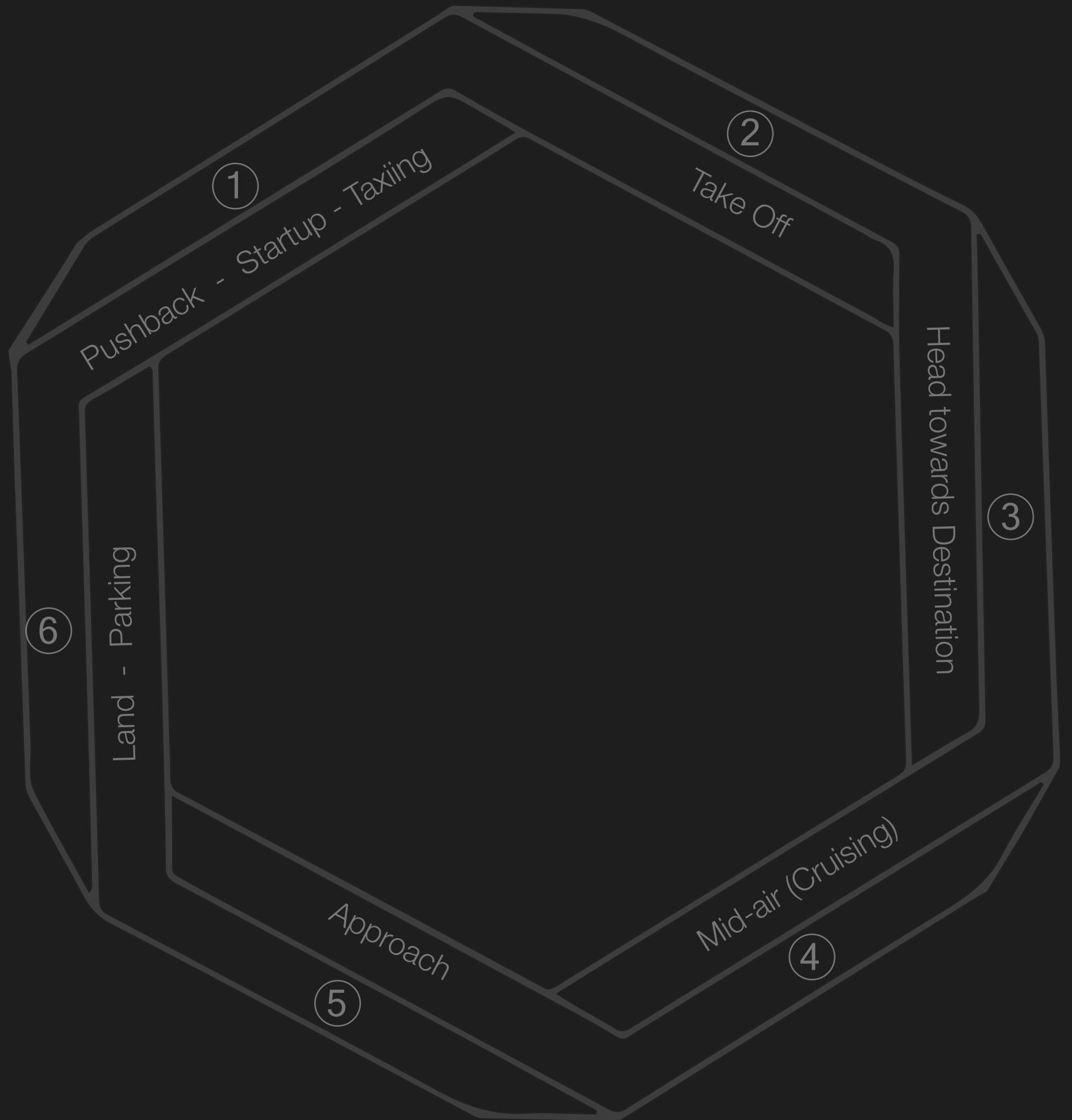
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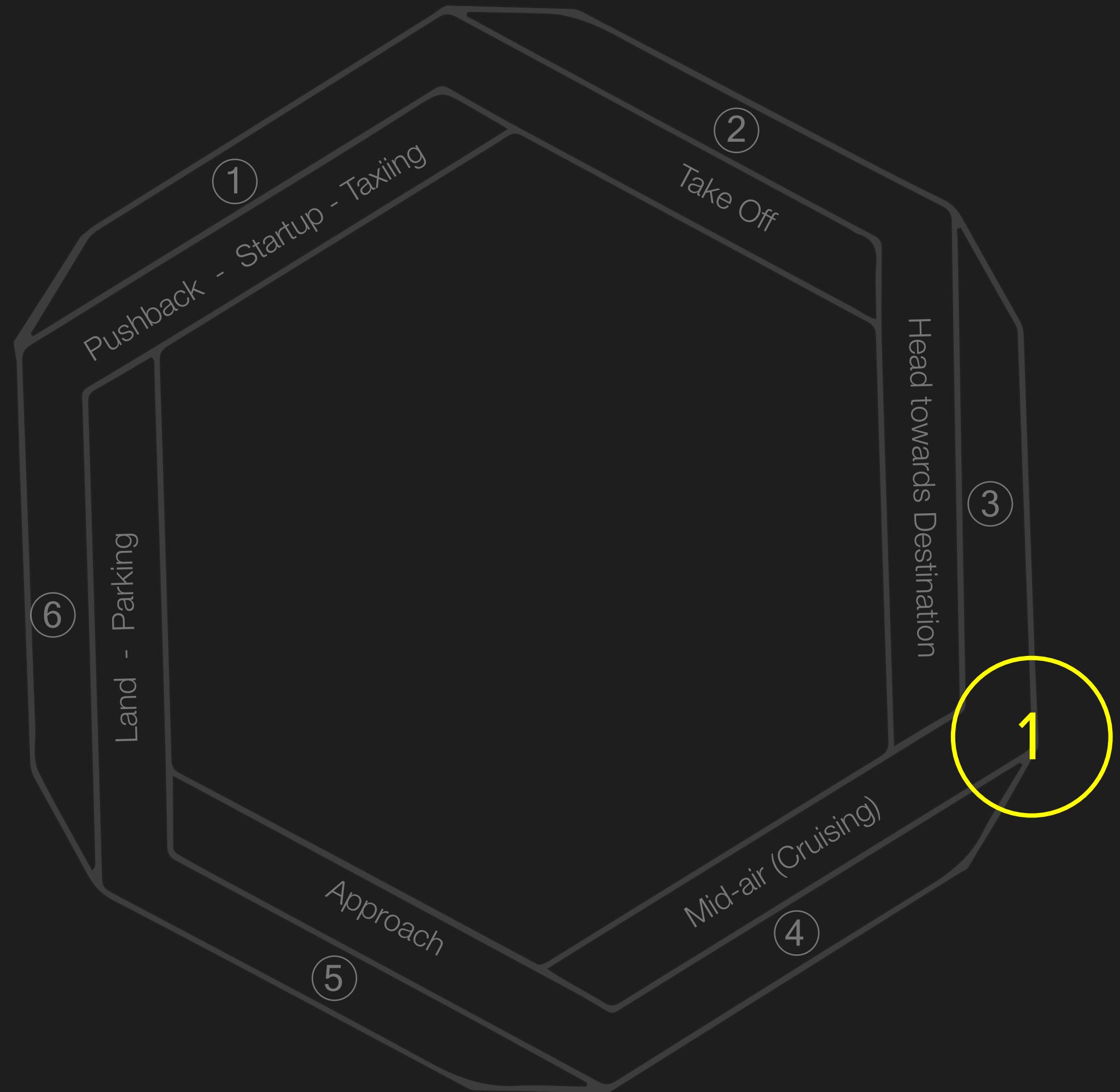
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# Problem Areas

