



# PILOT TRAINING ON THE STARTLE FACTOR

EAC Safety Forum  
Bruxelles, 7 & 8 June 2023

Florence BURATTO  
Michel RICHARME

An aerial photograph showing a vast, hazy landscape. In the foreground, there's a large body of water, possibly a lake or a wide river, with some smaller water bodies and marshy areas. The middle ground is filled with a dense, hazy expanse of land, likely a forest or a large agricultural area. In the far distance, a range of mountains is visible under a clear blue sky. The overall scene is bright and expansive, with a sense of vastness and openness.

**Startled?**



System Alert?

Turbulence?

Loud Noise?

**Startled?**

Traffic Alerts?

Lightning?

Bird Strike?



# Agenda

---

**1** Let's Define

---

**2** What Do the Pilots Tell Us?

---

**3** Some Startle Effects

---

**4** Manufacturer Data for EBT

---

**5** Manufacturer Analysis for  
Training Recommendations

---

**6** Conclusion

# Surprising Event

Human exposure to a sudden, intense event that violates the pilot's expectations



In 1 second:

## Startle Bodily Response

Spontaneous and uncontrollable physiological and cognitive reactions

If insidious danger

If danger confirmed



## Stress/Fear

Strong and unpleasant emotion caused by a real or imagined danger

Stress,  
Light Apprehension

Fear, Panic and  
Petrification

0

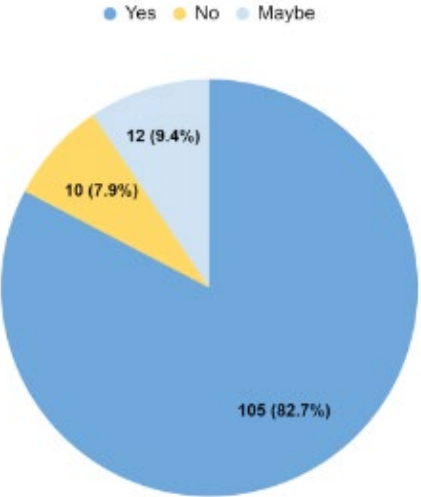
No Survival Risk

10

Perceived Survival Risk

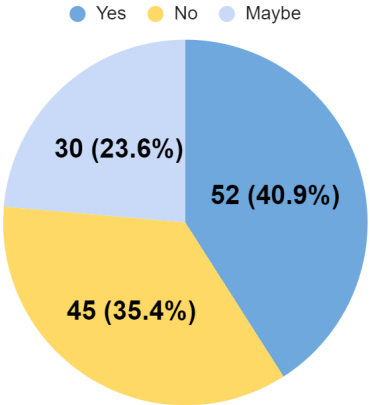
# First Results from Our Survey (in Progress)

Have you ever experienced surprising events during operations?



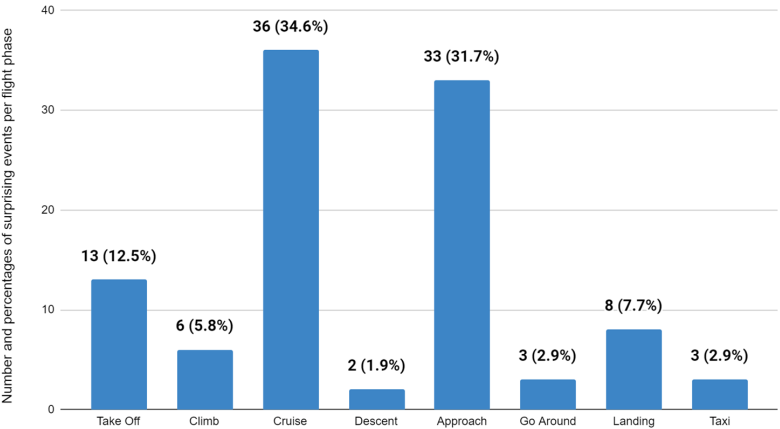
In this (these) event(s), did you detect you were startled?

Percentage of pilots who have detected being startled



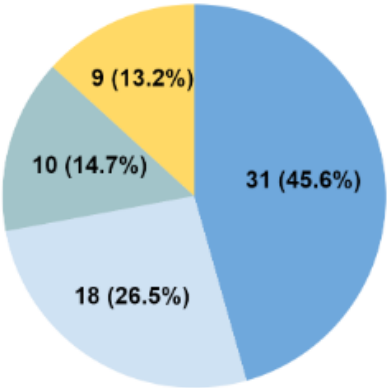
In which flight phases?

Distribution of surprising events per flight phases



How did you recognize the startle effect on you?

● Physiological ● Cognitive ● Emotional ● General



On the experienced surprising events

On the recognition of the startle effects

# SOME STARTLE EFFECTS

---

# Examining Startle

Why?

## Precipitated Reaction

Act quickly without thought

## Preservation Reaction

Duck attitude/Back-forward reaction

**Body mobilized** to react quickly and prior to understanding (muscle constrictions, breathing, heart rate,...)





# Examining Startle

Why?

