

STAIR Talks 2022

29. November 2022

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Aviation and UX

What we can learn
from aviation incidents

ergon

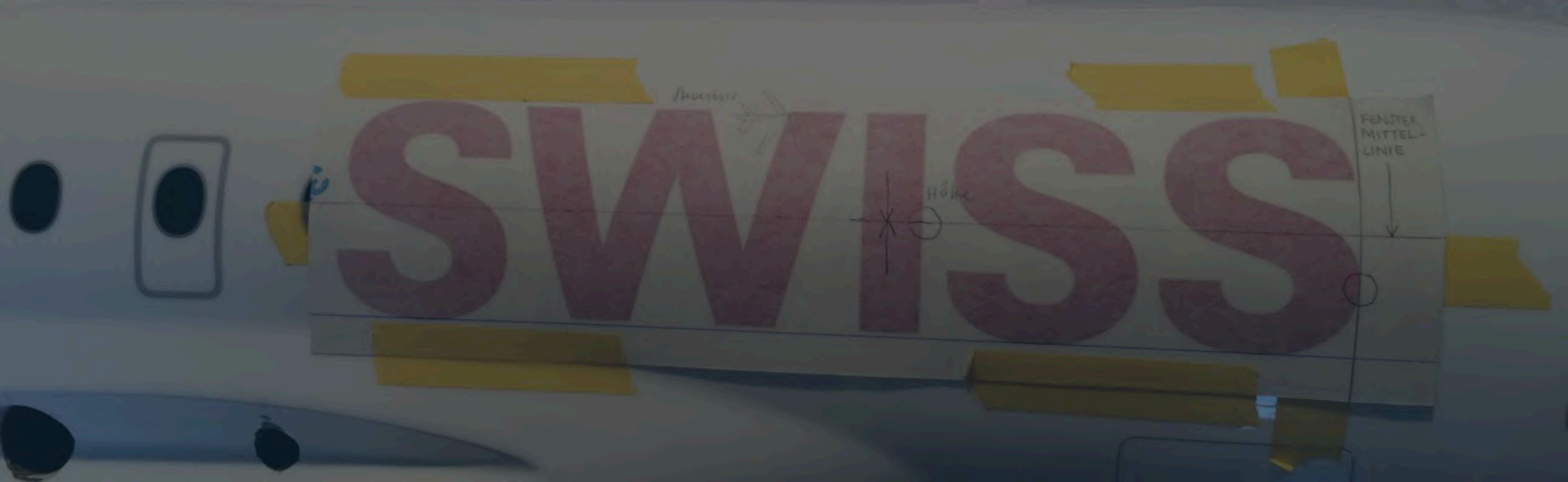
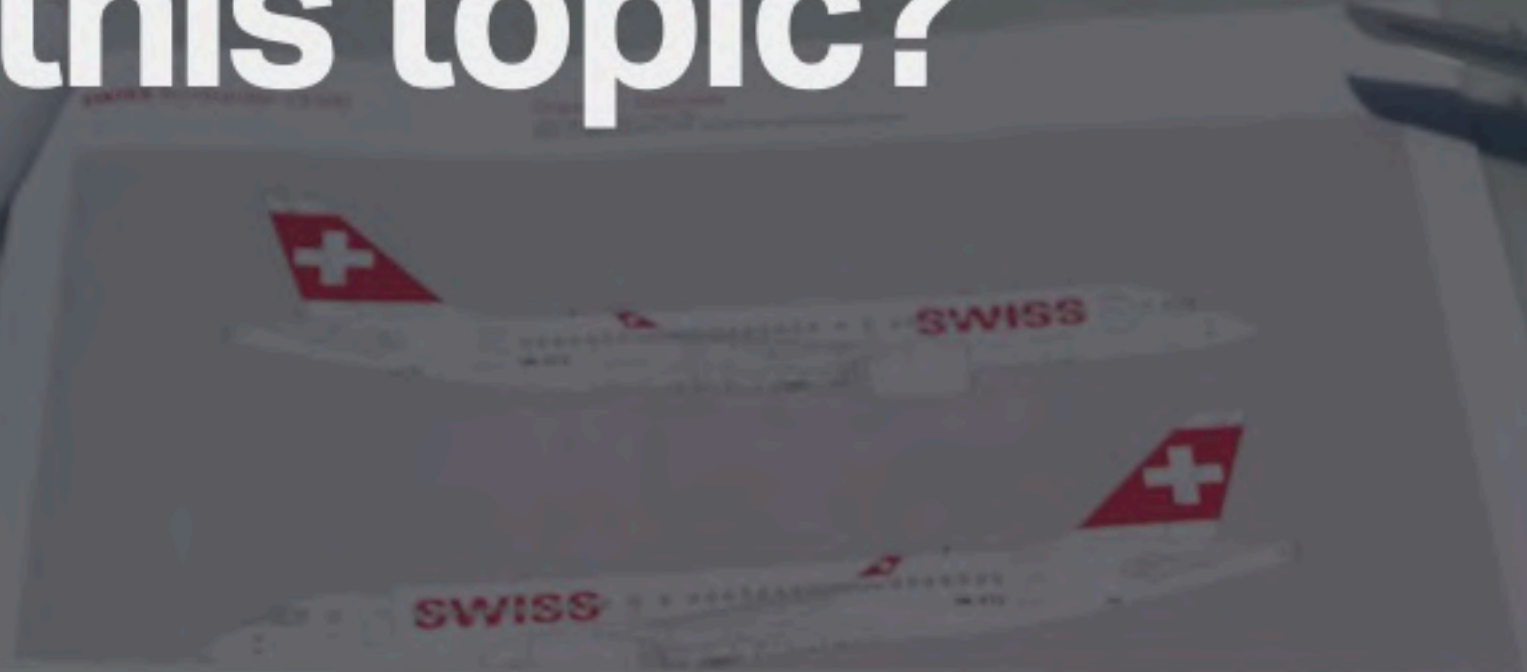
Welcome aboard

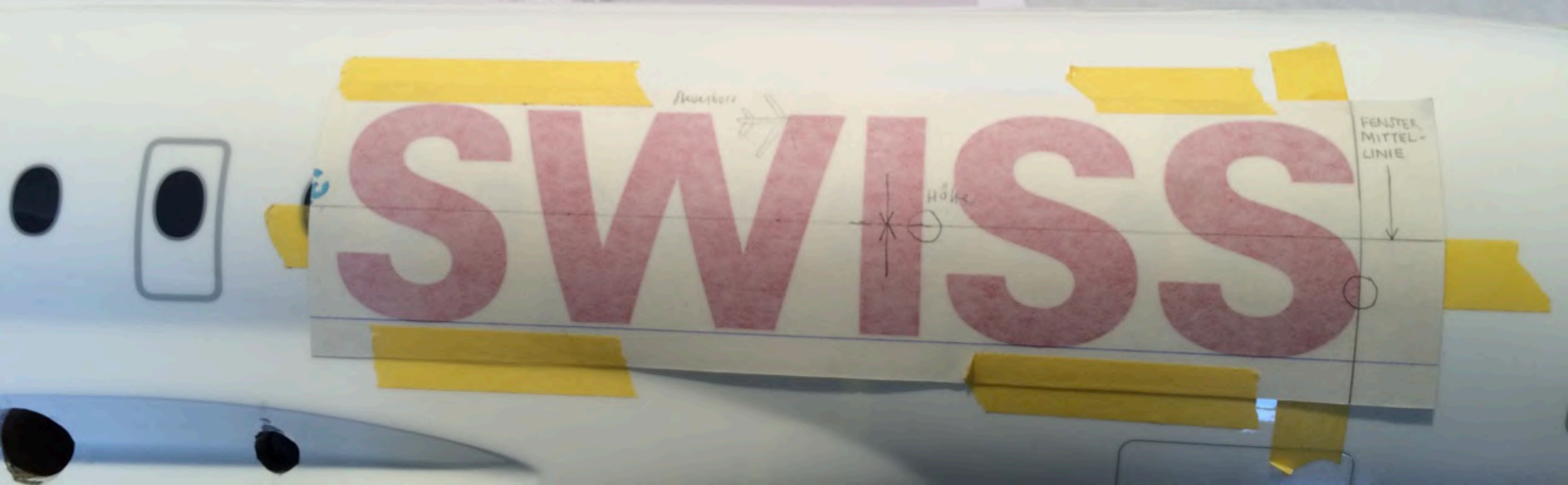


While man still strives,
still must he err.