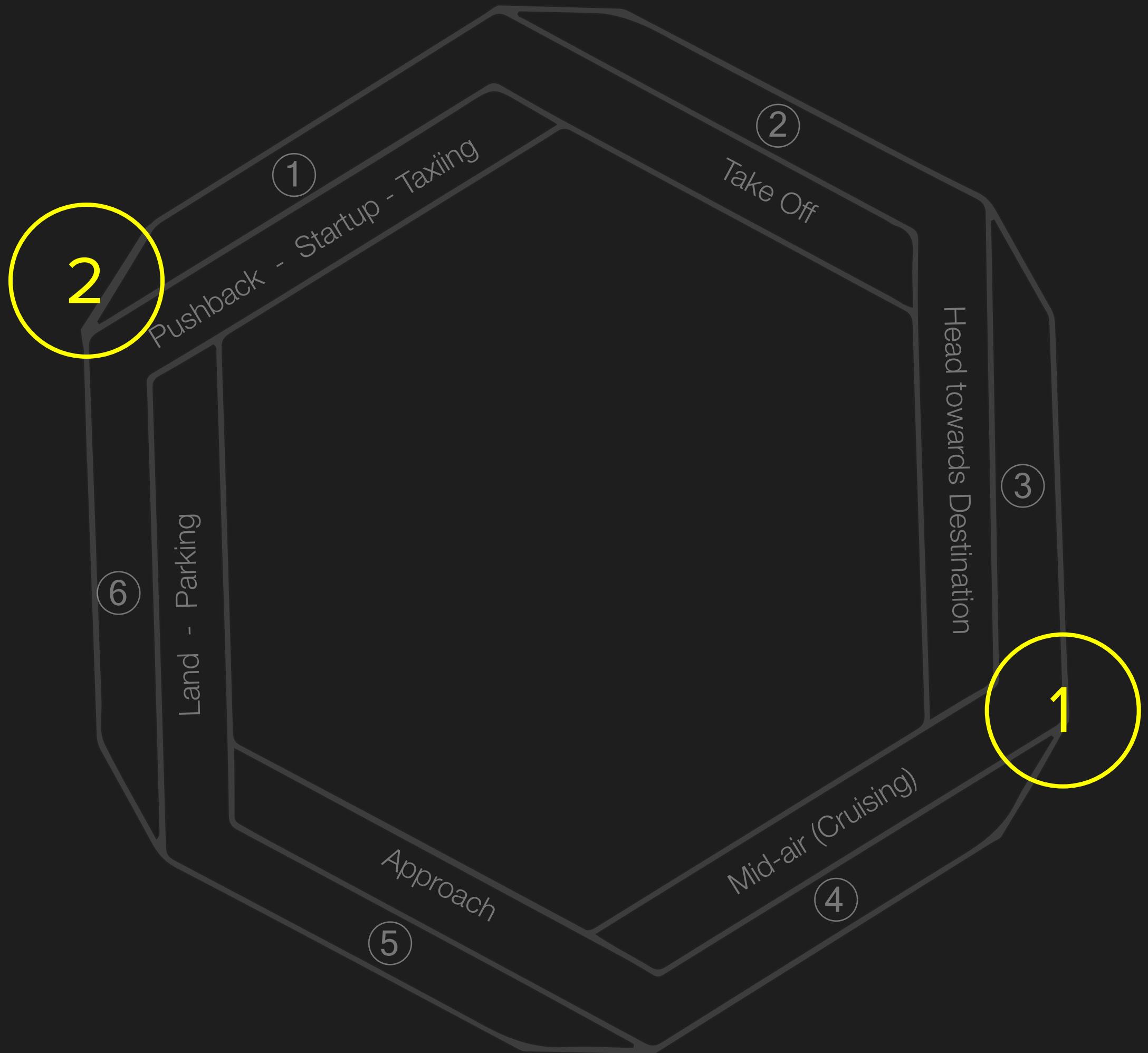


# Problem Areas



Air traffic controllers have a stressful job of visualising traffic in 3D space

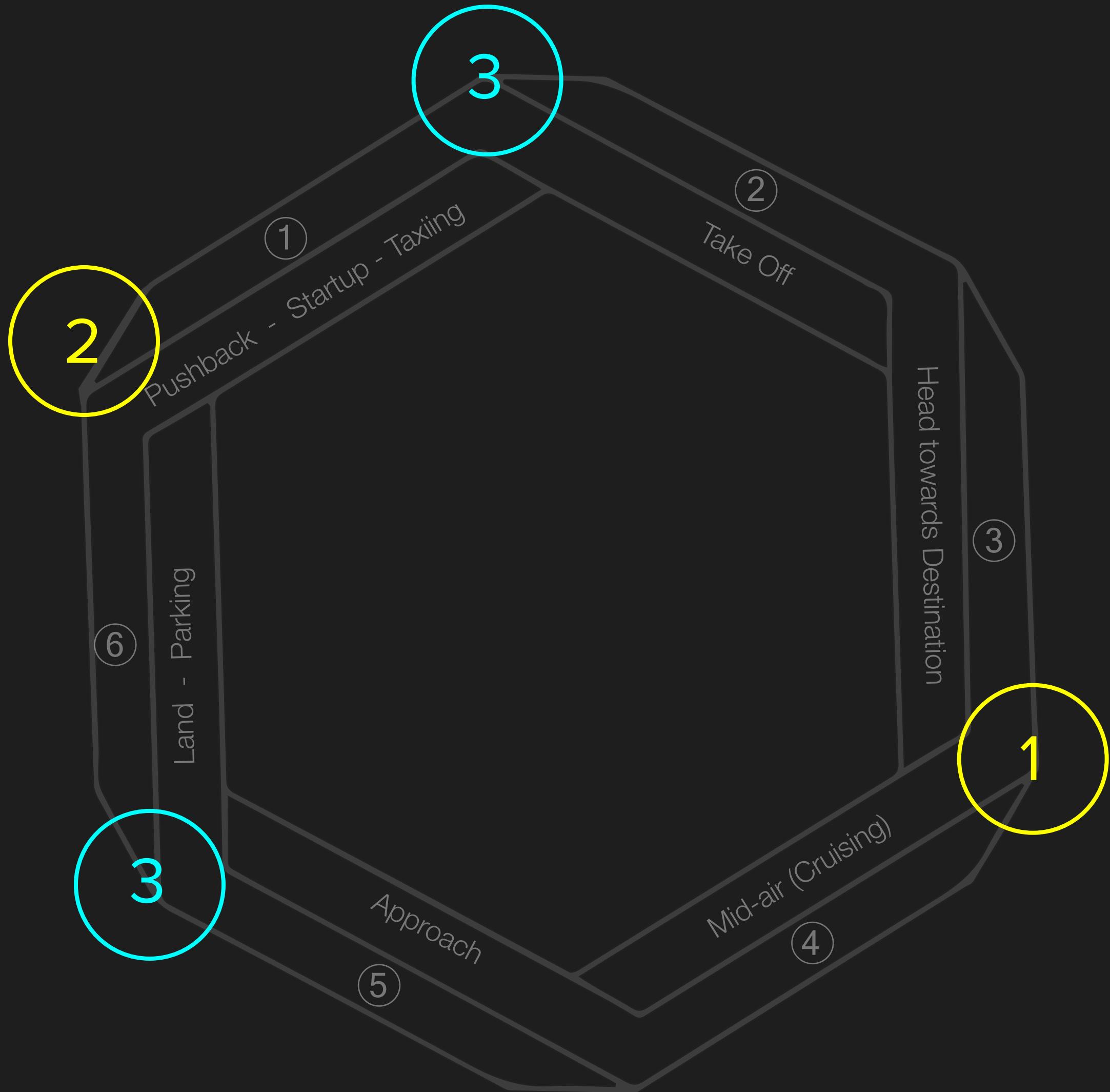
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Visualising traffic on the runway and during pushback in adverse weather conditions