## Precipitated Reaction

Act quickly without thought

## Preservation Reaction

Duck attitude/Back-forward reaction

## Overreaction

Excessive inputs

**Body mobilized** to react quickly and prior to understanding (muscle constrictions, breathing, heart rate,...)

**Body boosts the fibers in the large muscles** that are linked to simple, strong and symmetrical moves

# Examining Startle



**Why?**

## **Precipitated Reaction**

Act quickly without thought

## **Preservation Reaction**

Duck attitude/Back-forward reaction

## **Overreaction**

Excessive inputs

## **Mini-Freeze**

No reaction

**Body mobilized** to react quickly and prior to understanding (muscle constrictions, breathing, heart rate,...)

**Body boosts the fibers in the large muscles** that are linked to simple, strong and symmetrical moves

**Disruption of the cognitive process** to set-up a startle response



# Examining Startle



**Why?**

## **Precipitated Reaction**

Act quickly without thought

## **Preservation Reaction**

Duck attitude/Back-forward reaction

## **Overreaction**

Excessive inputs

## **Mini-Freeze**

No reaction

## **Group Preservation**

Scream

**Body mobilized** to react quickly and prior to understanding (muscle constrictions, breathing, heart rate,...)

**Body boosts the fibers in the large muscles** that are linked to simple, strong and symmetrical moves

**Disruption of the cognitive process** to set-up a startle response

## **Alert Group of Danger**

Scream of 1 individual activates other people's fear circuits in the brain

# Examining Startle



**Why?**

## **Precipitated Reaction**

Act quickly without thought

## **Preservation Reaction**

Duck attitude/Back-forward reaction

## **Overreaction**

Excessive inputs

## **Mini-Freeze**

No reaction

## **Group Preservation**

Scream

## **Visual Focus to Infinity**

No vision within 2 meters

**Body mobilized** to react quickly and prior to understanding (muscle constrictions, breathing, heart rate,...)

**Body boosts the fibers in the large muscles** that are linked to simple, strong and symmetrical moves

**Disruption of the cognitive process** to set-up a startle response

## **Alert Group of Danger**

Scream of 1 individual activates other people's fear circuits in the brain

**Muscles controlling vision** relax for a few seconds

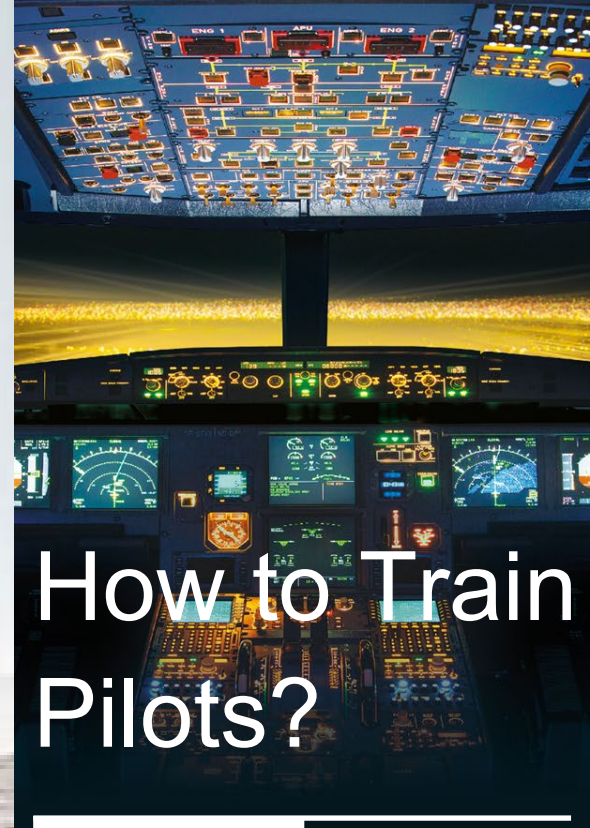




**Pilots are humans first**

**Difficult to go against DNA**

**People react differently to the same danger or situation**



**How to Train  
Pilots?**

**AIRBUS**

# Evidence Based Training (EBT): A Data-Driven Training

- An EBT program is based on:
  - ❑ Operator's operational data (FDA)
  - ❑ Training data (ATO)
  - ❑ Other data (Pilot population...)



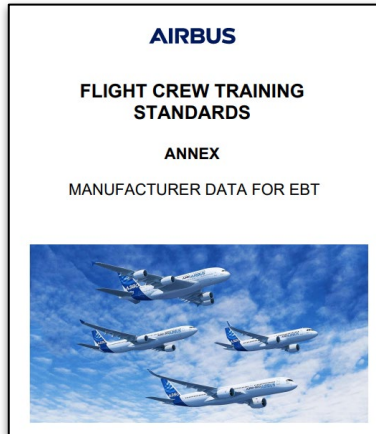
From  
Operator  
Experience  
to Training

Manufacturer Data for  
EBT

**AIRBUS**

# Evidence Based Training (EBT): A Data-Driven Training

- An EBT program is based on:
  - ☐ Operator's operational data (FDA)
  - ☐ Training data (ATO)
  - ☐ Other data (Pilot population...)
  - ☐ **Manufacturer data** based on:

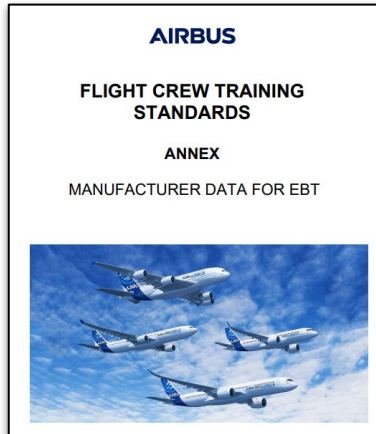


Manufacturer Data for  
EBT

AIRBUS

# Evidence Based Training (EBT): A Data-Driven Training

- An EBT program is based on:
  - ☐ Operator's operational data (FDA)
  - ☐ Training data (ATO)
  - ☐ Other data (Pilot population...)
  - ☐ **Manufacturer data** based on:



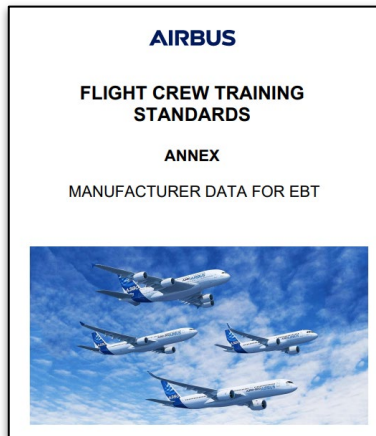
- ☐ The experience of numerous operators
- ☐ Different contexts of operations (short/long range flights, low costs carriers, etc.)
- ☐ Variety of environment (high terrain, specific weather conditions) in worldwide operations.