— Johann Wolfgang von Goethe (Faust)


Why this topic?







**What does that have to do
with UX?**

The background of the slide is an aerial photograph of a vast, flat, light-colored landscape, likely a salt flat or a desert. The terrain is extremely flat and extends to the horizon. The sky is a clear, pale blue. The overall tone is bright and open.

Human factors



World War II

**World War II:
huge advances in innovation**

3000%

increase in airspeeds

3500%

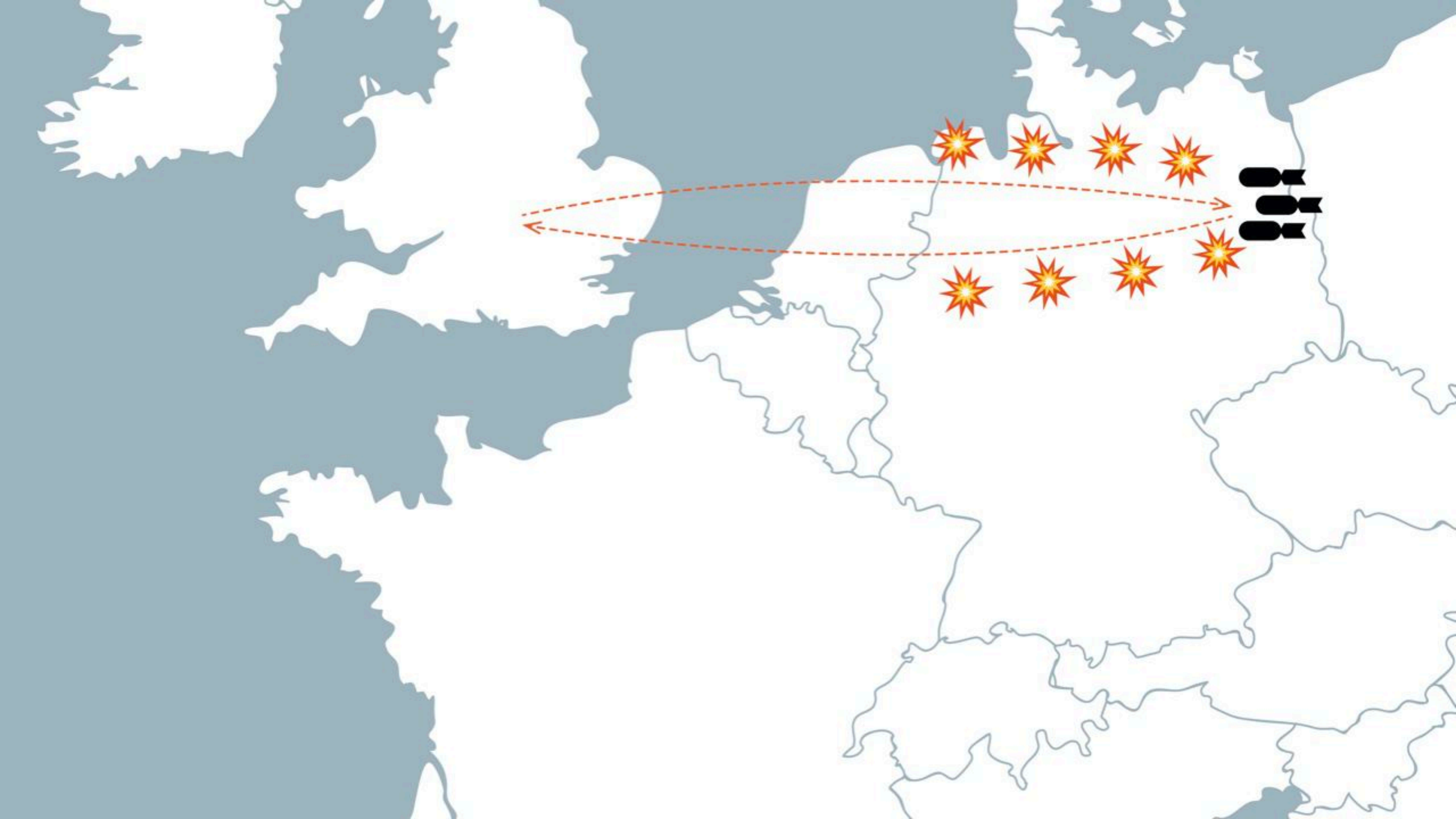
**increase in the number
of controls**

**Significant rise
in the number of accidents
→ Pilot errors**

Boeing B-17F Flying Fortress







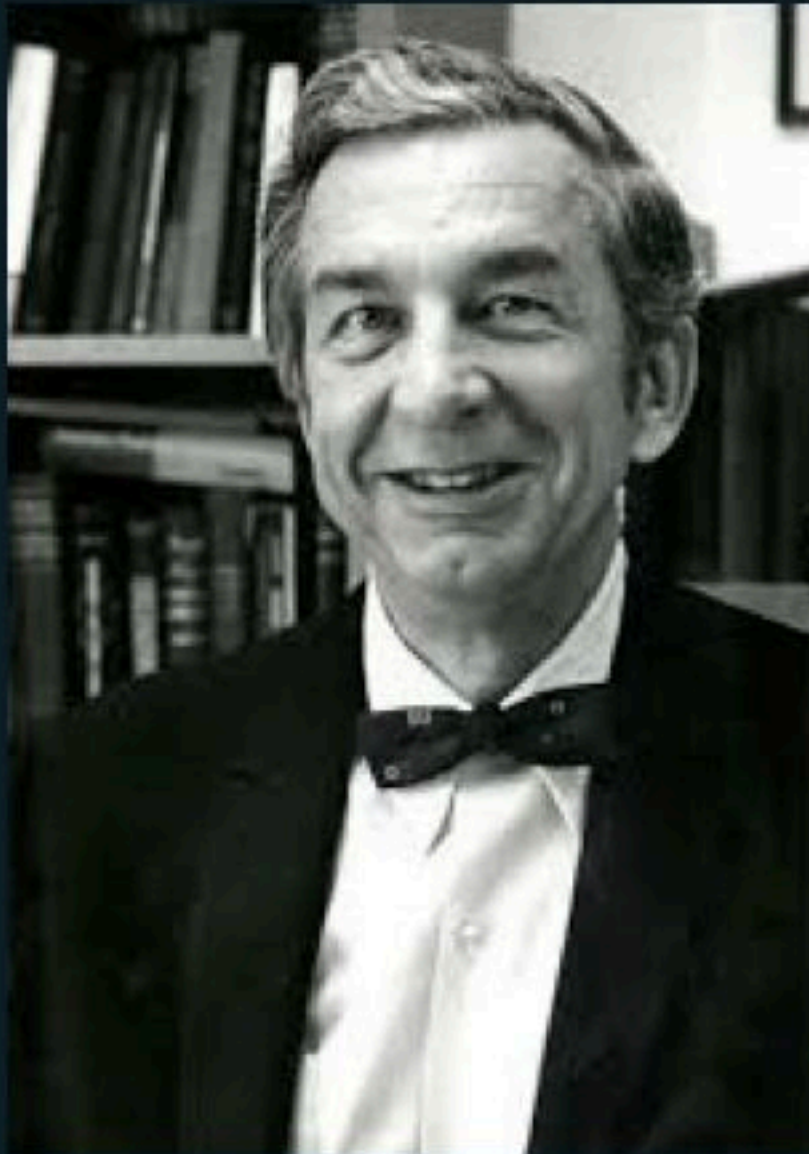


Accidents with the Flying Fortress

- 400 accidents
- Pilots retracted the landing gear upon approach

Alphonse Chapanis

Psychologist, 1917–2002



Study by Alphonse Chapanis

- Cause of failure: poorly designed control panel
- Controls for flaps and landing gear were the same shape
- Controls were close together

1

L ON R

OFF L R

BOTH

AAF TYPE B-5

2

LEFT ENGINES

MASTER IGNITION SWITCH DOES NOT DISCONNECT BATTERIES - BATTERY SWITCHES LOCATED ON GENERATOR PANEL.

3

L ON R

OFF L R

BOTH

AAF TYPE B-5

4

RIGHT ENGINES

FUEL SHUT-OFF VALVE

1 2

OPEN

CLOSED

ON

FUEL BOOST PUMP

OFF

STEADY

OFF RED KEY

AMBER

STEADY

RECOGNITION LIGHTS

OFF GREEN KEY

WHITE

KEY

RECOG. LIGHTS MAX. GROUND OPERATING TIME TEN (10) SEC.