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Air traffic controllers have a stressful job of visualising traffic in 3D space

Visualising traffic on the runway and during pushback in adverse weather conditions

Cognition of accents and disturbance due to radio interference

# SOLUTIONS

# 3D View in ATC Radar (SURVEILLANCE)



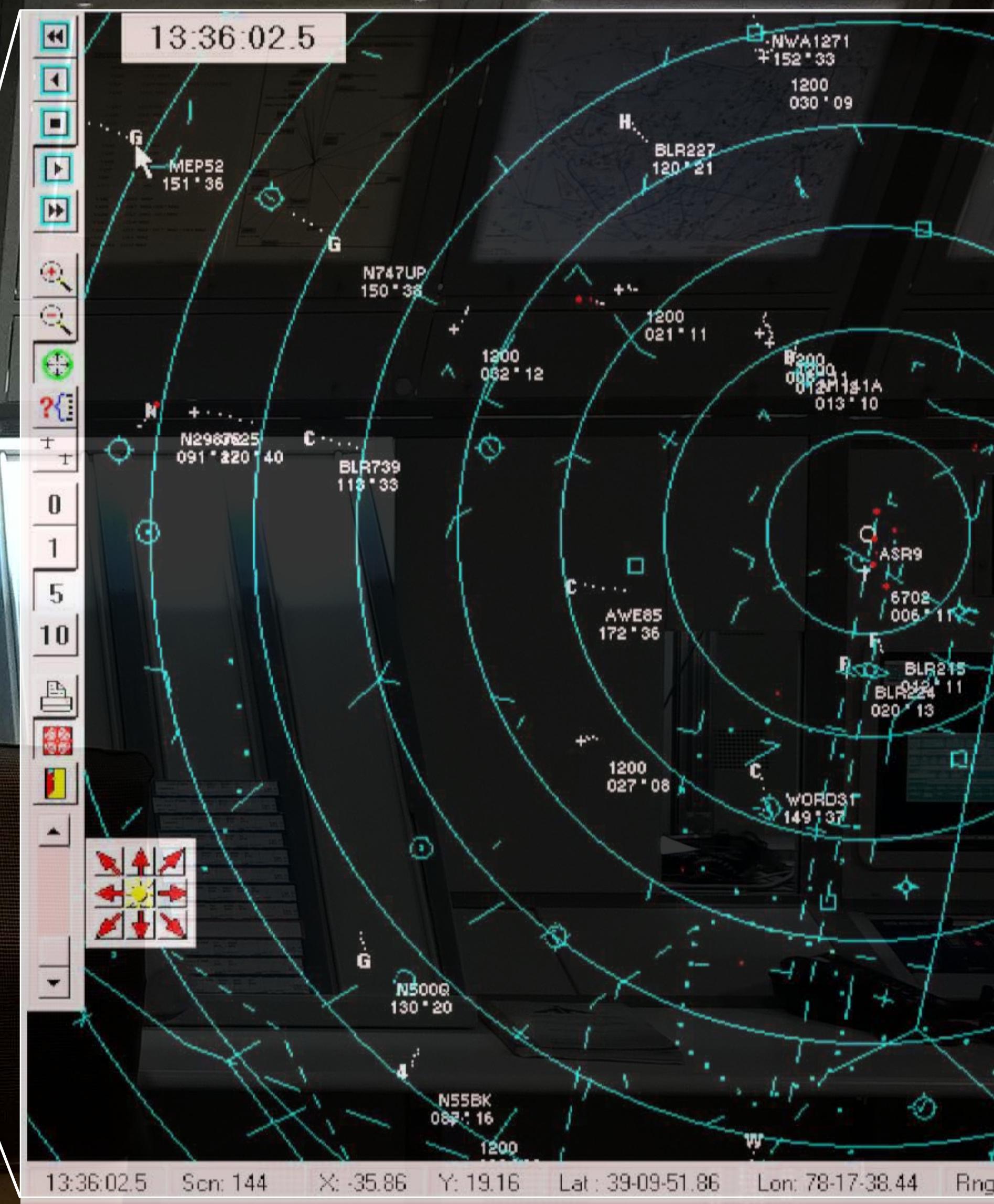
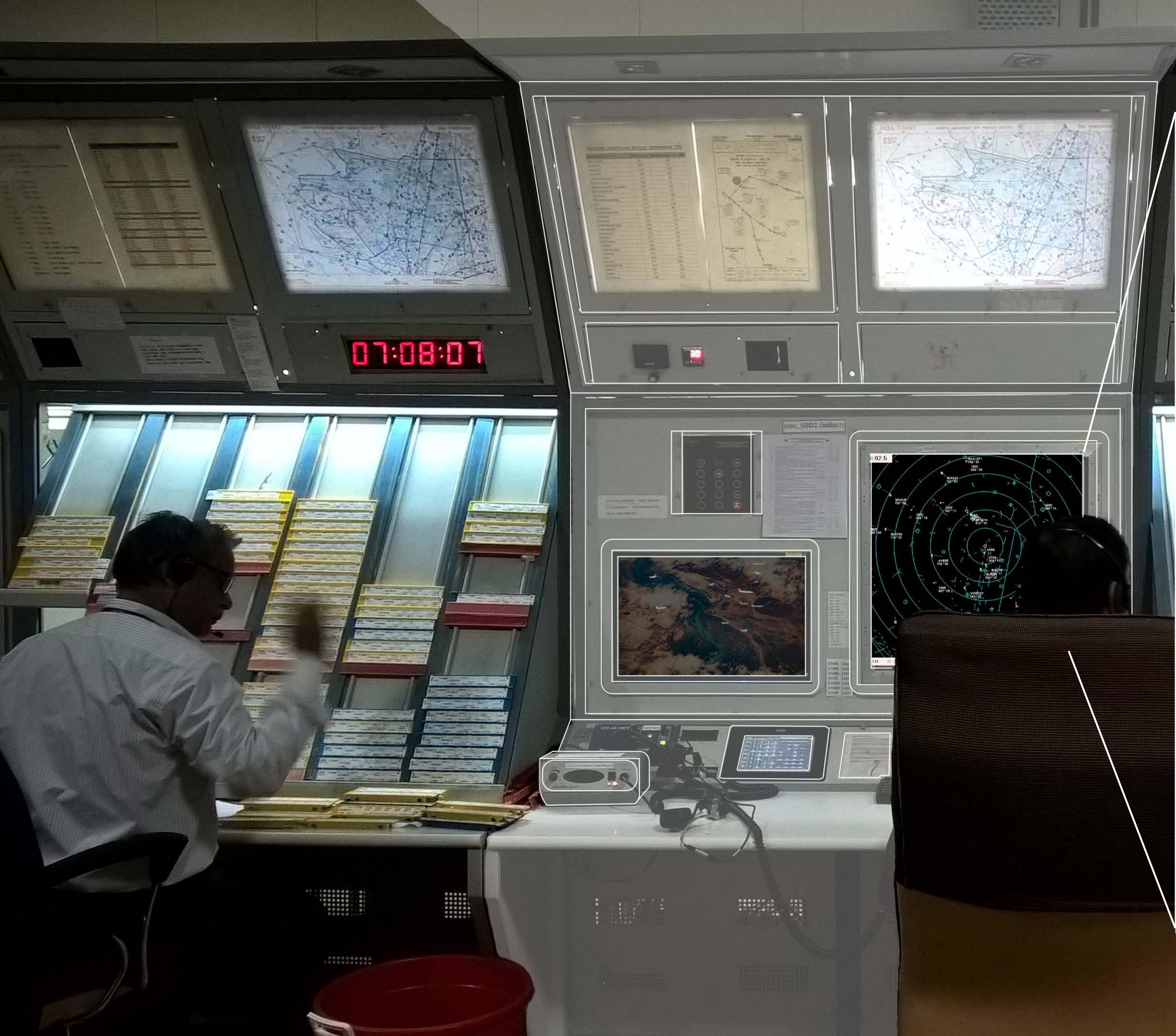