# Evidence Based Training (EBT): A Data-Driven Training

- An EBT program is based on:
  - ☐ Operator's operational data (FDA)
  - ☐ Training data (ATO)
  - ☐ Other data (Pilot population...)
  - ☐ **Manufacturer data** based on:



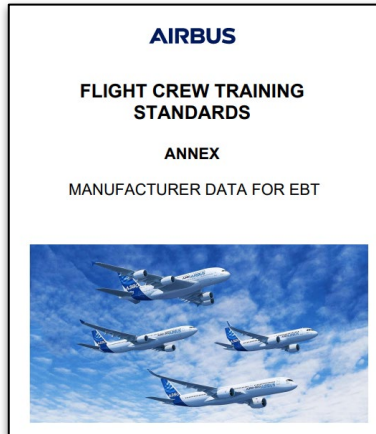
- ☐ The experience of numerous operators
- ☐ Different contexts of operations (short/long range flights, low costs carriers, etc.)
- ☐ Variety of environment (high terrain, specific weather conditions) in worldwide operations.

- Multiple sources of data:
  - ☐ Enrich the variety of training items and scenarios
  - ☐ Expose pilots to various and non expected training scenarios.



# Evidence Based Training (EBT): A Data-Driven Training

- An EBT program is based on:
  - ☐ Operator's operational data (FDA)
  - ☐ Training data (ATO)
  - ☐ Other data (Pilot population...)
  - ☐ **Manufacturer data** based on:



- ☐ The experience of numerous operators
- ☐ Different contexts of operations (short/long range flights, low costs carriers, etc.)
- ☐ Variety of environment (high terrain, specific weather conditions) in worldwide operations.

- Multiple sources of data:
  - ☐ Enrich the variety of training items and scenarios
  - ☐ Expose pilots to various and non expected training scenarios.

**Reinforcement of pilot's confidence to cope with unexpected events**



# Training Analysis of Events with Startle and Surprise Factors

- Example of data received from operators:



From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

AIRBUS

# Training Analysis of Events with Startle and Surprise Factors

- Example of data received from operators:
  - ❑ Overspeed events associated with not appropriate pilot reactions:
    - ❑ Light speed incursions in overspeed
    - ❑ Associated with overspeed aural warning
    - ❑ Sudden and full back stick input
    - ❑ Rapid engine thrust reduction to idle, without subsequent thrust readjustment.



From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

AIRBUS



# Training Analysis of Events with Startle and Surprise Factors

- Example of data received from operators:
  - ❑ Overspeed events associated with not appropriate pilot reactions:
    - ❑ Light speed incursions in overspeed
    - ❑ Associated with overspeed aural warning
    - ❑ Sudden and full back stick input
    - ❑ Rapid engine thrust reduction to idle, without subsequent thrust readjustment.

Suspicion of startle / surprise factor



# Training Analysis of Events with Startle and Surprise Factors

- Example of data received from operators:
  - ❑ Overspeed events associated with not appropriate pilot reactions:
    - ❑ Light speed incursions in overspeed
    - ❑ Associated with overspeed aural warning
    - ❑ Sudden and full back stick input
    - ❑ Rapid engine thrust reduction to idle, without subsequent thrust readjustment.

Suspicion of startle / surprise factor

- ❑ Crosswind landings associated with:
  - ❑ Moderate crosswind value (15 to 20 knots)
  - ❑ Important wind changes on final (300 feet above airport)
  - ❑ Degraded lateral control during the flare and the rollout (e.g. not appropriate application of the decrab technique)
  - ❑ Excessive aircraft attitude during the flare (airframe contact).



# Training Analysis of Events with Startle and Surprise Factors

- Example of data received from operators:
  - ❑ Overspeed events associated with not appropriate pilot reactions:
    - ❑ Light speed incursions in overspeed
    - ❑ Associated with overspeed aural warning
    - ❑ Sudden and full back stick input
    - ❑ Rapid engine thrust reduction to idle, without subsequent thrust readjustment.

Suspicion of startle / surprise factor

- ❑ Crosswind landings associated with:
  - ❑ Moderate crosswind value (15 to 20 knots)
  - ❑ Important wind changes on final (300 feet above airport)
  - ❑ Degraded lateral control during the flare and the rollout (e.g. not appropriate application of the decrab technique)
  - ❑ Excessive aircraft attitude during the flare (airframe contact).

Suspicion of startle / surprise factor



# Training Analysis of Events with Startle and Surprise Factors

A detailed view of an Airbus cockpit interior, showing the instrument panel, control yokes, and the overhead panel. The cockpit is illuminated with various lights, and the background shows a bright, hazy horizon.