GEAR UP

DOWN

ON LANDING LIGHTS

FLAP UP

FLAP DOWN

WARNING
NEVER EXCEED 147 MPH WITH FLAPS DOWN

COWL FLAP

ADDEL PRECISION PRODUCTS CORP. BURBANK, CALIF. U.S.A.

MODEL: [REDACTED]

PART NO: [REDACTED]

SERIAL NO: [REDACTED]

CUSTOMERS NO: [REDACTED]

U.S. AND FOREIGN PATENTS PENDING

RELIEF VALVE

SPEED CONTROL

LOCKED LOCKED LOCKED LOCKED

CLOSE OPEN CLOSE OPEN CLOSE OPEN CLOSE OPEN

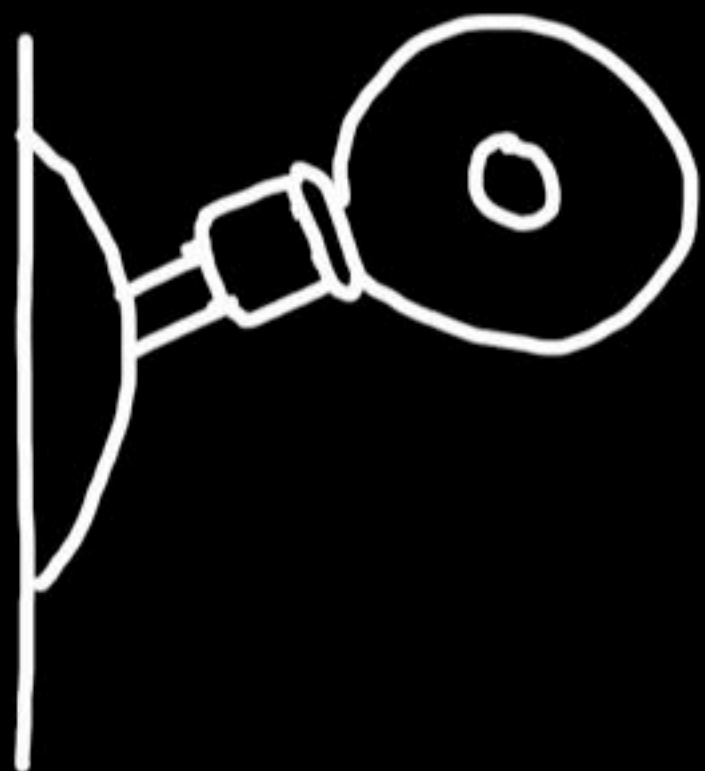
NOTE: PLACE ALL VALVE HANDLES IN LOCKED POSITION AFTER ACTUATING THE FLAPS TO DESIRED POSITION

ENG No 1 ENG No 2 ENG No 3 ENG No 4

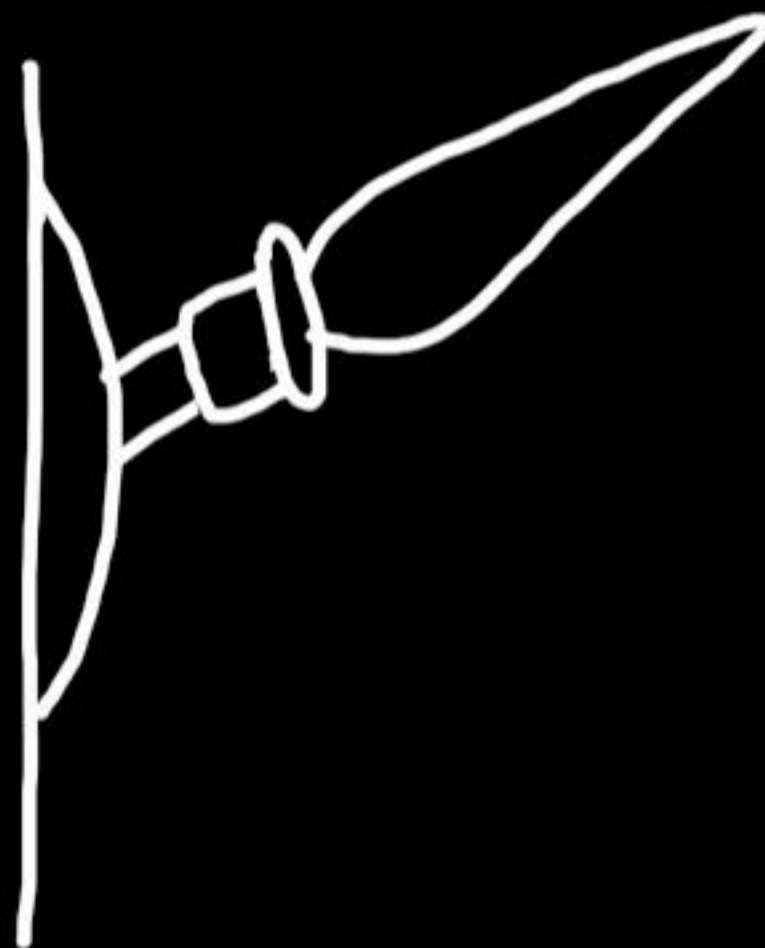
Recipe for disaster



Solution



Landing gear

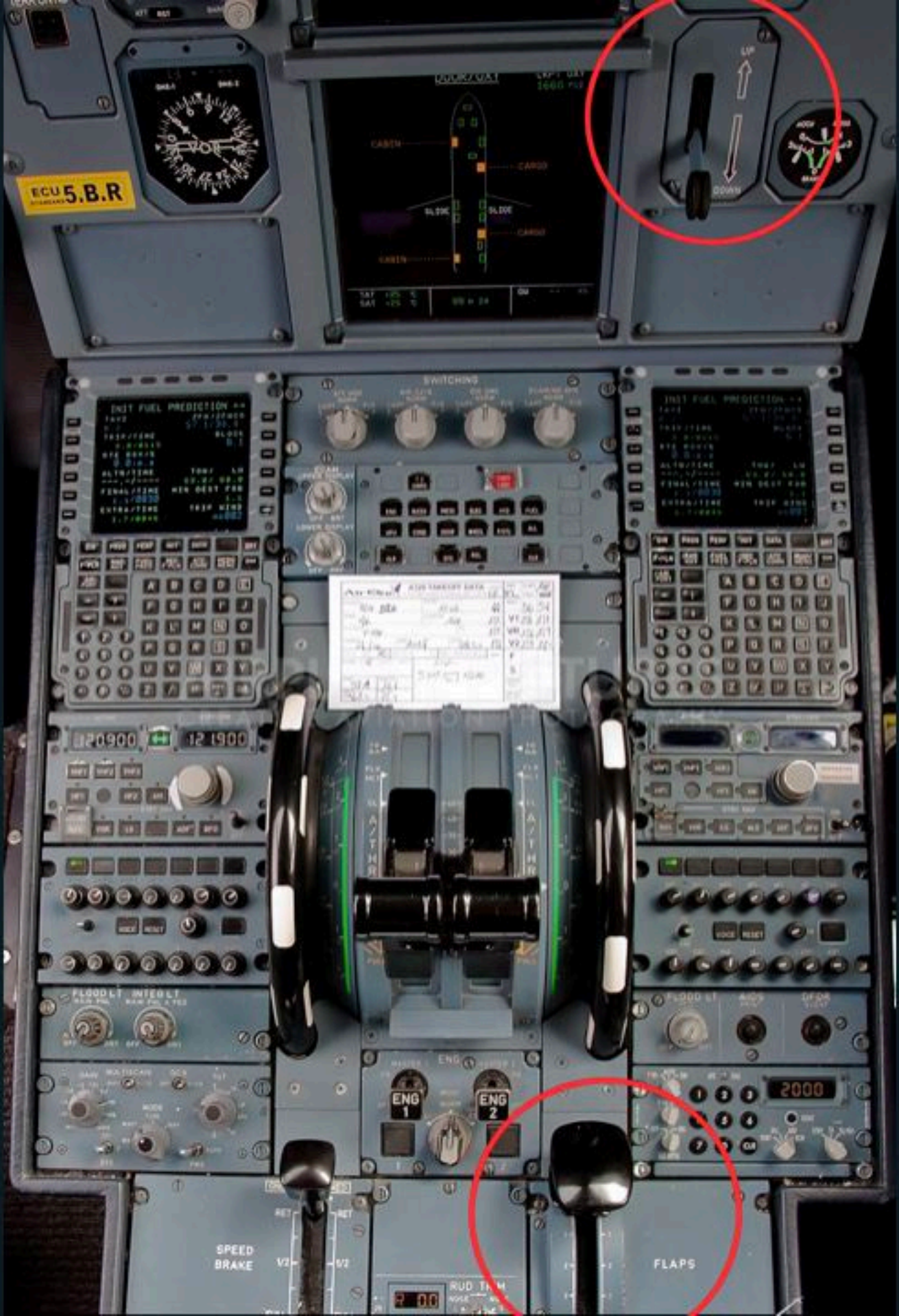


Flaps



Shape coding





Basic principle:

**User research is the foundation
of solid systems engineering.**

Shift in thinking:

Pilot errors → design errors

Human factors

Organisations:

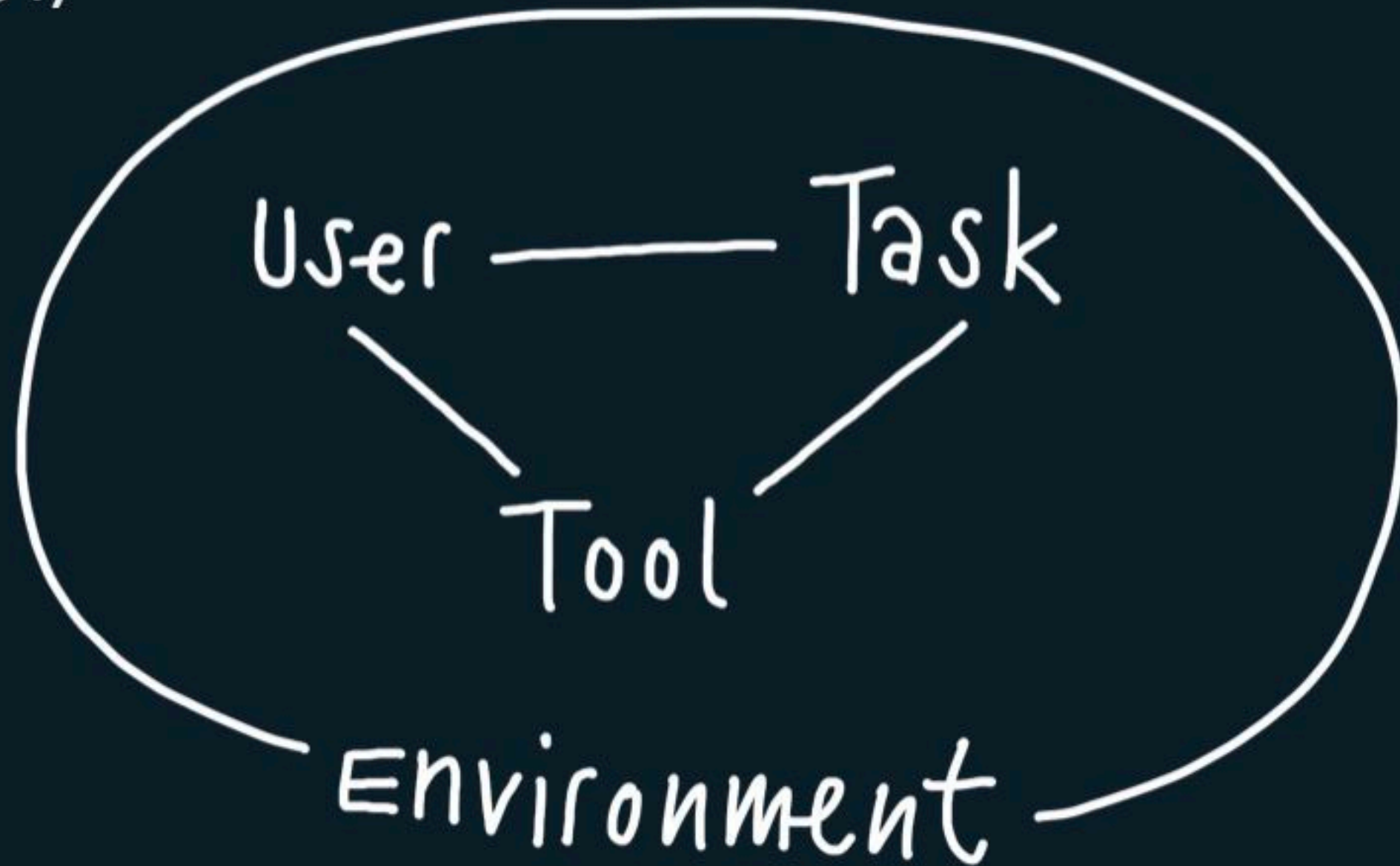
**Socio-
technical
systems**

Improve safety
Ease of use

Model: Shackel

User, task, tool, environment

Brian Shackel (1991)