3D View in ATC Radar



Toggle for Height Visualisation





ATC Radar (primary screen)

# Night Vision (SURVEILLANCE)







# **Accent Correction with AI**

## **(COMMUNICATION)**

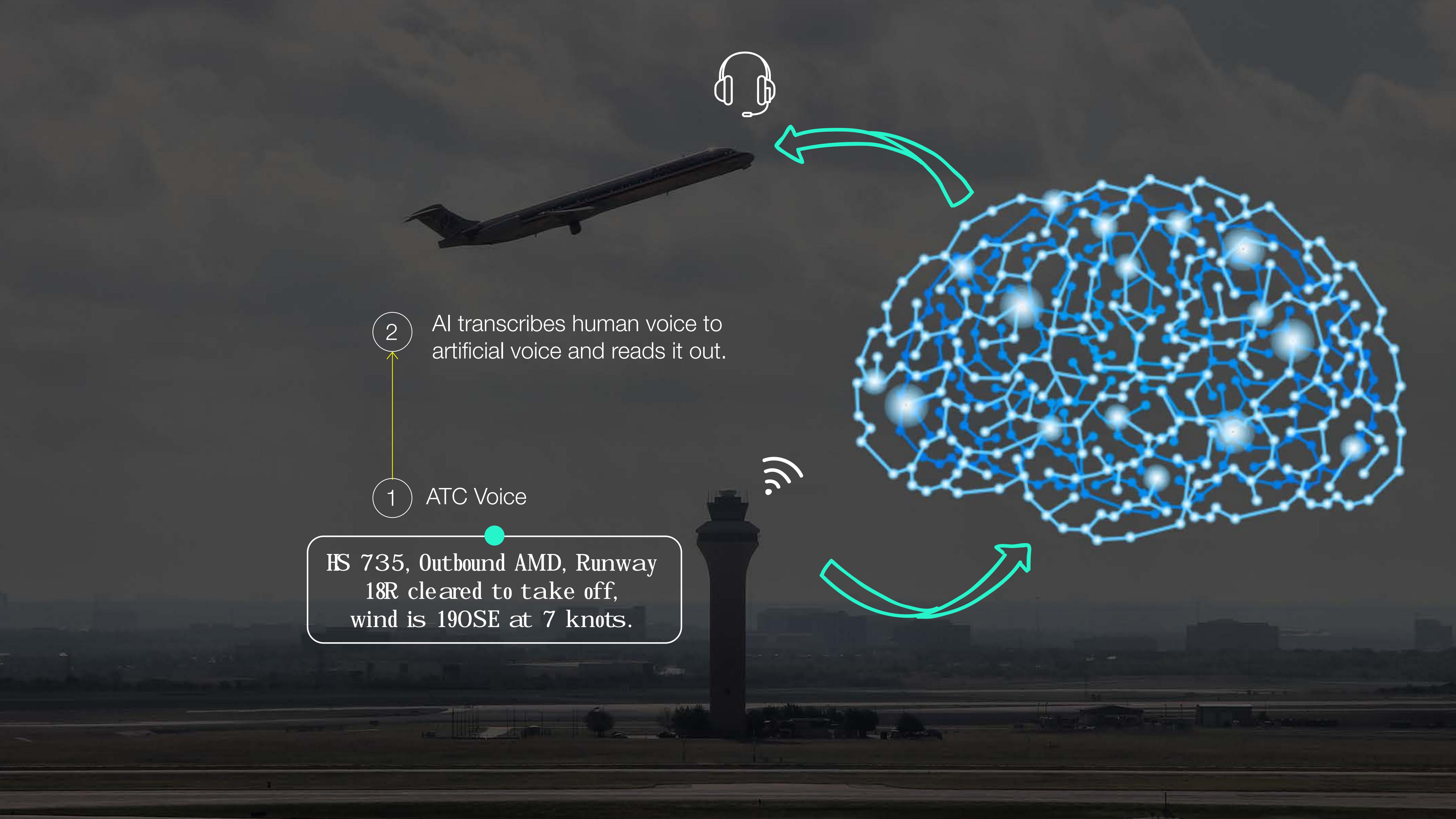






1 ATC Voice

HS 735, Outbound AMD, Runway  
18R cleared to take off,  
wind is 190SE at 7 knots.