From  
Operator  
Experience  
to Training

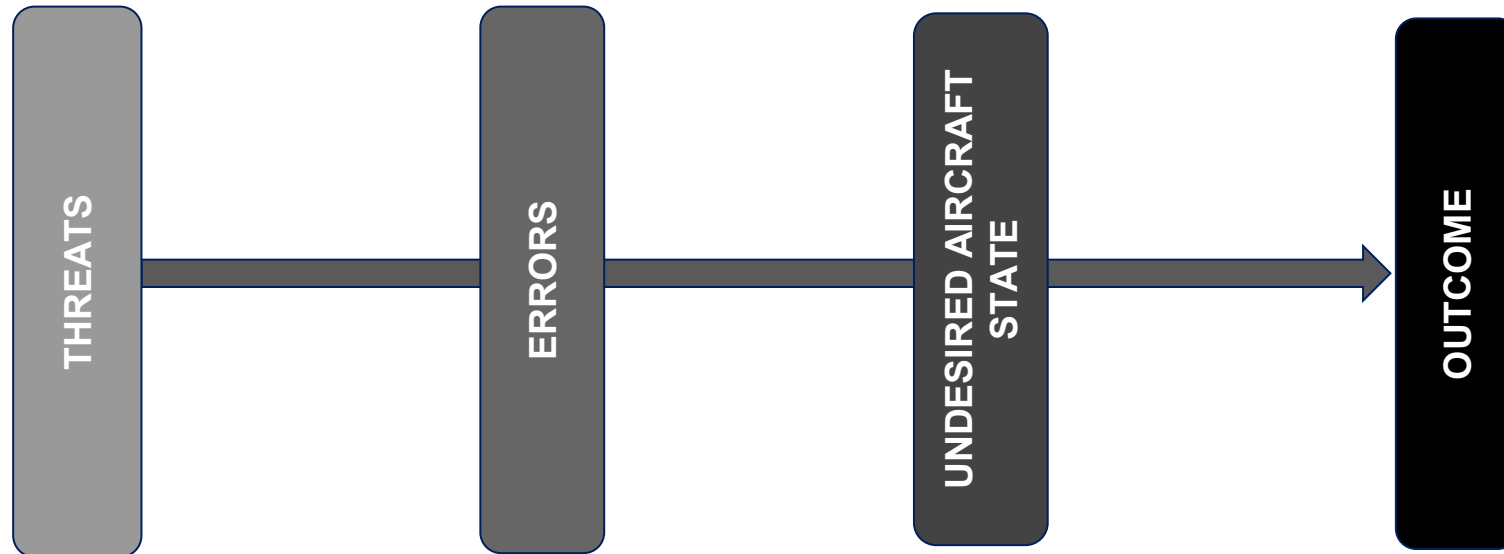
Manufacturer analysis for  
training recommendations