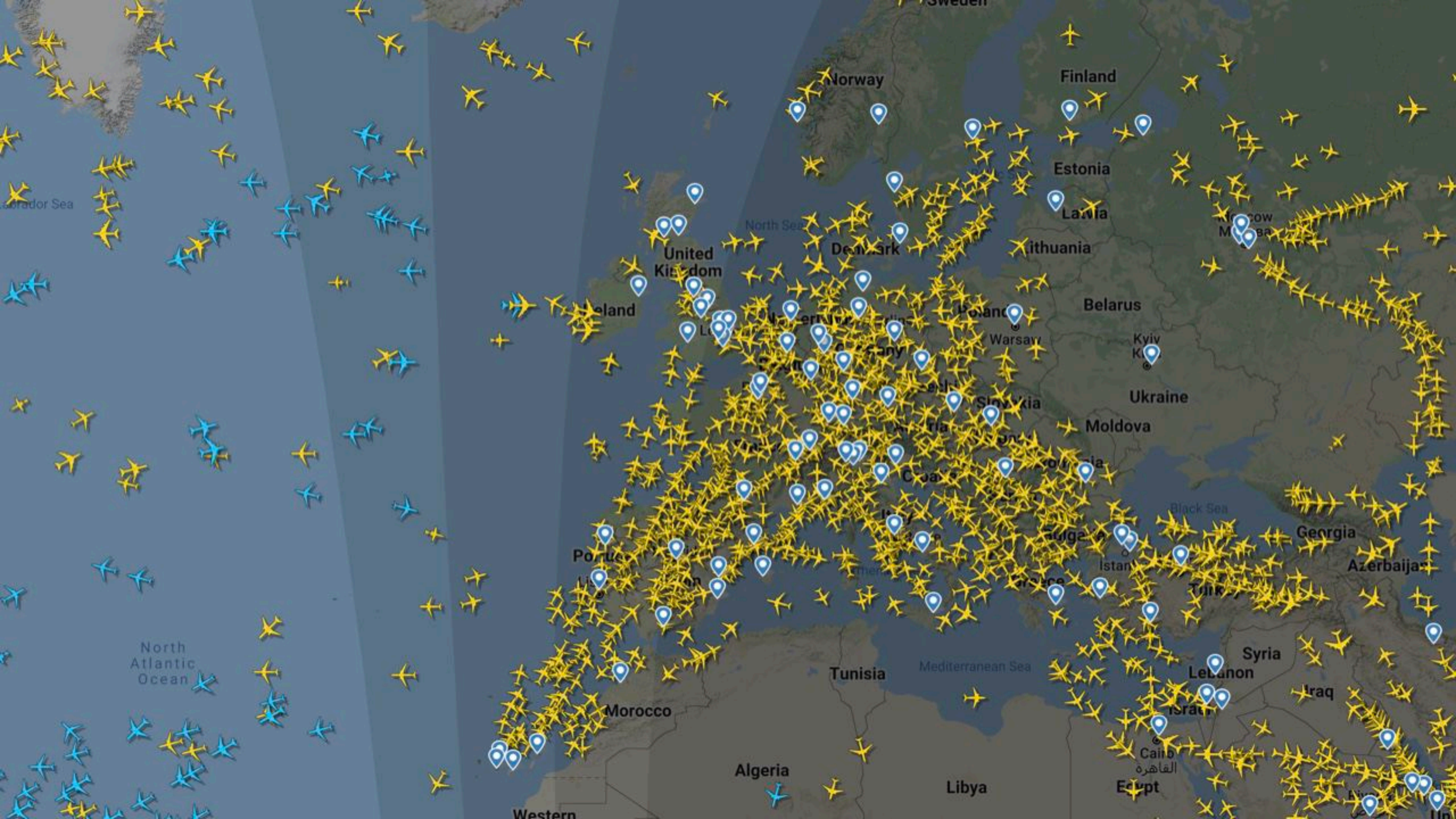


Überlingen

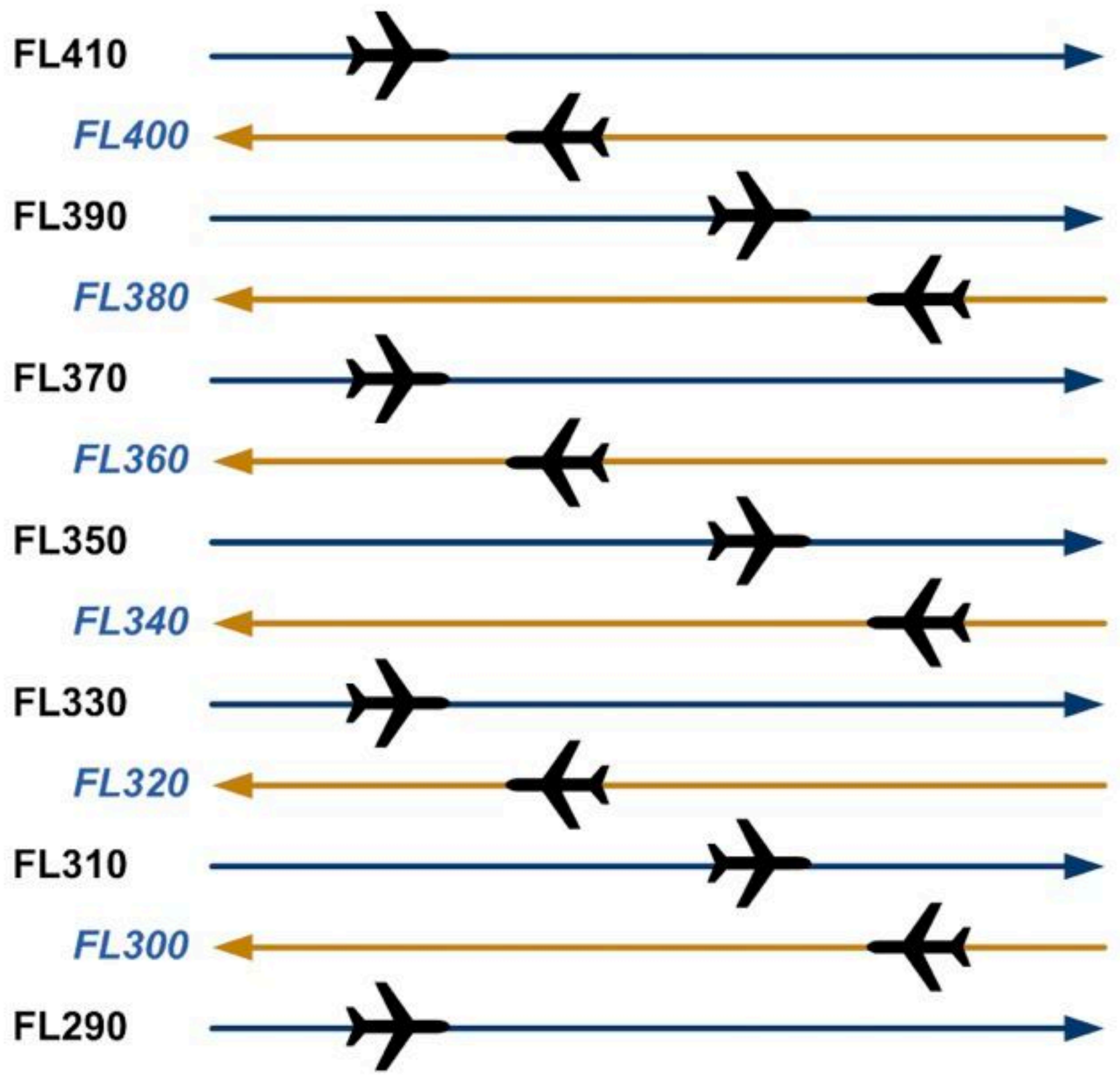
**In the late evening of 1 July 2002,
two aircraft collide
in almost empty airspace.**

How can that happen?

Air routes



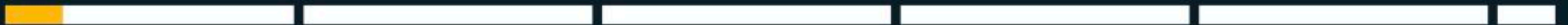
Layers (flight levels)



Sequence of events

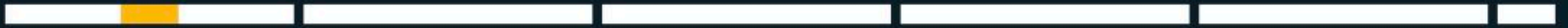
21:10

**The air-traffic controller
is alone in the control room.**



21:13

**The radar system
goes into fallback mode.**



21:21:50

Cargo plane

FL 320

FL 360
FL 350
FL 340
FL 330
FL 320



 Cargo Plane

Between 21:25 and 21:30 A delayed flight must be cleared for landing.




21:26:36

Cargo plane climbing

FL 320 → FL 360



 Cargo Plane

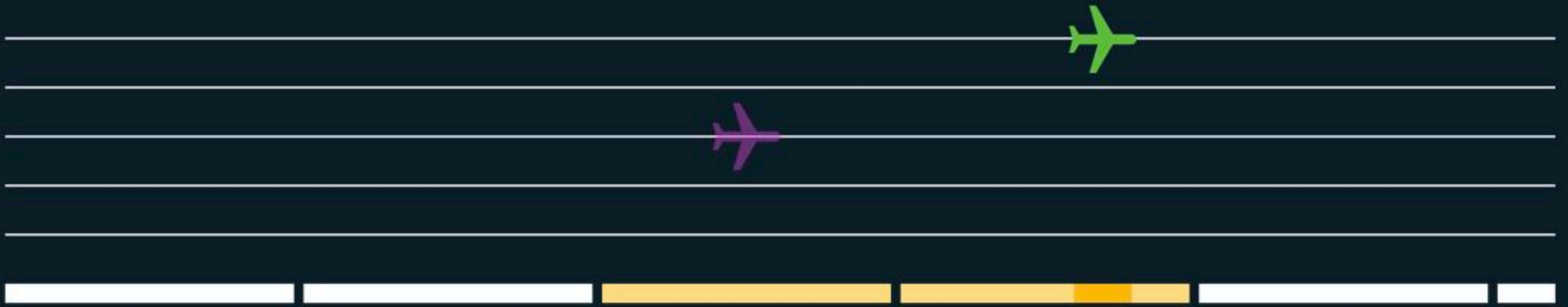
 Aircraft on approach

21:29:36


Cargo plane

FL 360

FL 360
FL 350
FL 340
FL 330
FL 320



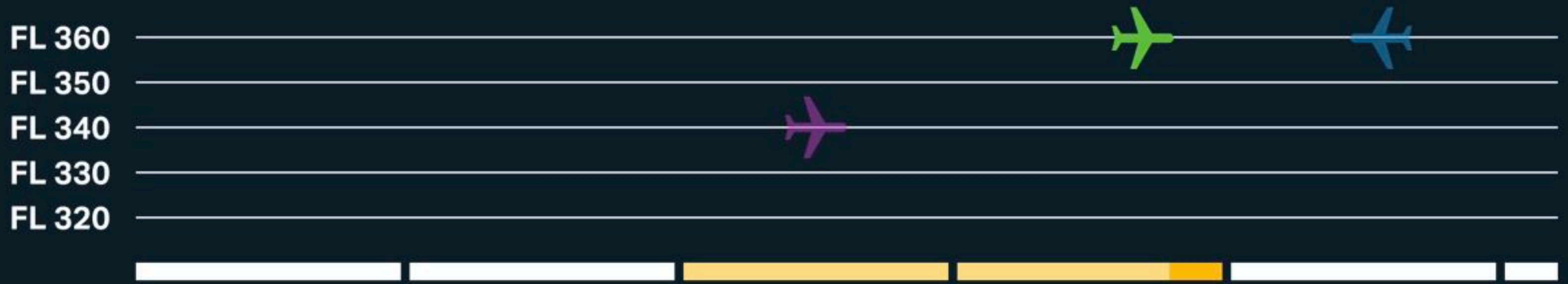
 Cargo Plane

 Aircraft on approach

21:30:11

Passenger aircraft

FL 360



 Cargo Plane

 Passenger aircraft

 Aircraft on approach

The ATCO does not realise that the two aircraft are on a collision course.



21:30 to 21:35

The ATCO is fully taken up with landing clearance.