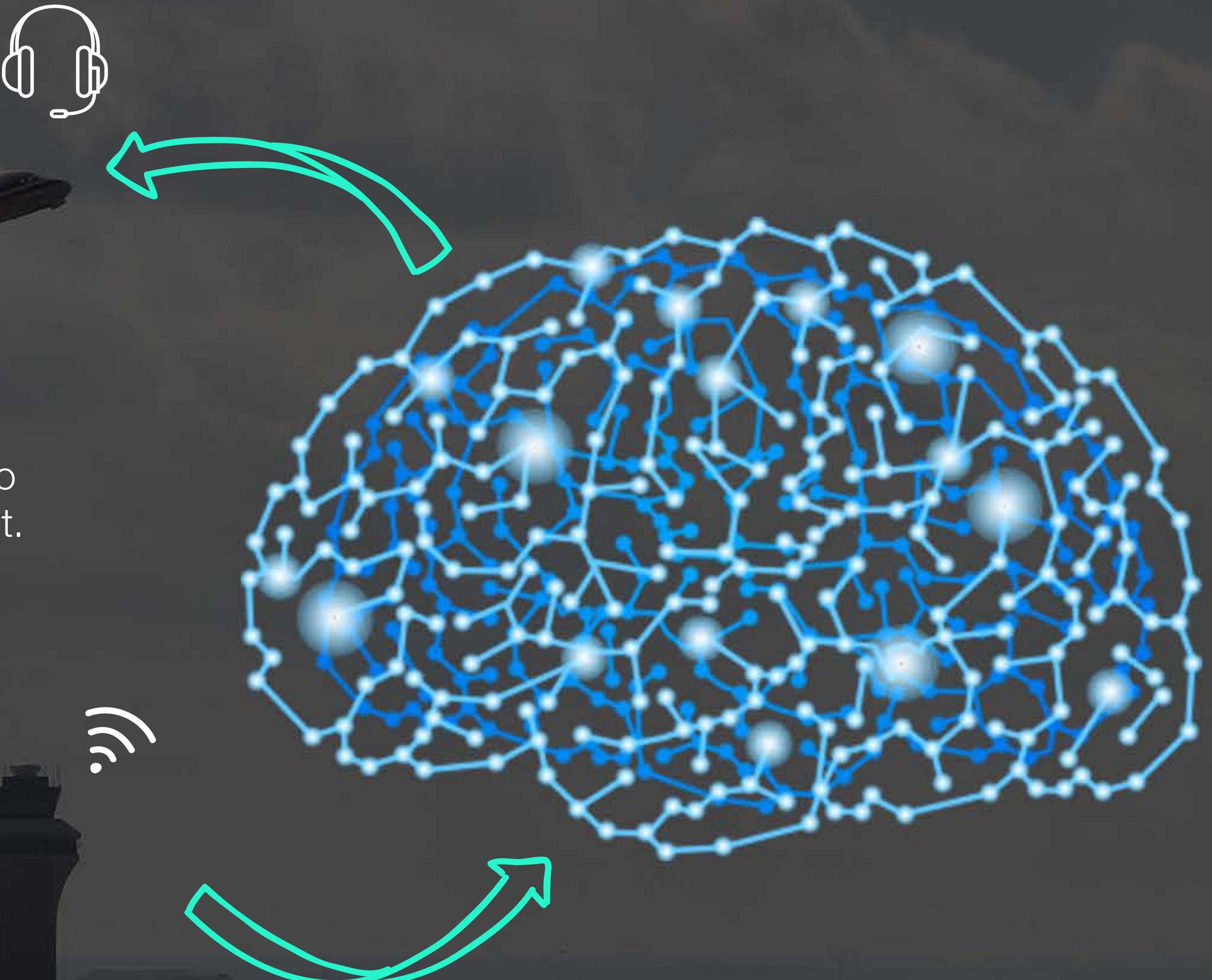


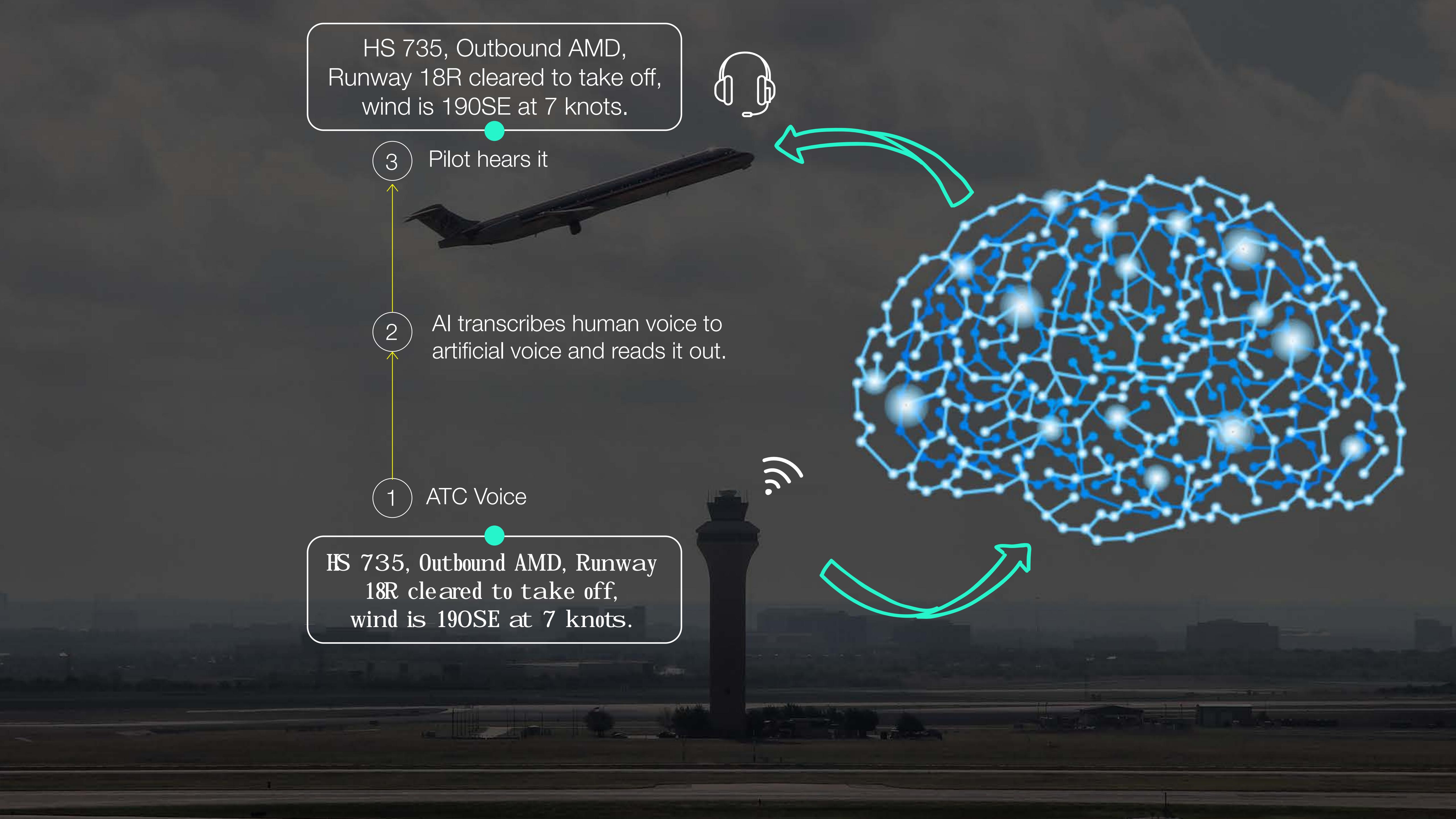
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1 ATC Voice

2

AI transcribes human voice to  
artificial voice and reads it out.





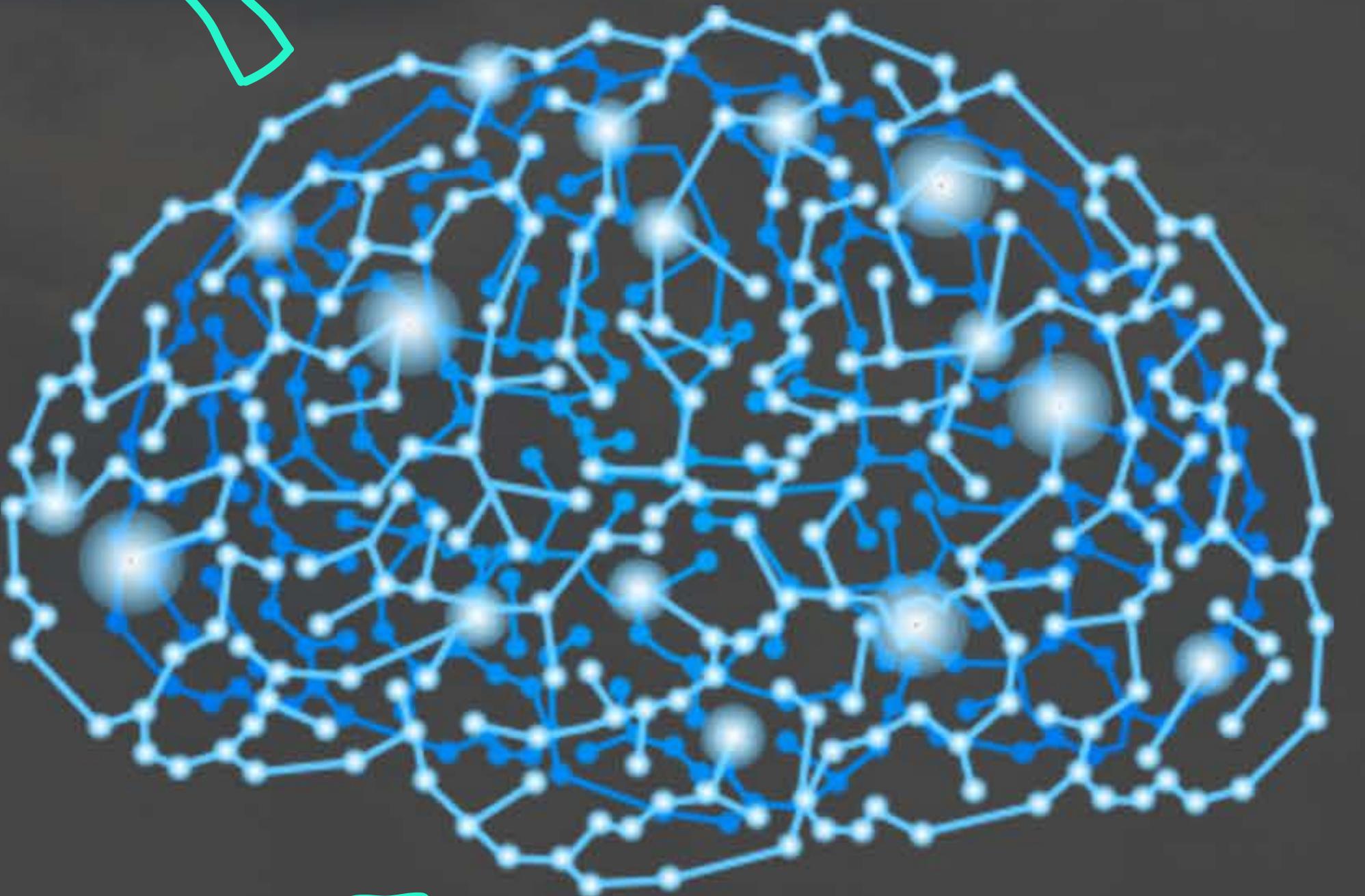
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③ Pilot hears it