**AIRBUS**



# Training Analysis of Events with Startle and Surprise Factors

- Training analysis based on **Threat and Error Management (TEM)** model

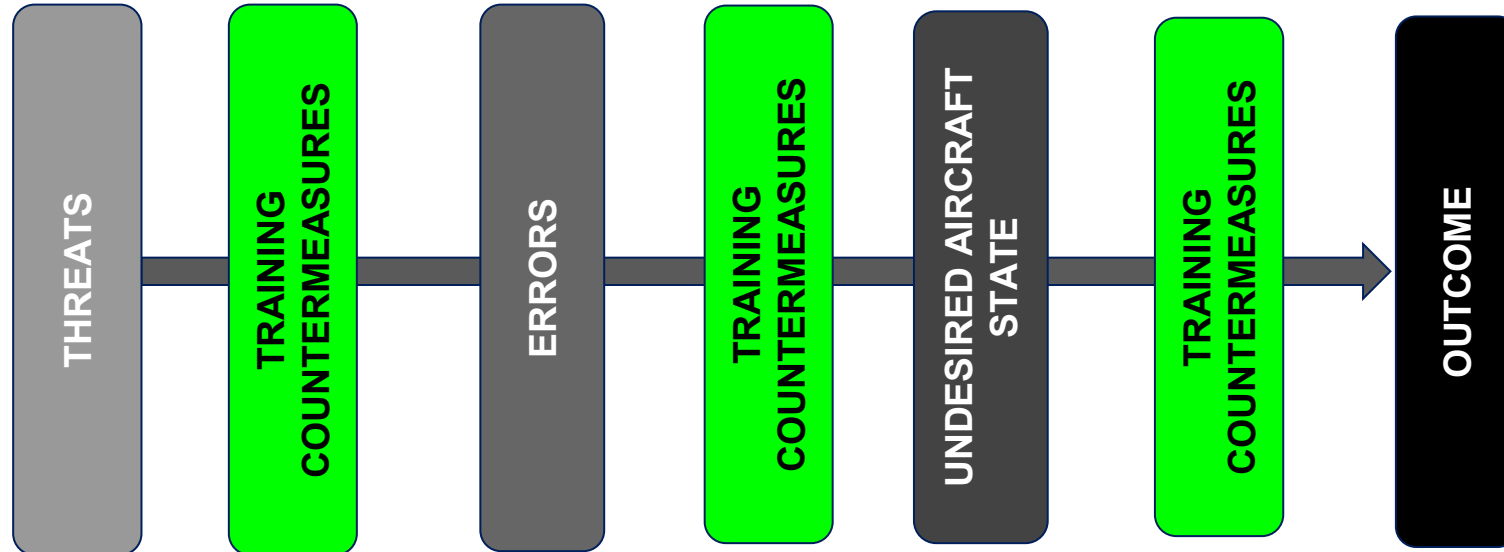


From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

# Training Analysis of Events with Startle and Surprise Factors

- Training analysis based on **Threat and Error Management (TEM)** model

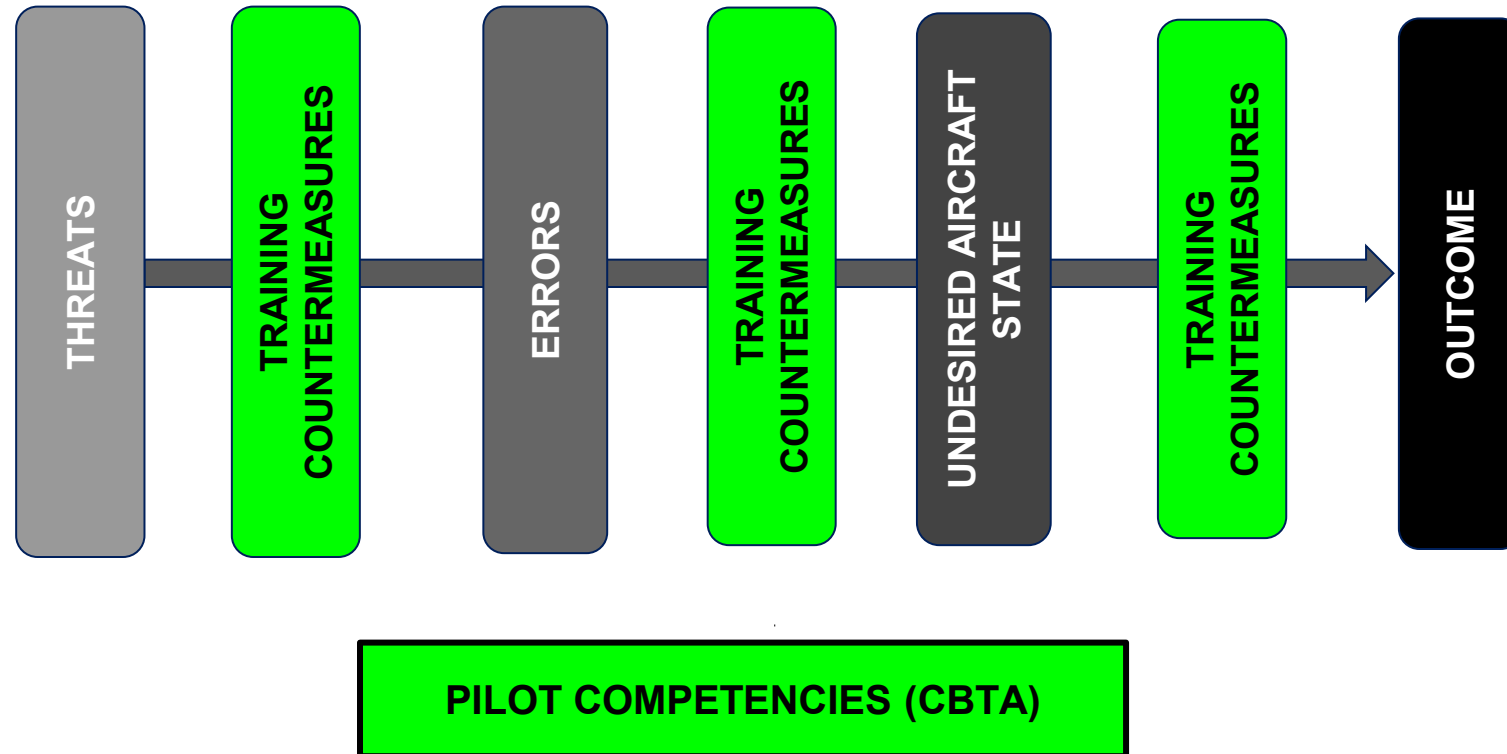


From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

# Training Analysis of Events with Startle and Surprise Factors

- Training analysis based on **Threat and Error Management (TEM)** model



- ☐ Knowledge
- ☐ Situation Awareness
- ☐ Workload Management
- ☐ Communication
- ☐ Leadership and Teamwork





# Training Recommendations: Knowledge

A detailed view of an Airbus cockpit interior, showing the instrument panel, engine gauges, and the view through the windshield. The text "From Operator Experience to Training" is overlaid in white, with a horizontal line underneath.

From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

**AIRBUS**

# Training Recommendations: Knowledge

- Reinforcement of the pilot knowledge

Startle effect	B	Reinforce pilot knowledge on startle effect. Recall the possibility for pilots to be surprised or startled by an overspeed event.	Review definitions and typical reactions associated to surprise and startle effects. This knowledge about surprise and startle effect should help to improve pilots awareness and capacity to perform as expected facing a surprising event such as an overspeed situation associated with overspeed warning.
			Review: - The importance to develop as PF or PM effective contingency plans based on the risks associated with surprise or startle effect - How to respond to indications of reduced situation awareness that affect the other crewmember due to surprise or startle effect (FCTM/ PR/ AEP/ MISC/ FLIGHT CREW INCAPACITATION).
			Explain the importance for pilots to accept assistance when they are surprised or startled.

From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

# Training Recommendations: Knowledge

- Reinforcement of the pilot knowledge

Startle effect	B	Reinforce pilot knowledge on startle effect. Recall the possibility for pilots to be surprised or startled by an overspeed event.	Review definitions and typical reactions associated to surprise and startle effects. This knowledge about surprise and startle effect should help to improve pilots awareness and capacity to perform as expected facing a surprising event such as an overspeed situation associated with overspeed warning.
			Review: - The importance to develop as PF or PM effective contingency plans based on the risks associated with surprise or startle effect - How to respond to indications of reduced situation awareness that affect the other crewmember due to surprise or startle effect (FCTM/ PR/ AEP/ MISC/ FLIGHT CREW INCAPACITATION).
			Explain the importance for pilots to accept assistance when they are surprised or startled.

- ❑ For a better **recognition** of startle or surprise effects in the cockpit





# Training Recommendations: Knowledge

- Reinforcement of the pilot knowledge

Startle effect	B	Reinforce pilot knowledge on startle effect. Recall the possibility for pilots to be surprised or startled by an overspeed event.	Review definitions and typical reactions associated to surprise and startle effects. This knowledge about surprise and startle effect should help to improve pilots awareness and capacity to perform as expected facing a surprising event such as an overspeed situation associated with overspeed warning.
			Review: - The importance to develop as PF or PM effective contingency plans based on the risks associated with surprise or startle effect - How to respond to indications of reduced situation awareness that affect the other crewmember due to surprise or startle effect (FCTM/ PR/ AEP/ MISC/ FLIGHT CREW INCAPACITATION).
			Explain the importance for pilots to accept assistance when they are surprised or startled.