21:33:00

Passenger aircraft

TCAS notification



Can the accident be averted?



TCAS: Traffic Alert and Collision Avoidance System

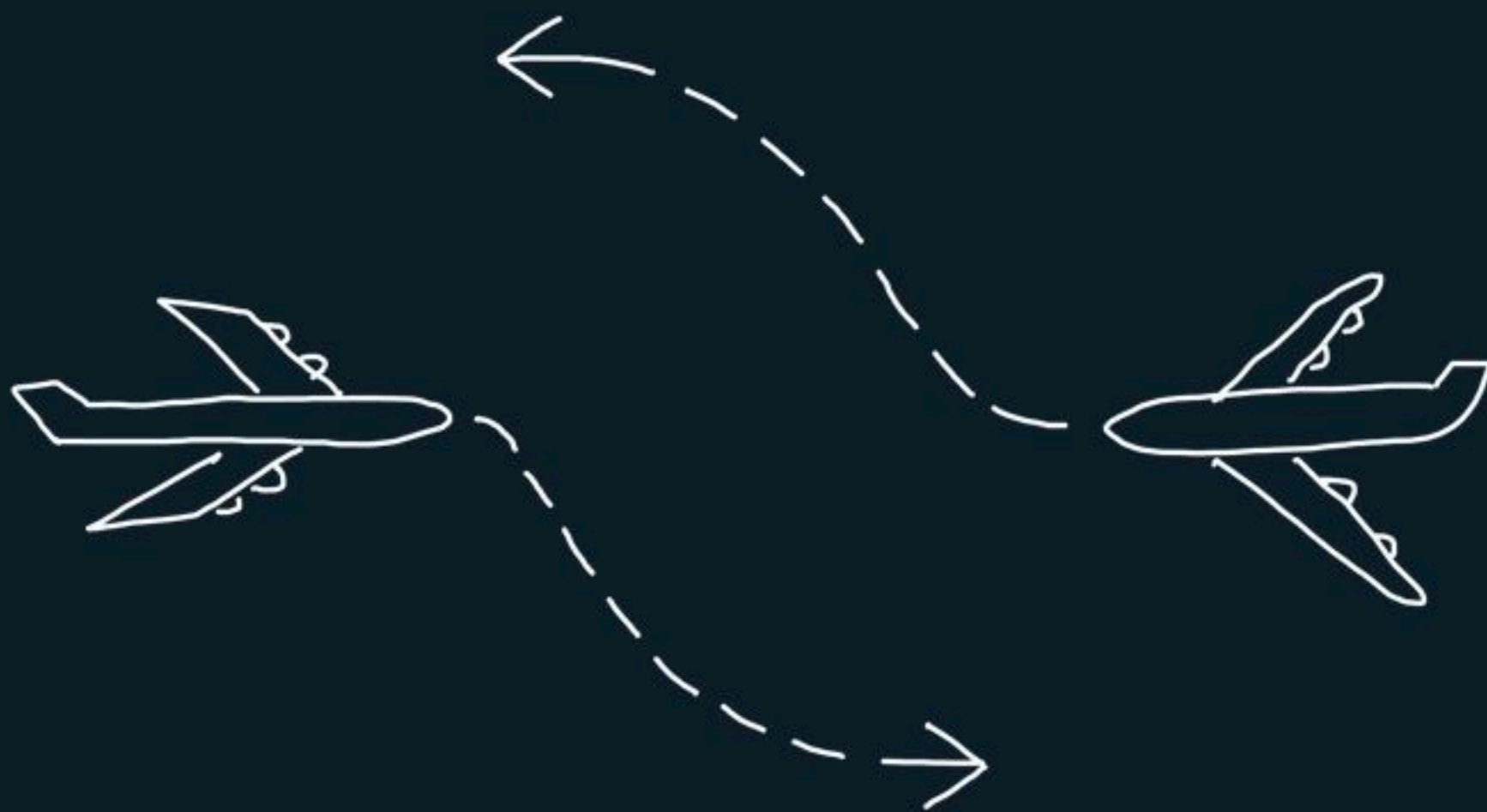
Aircraft on collision course

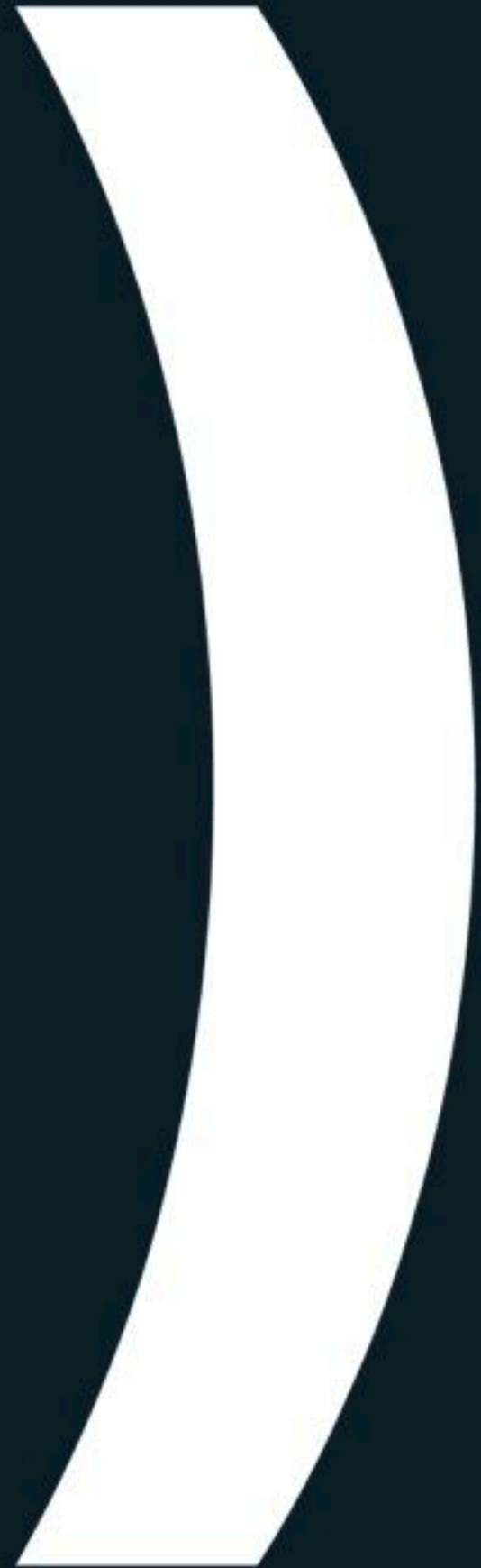


Radarsignal



Conflict resolution





21:33:00

Passenger aircraft

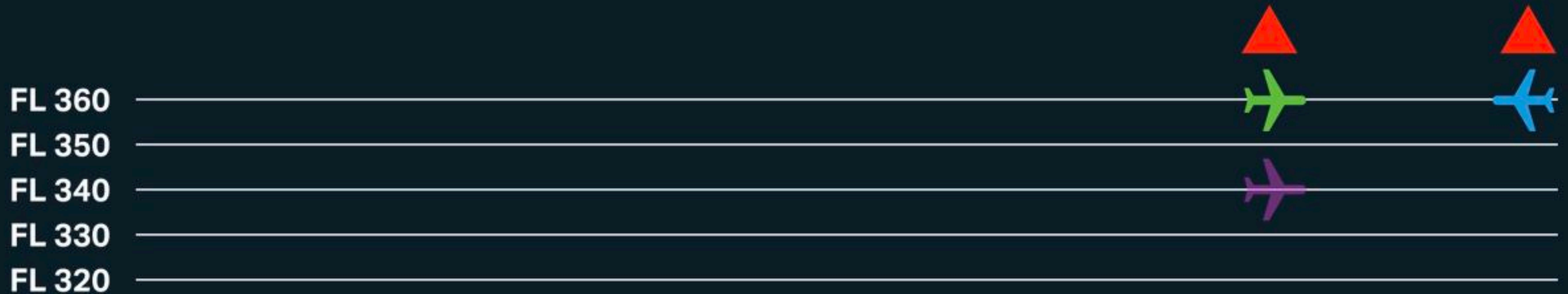
TCAS notification



21:34:42

Both aircraft

TCAS alert



 Cargo Plane

 Passenger aircraft

 Aircraft on approach

21:34:49

ATCO orders passenger aircraft to descend to lower altitude