② AI transcribes human voice to  
artificial voice and reads it out.

① ATC Voice

HS 735, Outbound AMD, Runway  
18R cleared to take off,  
wind is 190SE at 7 knots.



# Impact

+ 10 Years

Now

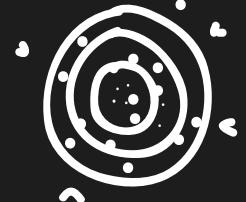
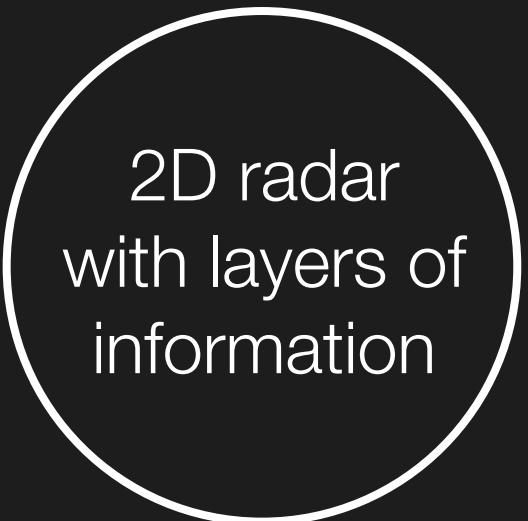


# Impact

+ 10 Years



Now



# Impact

+ 10 Years



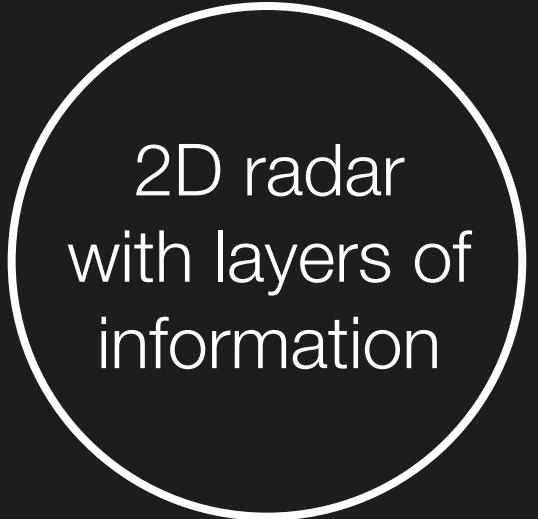
3D view in  
ATC radar  
with viewport  
toggle



Night Vision  
and Infrared  
Image  
Mapping



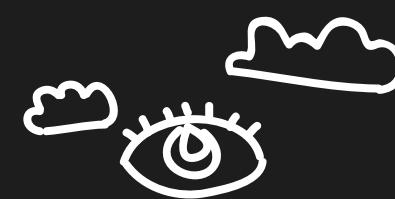
Now



2D radar  
with layers of  
information

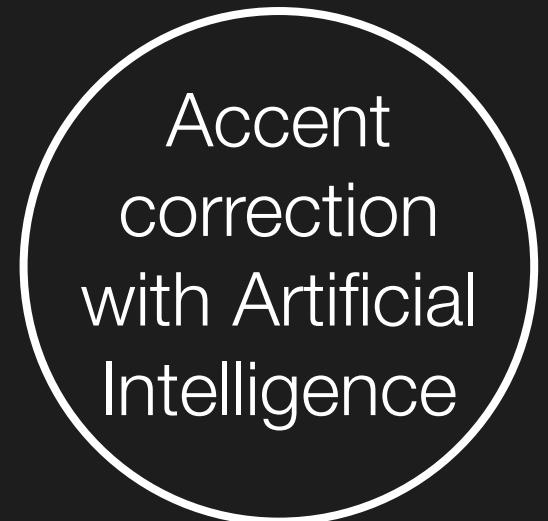


Visual  
judgement  
in adverse  
visibility

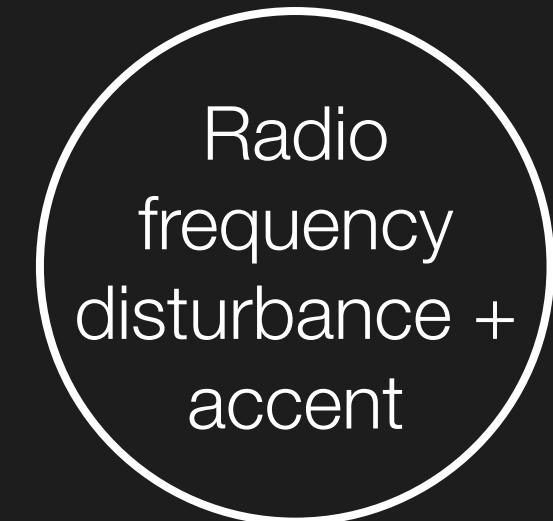
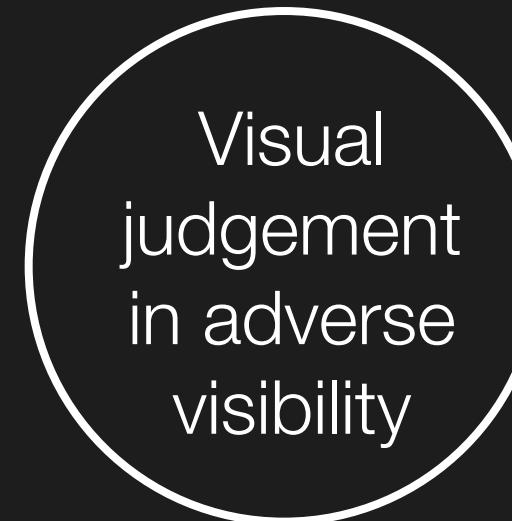
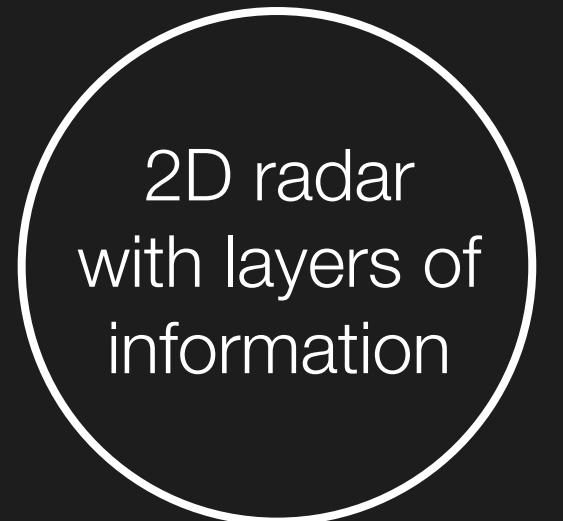