- ❑ For a better **recognition** of startle or surprise effects in the cockpit
- ❑ Theoretical classroom training, or during briefing before a simulator session



# Training Recommendations: Knowledge

- Reinforcement of the pilot knowledge

Startle effect	B	Reinforce pilot knowledge on startle effect. Recall the possibility for pilots to be surprised or startled by an overspeed event.	Review definitions and typical reactions associated to surprise and startle effects. This knowledge about surprise and startle effect should help to improve pilots awareness and capacity to perform as expected facing a surprising event such as an overspeed situation associated with overspeed warning.
			Review: - The importance to develop as PF or PM effective contingency plans based on the risks associated with surprise or startle effect - How to respond to indications of reduced situation awareness that affect the other crewmember due to surprise or startle effect (FCTM/ PR/ AEP/ MISC/ FLIGHT CREW INCAPACITATION).
			Explain the importance for pilots to accept assistance when they are surprised or startled.

- ❑ For a better **recognition** of startle or surprise effects in the cockpit
- ❑ Theoretical classroom training, or during briefing before a simulator session
- ❑ Available resource:

Airbus Win video: *"The Two Sides of Fear"*



Manufacturer analysis for training recommendations

AIRBUS

A detailed view of an Airbus cockpit interior, showing the instrument panel with multiple digital displays, control yokes, and overhead panels. The lighting is dim, with the primary light source coming from the instrument displays and the runway ahead.

## From Operator Experience to Training

Manufacturer analysis for training recommendations



# Training Recommendations: Skills

- Apply and develop the relevant skills to efficiently cope with startle or surprise situations

A detailed view of an Airbus cockpit interior, showing the instrument panel with multiple digital displays, the overhead panel with numerous switches and lights, and the side console. The cockpit is illuminated with blue and green light, and the background shows a bright, hazy horizon.

From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

**AIRBUS**

# Training Recommendations: Skills

- Apply and develop the relevant skills to efficiently cope with startle or surprise situations

Startle / surprise effect in the case of an overspeed event	E	Unanticipated overspeed warning.	Exercises self-control in a situation of unexpected overspeed (OB 8.1).
		- Trigger an overspeed event type 2 while pilots are managing others tasks than only flying (e.g. approach briefing at the end of the cruise, ECAM management).	PM applies effective intervention strategies to resolve identified deviations (OB 5.10).

From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations

# Training Recommendations: Skills

- Apply and develop the relevant skills to efficiently cope with startle or surprise situations

Startle / surprise effect in the case of an overspeed event	E	Unanticipated overspeed warning.	Exercises self-control in a situation of unexpected overspeed (OB 8.1).
		- Trigger an overspeed event type 2 while pilots are managing others tasks than only flying (e.g. approach briefing at the end of the cruise, ECAM management).	PM applies effective intervention strategies to resolve identified deviations (OB 5.10).

- Training scenarios tested and validated to:
  - ☐ Ensure realistic training conditions (based on operational data analysis)
  - ☐ Respect the simulator training envelop
  - ☐ Avoid negative learning.

From  
Operator  
Experience  
to Training

Manufacturer analysis for  
training recommendations



# Training Recommendations: Skills

- Apply and develop the relevant skills to efficiently cope with startle or surprise situations

Startle / surprise effect in the case of an overspeed event	E	Unanticipated overspeed warning.	Exercises self-control in a situation of unexpected overspeed (OB 8.1).
		- Trigger an overspeed event type 2 while pilots are managing others tasks than only flying (e.g. approach briefing at the end of the cruise, ECAM management).	PM applies effective intervention strategies to resolve identified deviations (OB 5.10).

- Training scenarios tested and validated to:
  - ☐ Ensure realistic training conditions (based on operational data analysis)
  - ☐ Respect the simulator training envelop
  - ☐ Avoid negative learning.

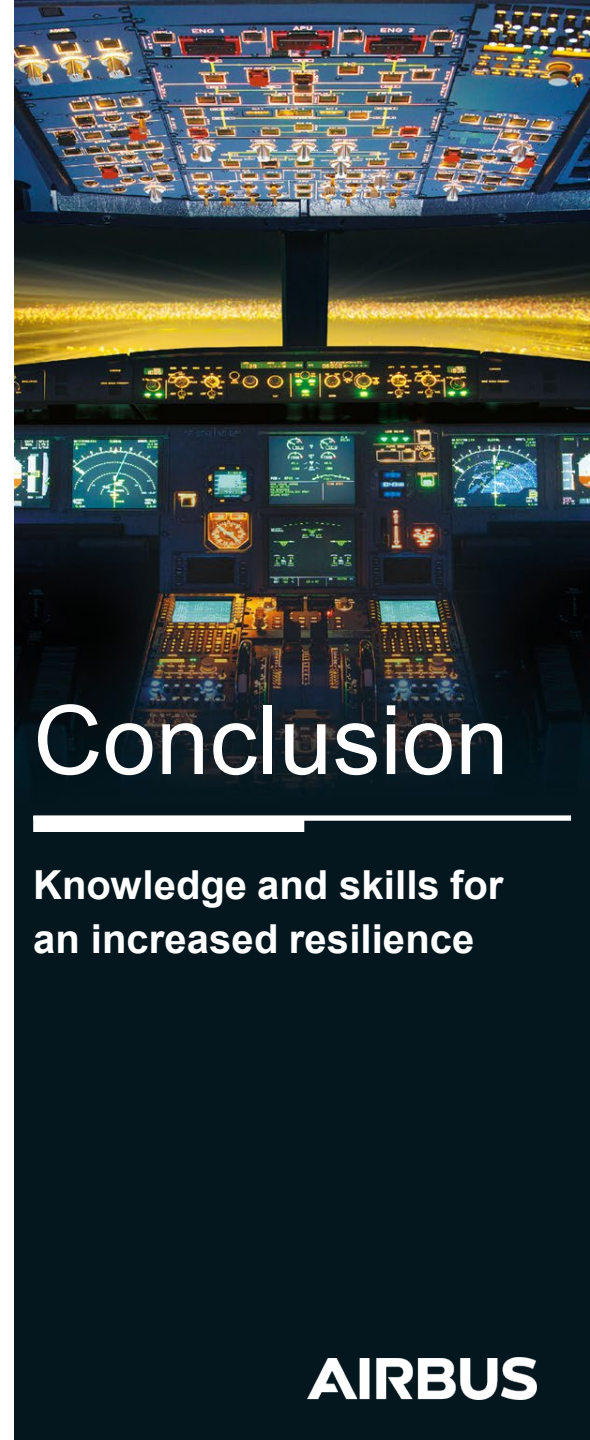
**Training scenarios enable pilots to have experience on startle and surprise situations, in controlled conditions**

