

# Developing Startle and Surprise Training Interventions for Airline Training Programs



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# The Problem with Startle and Surprise

## Surprise

An unexpected event that violates a pilot's expectations and can affect the mental processes used to respond to the event

(FAA, 2015)



# The Problem with Startle and Surprise

## Two Types of Surprise

- Fundamental Surprise
- Situational Surprise



# The Problem with Startle and Surprise

## Startle

An uncontrollable, automatic muscle reflex, raised heart rate, blood pressure, etc., elicited by exposure to a sudden, intense event that violates a pilot's expectations.

(FAA, 2015)



# The Problem with Startle and Surprise

Colgan Air – Buffalo 2009



# The Problem with Startle and Surprise

## Turkish Airlines – Amsterdam 2009





# The Problem with Startle and Surprise

Air France – Atlantic Ocean 2009



# The Problem with Startle and Surprise

## Pinnacle Airlines – Jefferson City 2004





# The Problem with Startle and Surprise

West Caribbean Airlines – Venezuela 2005



# The Problem with Startle and Surprise

## Air Asia – Indonesia 2014



# A Conditioned Expectation of Normalcy

While Pilots may practise emergencies in the sim for perhaps four days a year, the remainder of the 360+ days are often routine and emergency-free.

On those rare occasions when things do go wrong, then a lack of expectation can produce some heightened surprise and stress reactions, with negative effects on situation outcome.

# The Problem with Startle and Surprise



The FAA Experiments – A powerful example





# Training Interventions





# Training Interventions



Simulator experiments are being conducted to expose pilots to 'controlled' interventions.



# Training Interventions



## Pilot Briefing Package

### THE EFFECTS OF STARTLE AND SURPRISE

#### Introduction

On the 12<sup>th</sup> of February 2009 a Dash 8-400 operated by ~~Colgan~~ Air on behalf of Continental Connection was approaching Buffalo airport in New York State in fair weather with occasional snow showers. While icing conditions had been encountered earlier in the flight, the aircraft was not experiencing icing during the actual approach.

ATC levelled the aircraft at 2300 feet for the ILS approach and the Captain, who was PF, started to configure the aircraft in anticipation of commencing the approach. As part of this process the Captain, reduced power to idle, called for the landing gear to be lowered, the flaps to be lowered to the 5° position and the condition levers to be increased to the maximum rpm position. This had the effect of significantly increasing the aircraft drag, in a level flight phase, which resulted in a rapid reduction in indicated airspeed. The Captain then called for the Flap to be lowered to the 15° position and the First Officer started to select this with the Flap lever.

As the airspeed reduced through 131kts however, the stick shaker stall warning activated. This was some 15kts higher than the normal activation point because an icing accretion reference speed adjustment switch (INCR REF SPD) had been selected on earlier in the flight, which was a requirement prior to entering icing conditions. The switch increases the stall warning margin above normal stall to allow for ice accretion.