# Impact

+ 10 Years



Now



# Impact

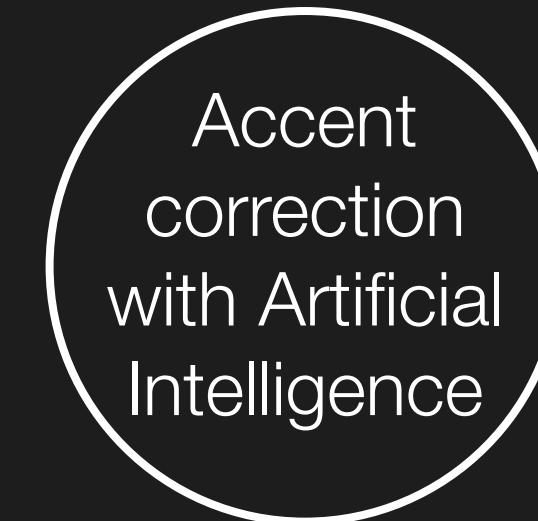
+ 10 Years



3D view in  
ATC radar  
with viewport  
toggle

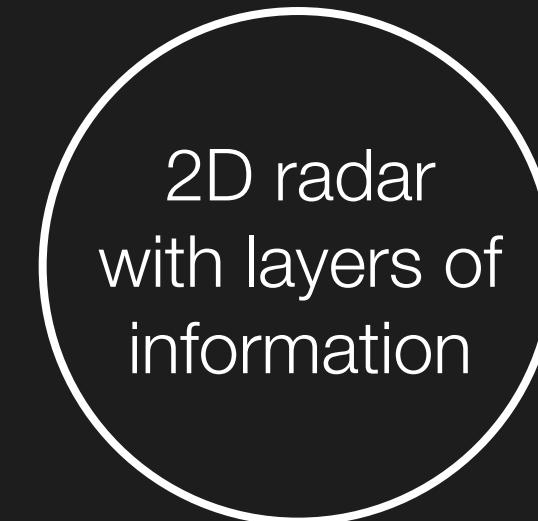


Night Vision  
and Infrared  
Image  
Mapping

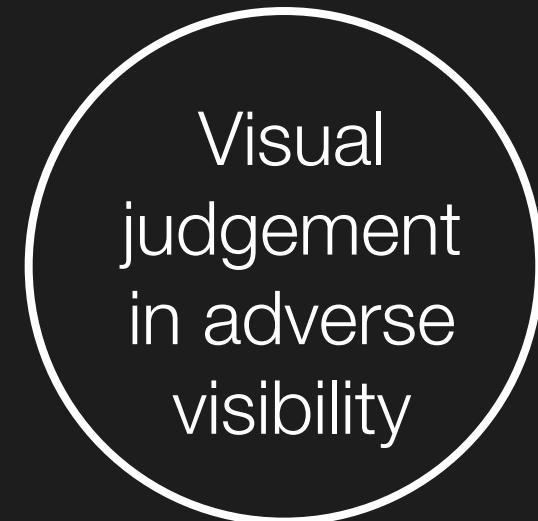


Accent  
correction  
with Artificial  
Intelligence

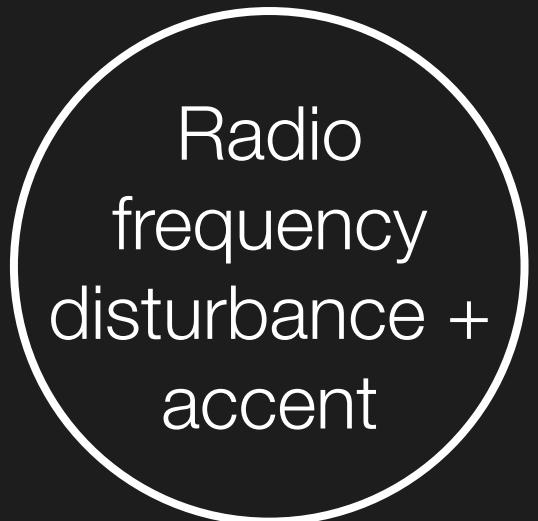
Now



2D radar  
with layers of  
information



Visual  
judgement  
in adverse  
visibility



Radio  
frequency  
disturbance +  
accent

Observe + Orient = Situational Awareness

# Impact

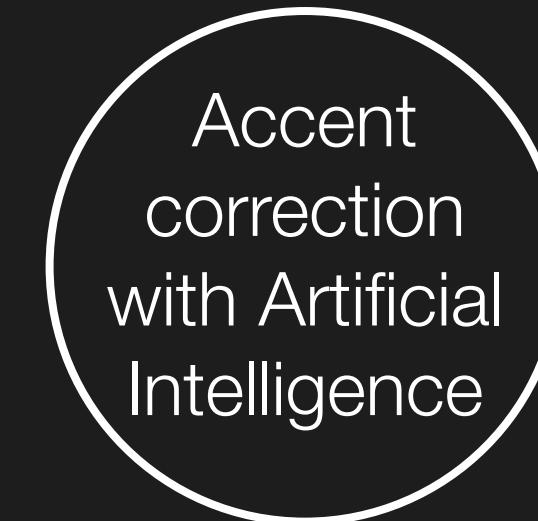
+ 10 Years



3D view in  
ATC radar  
with viewport  
toggle

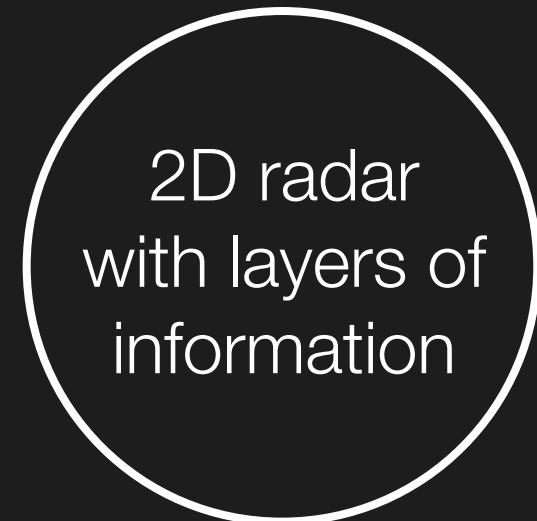


Night Vision  
and Infrared  