**From  
Operator  
Experience  
to Training**

**Manufacturer analysis for training recommendations**

# Conclusion

- Identified as a contributing factor in several events, the startle factor must be part of the pilot training

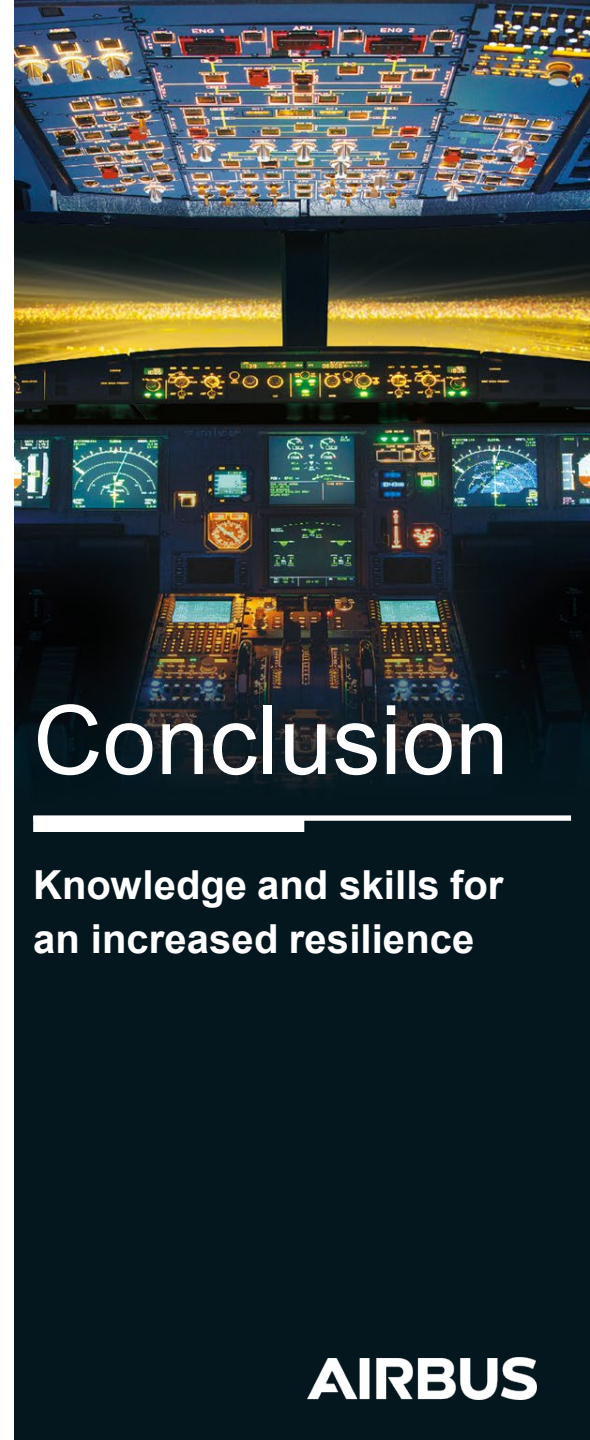


# Conclusion

Knowledge and skills for  
an increased resilience

# Conclusion

- Identified as a contributing factor in several events, the startle factor must be part of the pilot training
- Airbus, as Original Equipment Manufacturer, publishes training recommendations to support the operators