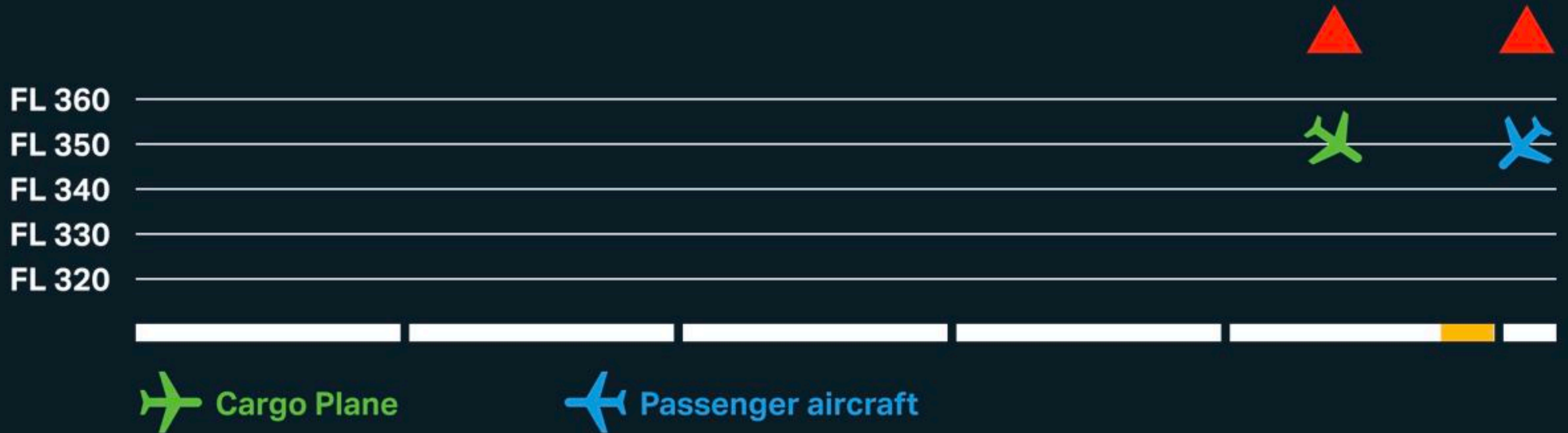


21:34:58

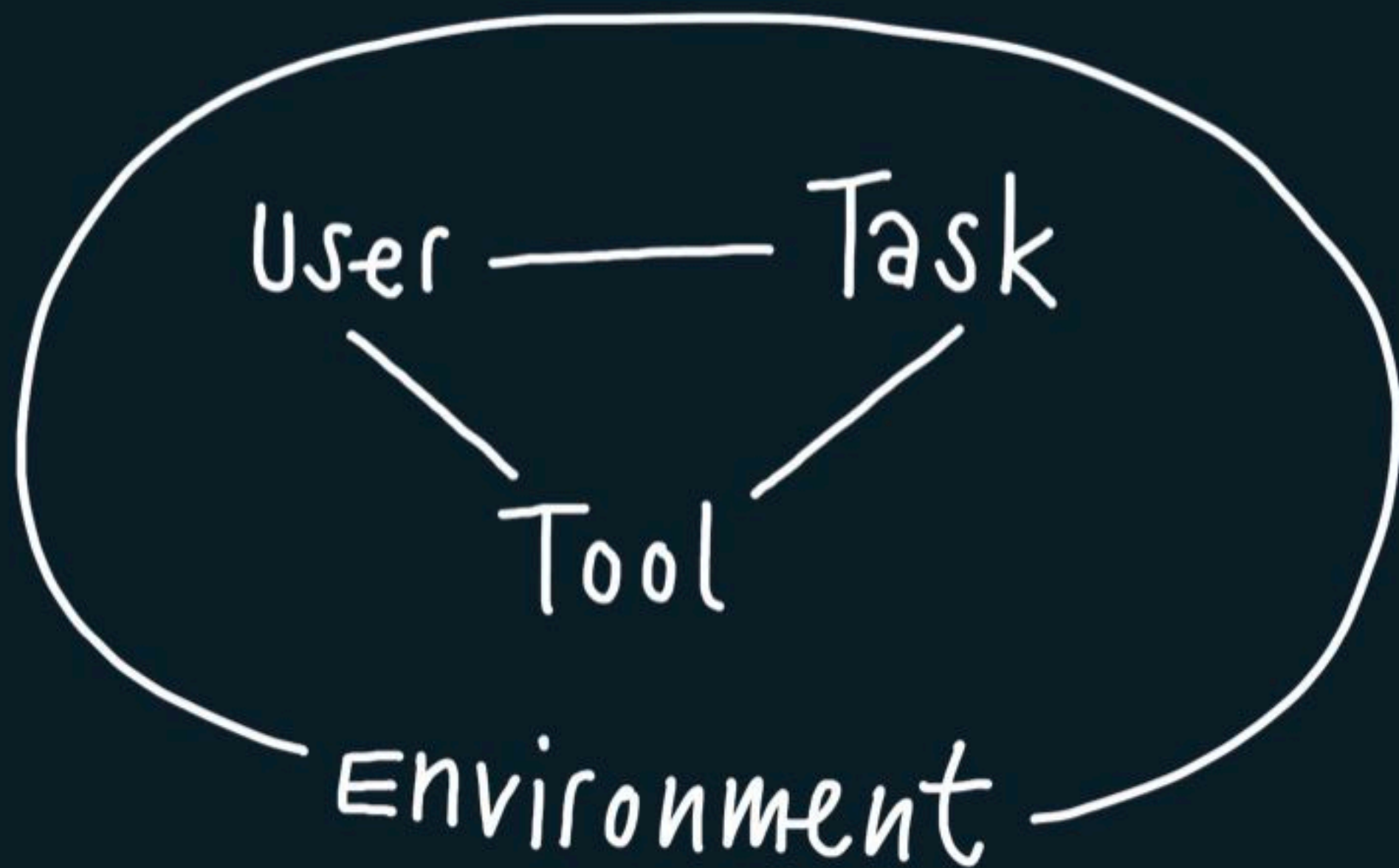
Cargo plane obeys TCAS and begins to descend



Both aircraft are now descending



Shackel



Environment:
Control room

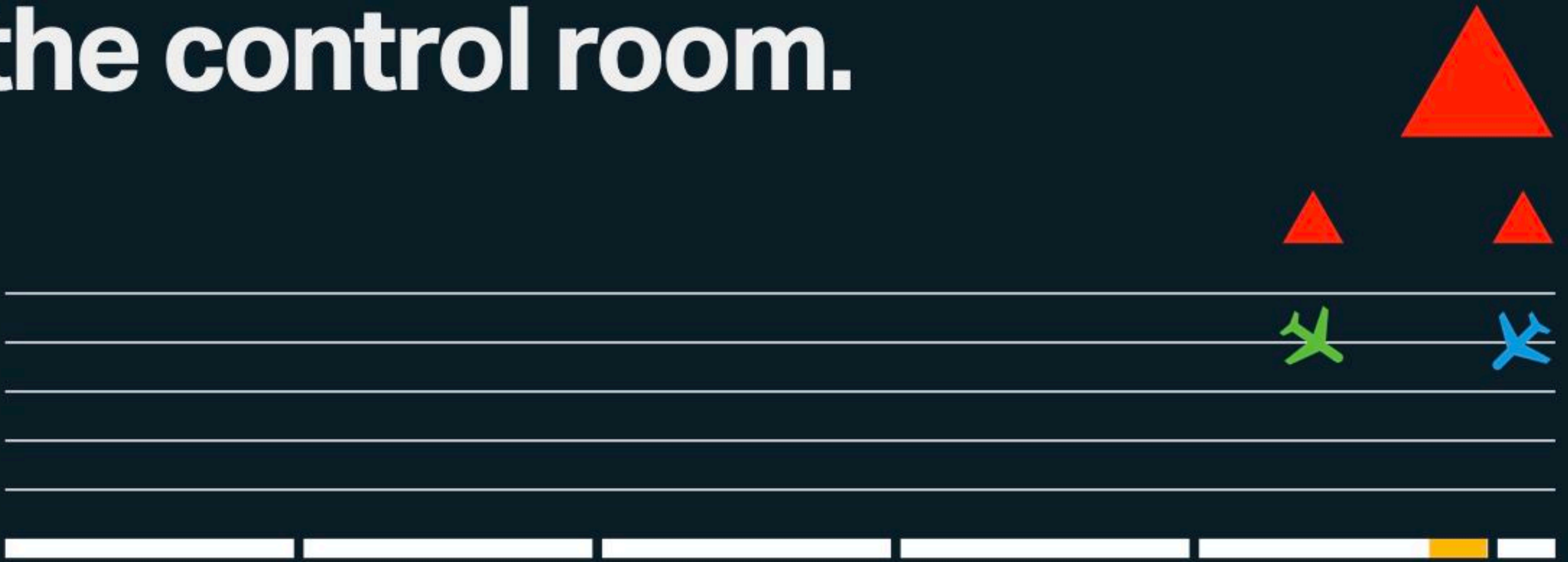
Control room

- ATCO is alone (single manned operation)
- Has three functions
- Must monitor two radar displays
- Must monitor two radio frequencies
- Must roll back and forth between two radar monitoring terminals

21:35:00

An alarm sounds
in the control room.