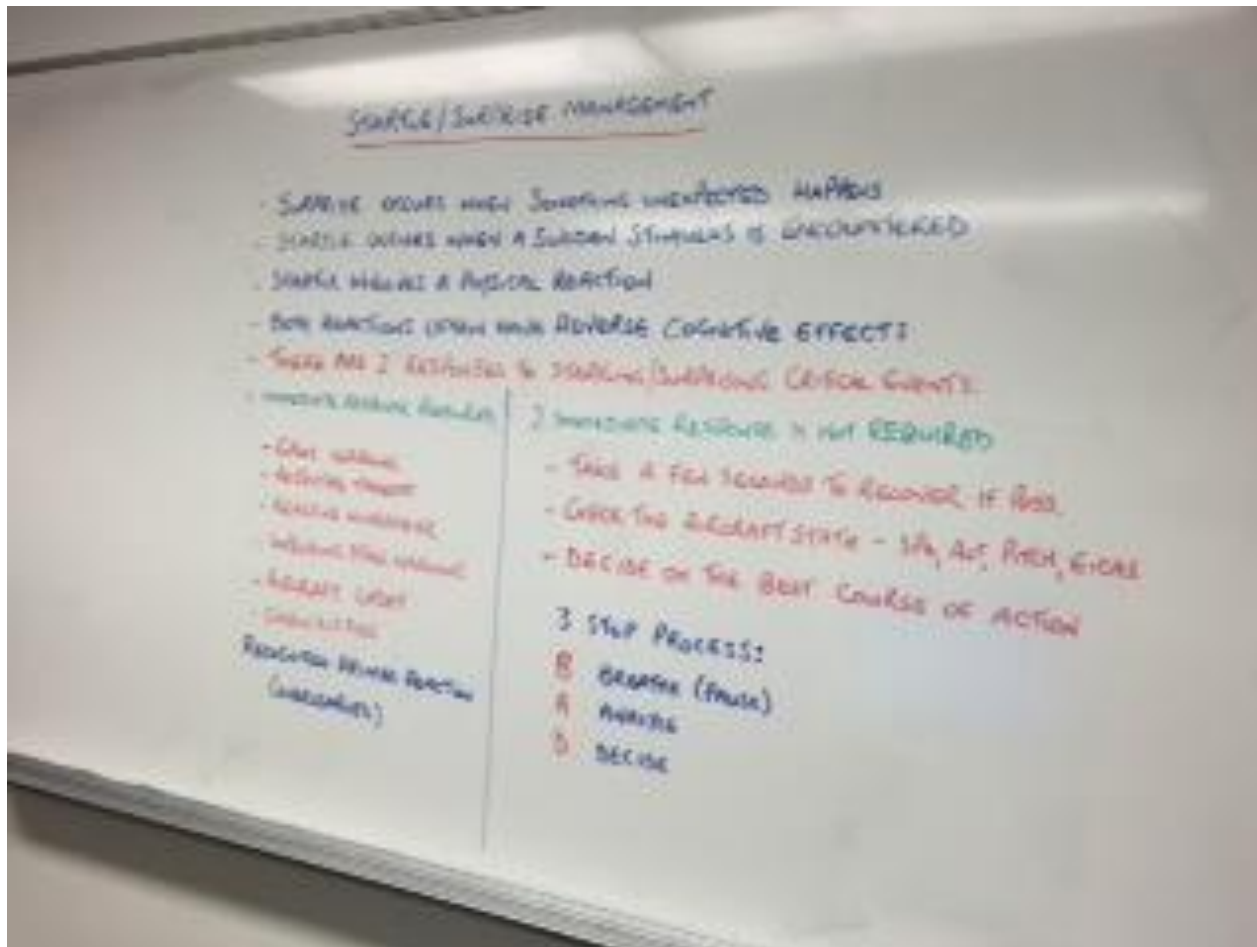
The Captain was clearly startled and surprised by the activation of the stick shaker and immediately applied a 37 pound pull force on the control column, resulting in a pitch up to 18°. This resulted in an aerodynamic stall as the airspeed decayed rapidly and was accompanied by multiple aircraft stick pusher activations. The Captain tried to override the stick pushers by pulling even harder (160 pounds force at one stage) on the control column. During this time the aircraft had also commenced alternately rolling left and right between 45 degrees one way and 105 degrees the other.

While this was happening the First Officer, who was likely also startled by the stick shaker and ensuing events, had elected to select the flaps up. This had the effect of exacerbating the aerodynamic stall, and this, coupled with the counterproductive control column inputs from the Captain, meant a recovery was never effected, resulting in the aircraft crashing with the loss of all 49 people on board and one additional person on the ground.



For further information you can download the accident report [here](#).

# Training Interventions



# Training Interventions



## Immediate Action Events

EGPWS Terrain Warning

Rejected Takeoff

Reactive Windshear

(Impending) Stall Warning

Aircraft Upset

Cabin Altitude

TCAS RA

Recognition  
Primed Reactions  
  
(Overlearned)

# Training Interventions



## Non-immediate Action Events

1. Take a few seconds to recover if possible
2. Check and call the aircraft state
  - Speed, Alt, Pitch, EICAS/ECAM
3. Decide on the best course of action

### A 3 step process:

- B** - Breathe (Pause)
- A** - Analyse
- D** - Decide



# Training Interventions



## Simulator Exercises

Simulator exercises which incorporate startle/surprise event training must be very carefully managed to avoid negative training.

It is quite possible that poorly conducted training could actually have negative consequences during future unexpected critical events.