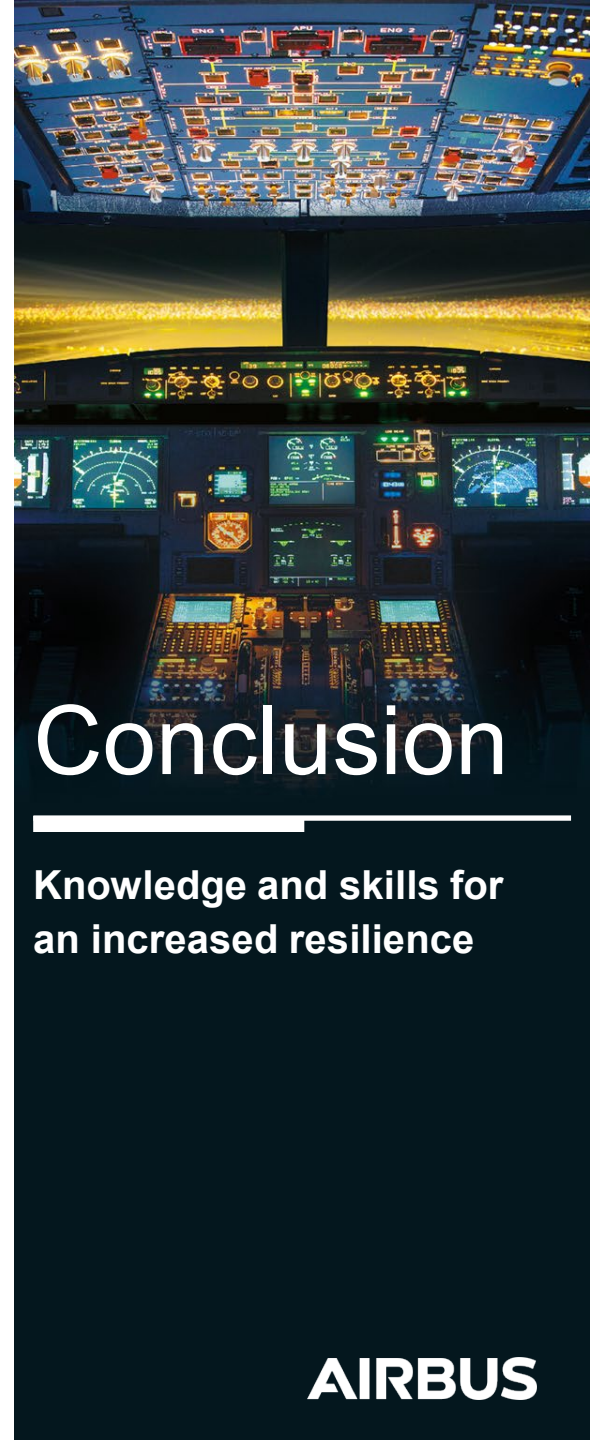
## Conclusion

Knowledge and skills for  
an increased resilience

# Conclusion

- Identified as a contributing factor in several events, the startle factor must be part of the pilot training
- Airbus, as Original Equipment Manufacturer, published training recommendations to support the operators
- Training recommendations are based on:
  - ❑ Manufacturer data analysis
  - ❑ Human factors expertise.

These training recommendations aim to reinforce knowledge, and to develop pilot competencies in validated training scenarios.



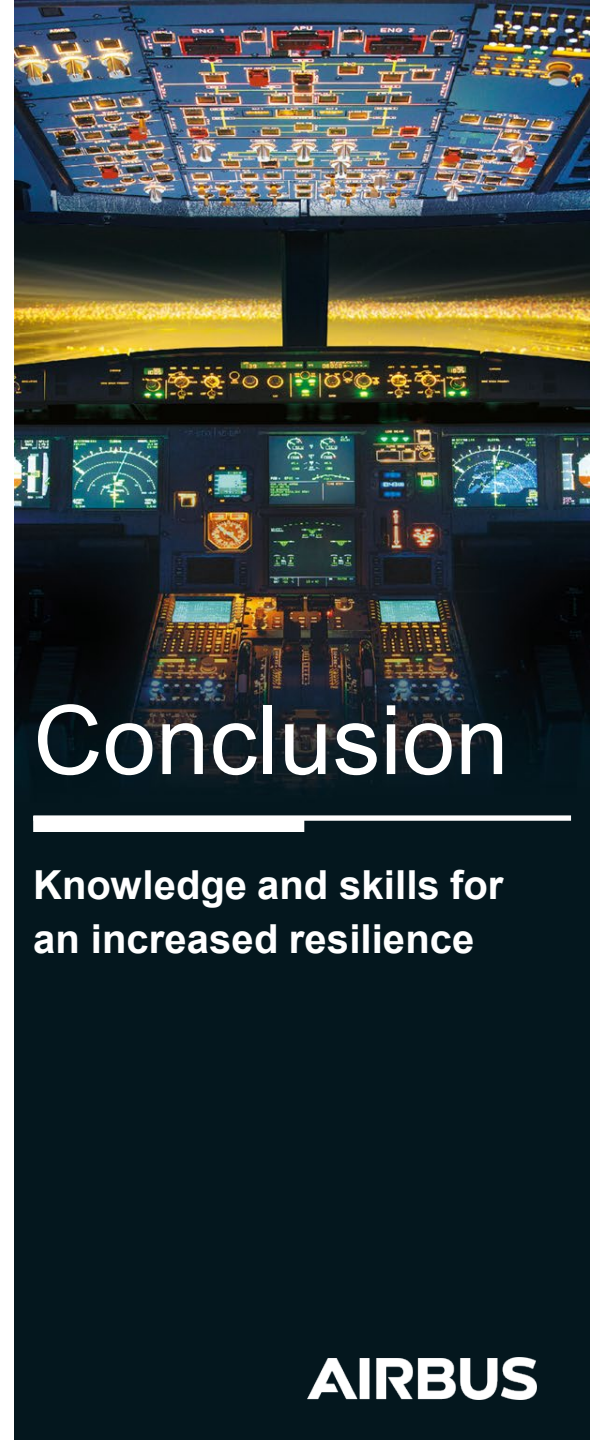


# Conclusion

- Identified as a contributing factor in several events, the startle factor must be part of the pilot training
- Airbus, as Original Equipment Manufacturer, published training recommendations to support the operators
- Training recommendations are based on:
  - ❑ Manufacturer data analysis
  - ❑ Human factors expertise.


These training recommendations aim to reinforce knowledge, and to develop pilot competencies in validated training scenarios.

**Reinforce pilot resilience to safely respond to startle events**



## Conclusion

**Knowledge and skills for  
an increased resilience**



# Thank you

© Copyright Airbus (Specify your Legal Entity YEAR) / Presentation title runs here

This document and all information contained herein is the sole property of Airbus. No intellectual property rights are granted by the delivery of this document or the disclosure of its content. This document shall not be reproduced or disclosed to a third party without the expressed written consent of Airbus. This document and its content shall not be used for any purpose other than that for which it is supplied. Airbus, its logo and product names are registered trademarks.

**AIRBUS**