FL 360
FL 350
FL 340
FL 330
FL 320



 Cargo Plane

 Passenger aircraft

Can the accident be averted?

The ATCO does not notice the alarm.



The ATCO does not notice the alarm.



1 July 2002

21:35:32

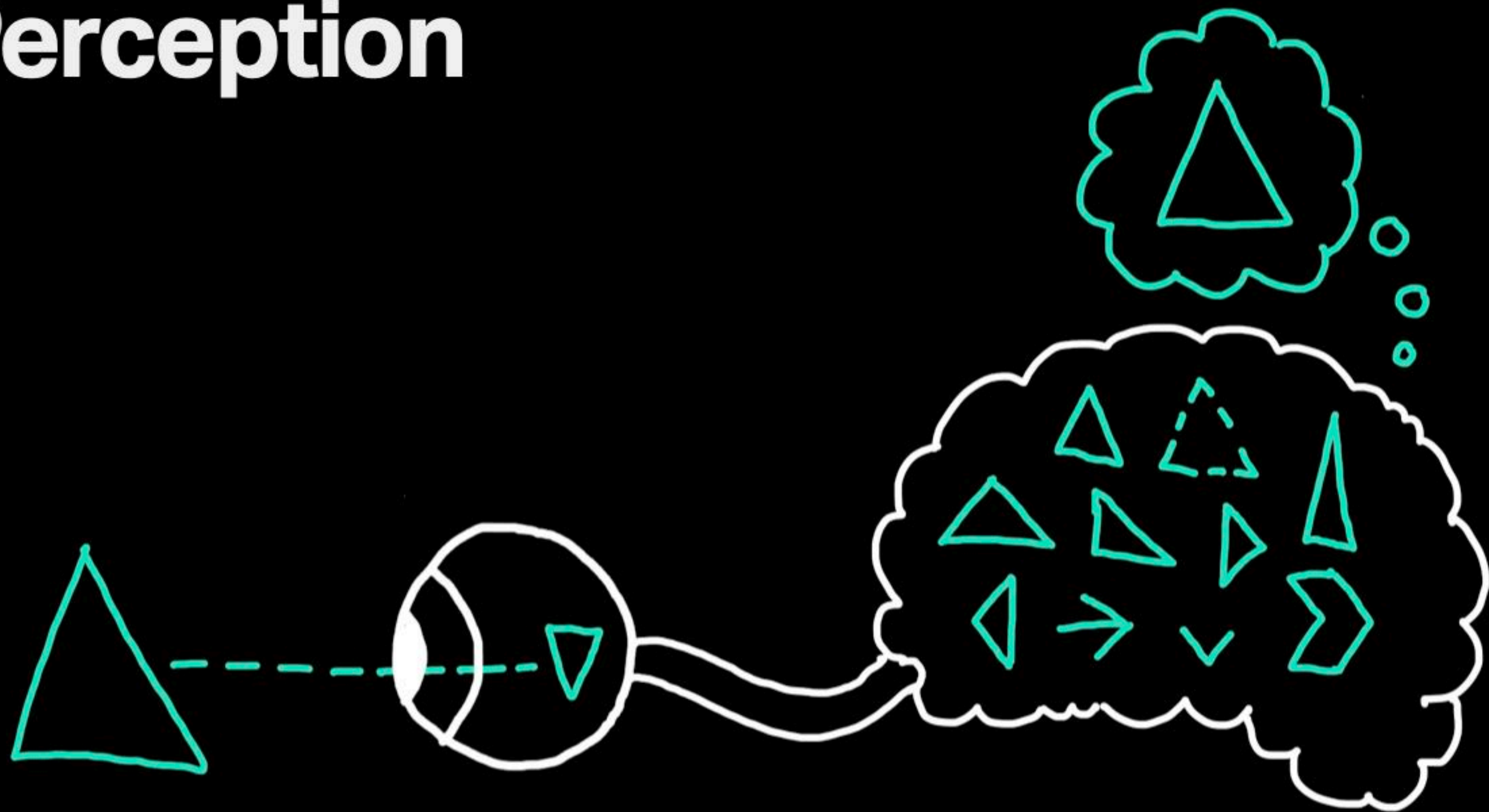


Insights

Überlingen: Mental workload

The scope of conscious human attention is limited. If this limited attention must be divided between several demanding tasks, it is impossible to continuously analyse all of the incoming information in detail.

Perception



**Human perception functions
in exactly the same way
whether you are an expert
or a layperson.**

**There is no such thing as
"expert" perception.**

“That’s expert software.
The user experience doesn’t
have to be so great.”

— Anonymous

Not true

Impact

as a unit of measurement

In complex systems – like nuclear power, health care, or aviation – cognitive engineering can make the difference between life and death.

— Kim Vicente

You have to know why people
behave as they do – and design
around their foibles
and limitations.

— Cliff Kuang

Human-centred software engineering



Nope

ISO 9241-210:2010

**A process for designing usable
interactive systems**

ISO 9241-210:2010

**A process for designing usable
interactive systems**

**Principles of
human-centred design**

User Research

Engage

Examine

Establish

3

Take-aways

1

**The technology must
adapt to human behaviours.
Not the other way around.**

2

Perception is a physiological and a psychological process.

3

**Software is always used
in a context.**



TLD

CA

Line Maintenance

No Ladders

**We need to be interested
in this context.**

**We need to be interested
in this context.**

**We owe that to the people
who use our software.**

Thank you

Danke

Grazia fitg

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29. November 2022

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ergon

Dein Berufseinstieg ins Software Engineering...

Praktikum

Berufserfahrung nach
abgeschlossenem Bachelor

Pensum: 100%

Dauer: min. 5 Monate

Werk- studium

Berufserfahrung nach
abgeschlossenem
Praktikum oder
während dem Master

Pensum: Teilzeit

Dauer: nach Absprache

Fest- anstellung

Training, Betreuung und
Weiterentwicklung
bestehender Lösungen,
um sich kontinuierlich
an verändernde Markt-
bedingungen und Geschäfts-
prozesse anzupassen.

Warum ein Praktikum bei Ergon?

Abwechslungsreich

1:1 Betreuung durch
einen Senior Software
Engineer

Vollwertiges
Teammitglied

Rundum-Einblick in die
IT-Arbeitswelt

Selbstständiges Arbeiten

Über sich hinauswachsen

Anspruchsvolle &
spannende Projekte

Echten Kundennutzen
liefern

Netzwerk fürs
Berufsleben aufbauen



Unsichtbar
und doch im Alltag
vorfindbar



Engineering ist doch nicht so ganz deins?

Software Testing

Du stellst die Qualität unserer Software durch systematisches Testen und kritisches Hinterfragen sicher.

1. Basisjahr
 - Pensum im ersten Jahr: min. 60%
 - Umfassende Testing-Ausbildung in unserer Academy
2. Danach Werkstudium (i.d.R. befristet bis Ende Studium) oder Festanstellung (unbefristet)

Consulting

Du begleitest komplexe Projekte von der Idee bis zur Markteinführung und führst als Teil eines interdisziplinären Projektteams unsere Kund:innen zum Erfolg.

- Nach abgeschlossenem Studium
- Pensum: Vollzeit
- unbefristet



Ergon Mobil



Gratis Drinks & Snacks



2 Wochenendausflüge



In-house Yoga



**Kaffeemaschinen/
Pausenräume**



Weiterbildungsangebot



ÖV-Zustupf



Velo-Beitrag



Game Nights



Brown Bag Events



Thirsty Thursday



Wähle deine Hardware

**Ergon entwickelt sich
laufend weiter,
unser Angebot ebenfalls.**

#stayintouch