It is critical that pilots leave the sim with a sense of self-efficacy for managing such events.

# Training Interventions



## Simulator Exercises

The utility of startle/surprise exercises will vary between simulators.

The use of distraction immediately prior to an event is recommended to add to the surprise effect.

# Training Interventions

## Simulator Exercises - Examples

- Forward Cargo Door Blowout with Associated Engine Failure
- Unexpected Stick Shaker Stall warning
- Unexpected EGPWS Terrain warning (Glass Mountain)
- Autothrottle Failure during Level Off in Climb or Descent (with distraction)
- Failure of PF Autopilot Disconnect on RNAV GNSS Approach
- Subtle Autopilot Failure during Level Off in descent (with distraction)
- Altitude Capture Failure
- Dual AC Bus Failure at 500 feet on Approach
- Compressor Stall during Go Around

# Training Interventions





# Training Interventions

## Behavioural Marker Assessment

Startle and Surprise Exercise Behavioural Marker System					
Behaviour	Very Poor	Poor	Acceptable	Good	Very Good
<b>Generic Assessment Statement</b>	Observed behaviour directly endangers flight safety	Observed behaviour in other conditions could endanger flight safety	Observed behaviour does not endanger flight safety but needs improvement	Observed behaviour enhances flight safety	Observed behaviour optimally enhances flight safety and could serve as an example for other pilots
<b>Appropriate responses</b> Was the situation assessed accurately and an appropriate remedy implemented?	Observed jumping to conclusions or showing impulsive behaviour. No evidence of accurate problem analysis.	Some evidence of impulsive behaviour but of a minor nature. Misses some important information which could affect problem solving and decision making.	Reacts in an appropriate manner but problem solving flawed and responses less than optimal. Misses some items but gets the important information.	Generally acts appropriately to the circumstances. Information seeking, analysis and decision making good, but less than optimal.	Reacts appropriately after due consideration of the situation. Accurate analysis of the problem and interpretation of the situation.
<b>Reaction delay</b> Was there a short pause then accurate and timely implementation of the assessment and decision processes?	Observed 'frozen' or 'inactive' type behaviour for quite some time. Observed fixated on one stimulus at the expense of situational awareness.	Noticeably slow in identifying the problem and determining the best course of action. May have been fixated for some time on one thing.	Observed a moderate and obvious delay in making any statement of the problem, deciding on an action, or in taking action.	Some slight delay in switching attention from the stimulus to the flight instruments. Slightly slow to problem solve and decide on a course of action, but overall acceptable outcomes.	Reacts in an appropriately timely manner with little evidence of cognitive impairment during problem solving or decision making.
<b>Communication</b> Were the aircraft state, any changes to automation, key indications, decisions and intentions enunciated clearly?	Operates completely independently with no discussion of the problem, implications or intentions.	Fails to verbalise most observations of aircraft state, the problem at hand or intentions, but calls some issues.	Enunciates some issues to do with the problem, implications or intentions, but misses some key calls.	Enunciates most of the problem identification issues, indications, and intentions, but not all of them.	Clearly enunciates key instrument readings, changes in automation, the problem at hand, and intentions
<b>Confusion</b> Was there a fundamental misunderstanding of the problem and solution evident?	Observed to be very confused about the nature of the problem and reluctant to, or incapable of producing an effective solution. May take actions which exacerbate the problem.	Observed to be struggling to identify the exact problem or the best solution. Comes up with a solution which is somewhat ineffective	Roughly identifies the situation but without reference to all of the available information. Doesn't necessarily comprehend fully the situation but produces an adequate solution	Generally identifies the situation correctly but some elements may be misinterpreted slightly. Produces a generally effective solution.	Accurately identifies the situation and then nominates and implements the best solution without error.



# Training Interventions



## Behavioural Marker Assessment

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# Training Interventions

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# Training Interventions



## Summary

While uncommon, the negative effects of startle and surprise have the potential to adversely affect safety, particularly during unexpected critical events

UPRT training, which is being rolled out around the world may incorporate startle and surprise exercises, however the potential for negative training is significant.

Conduct of such exercises is critical and needs to be carefully considered, constructively run, and leave pilots with a greater sense of self-efficacy.





# Questions?