Image  
Mapping



Accent  
correction  
with Artificial  
Intelligence

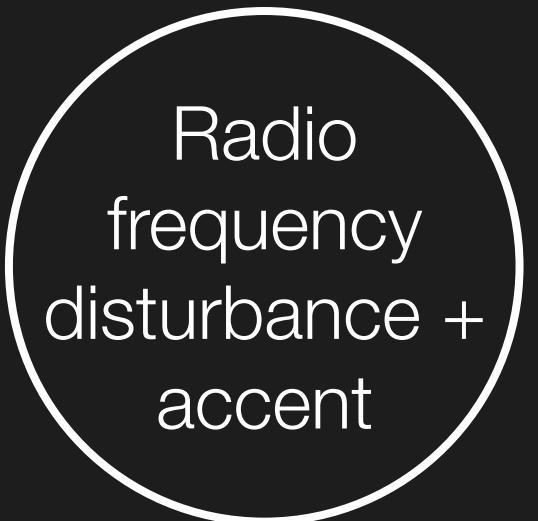
Now



2D radar  
with layers of  
information



Visual  
judgement  
in adverse  
visibility



Radio  
frequency  
disturbance +  
accent

## Observe + Orient = Situational Awareness

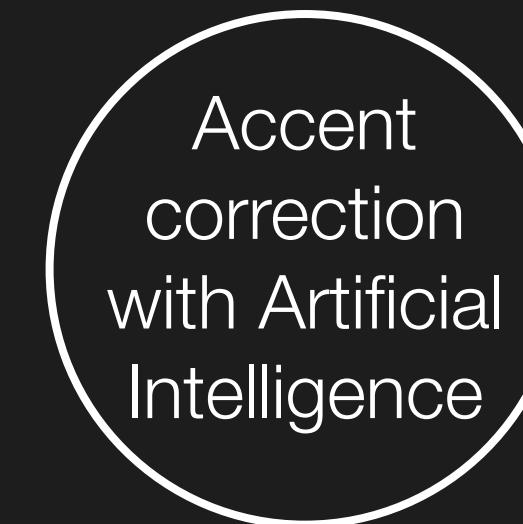
relaxed alert

baseline goals and  
action plans

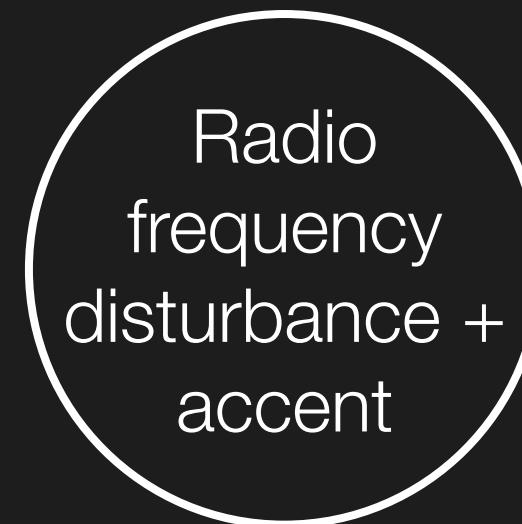
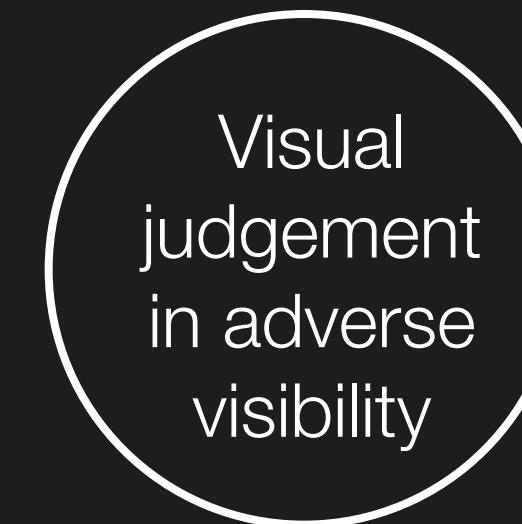
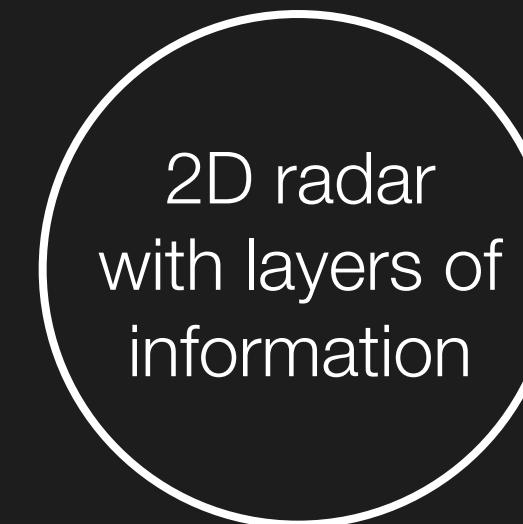
better decision making

# Impact

+ 10 Years



Now



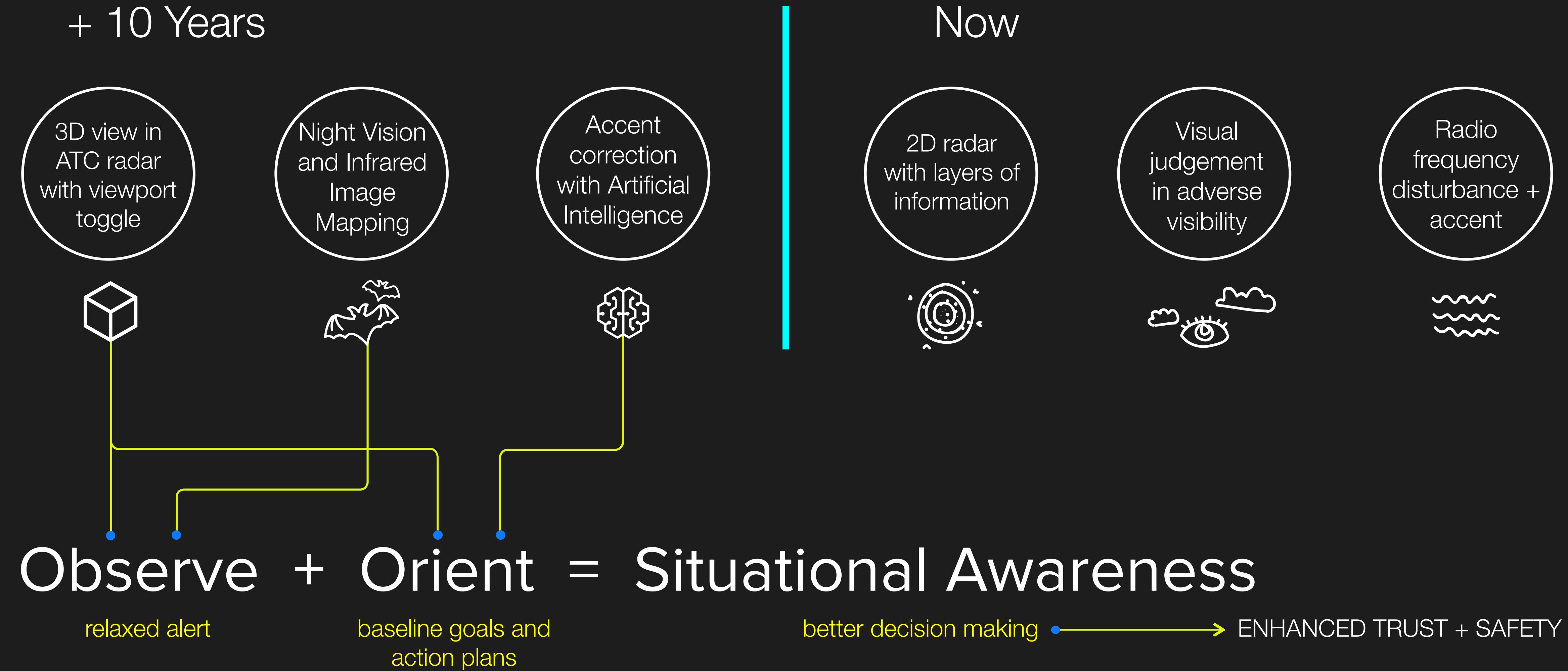
Observe + Orient = Situational Awareness

relaxed alert

baseline goals and action plans

better decision making

# Impact



# VIDEO