

LOC-I DURING GO-AROUNDS...

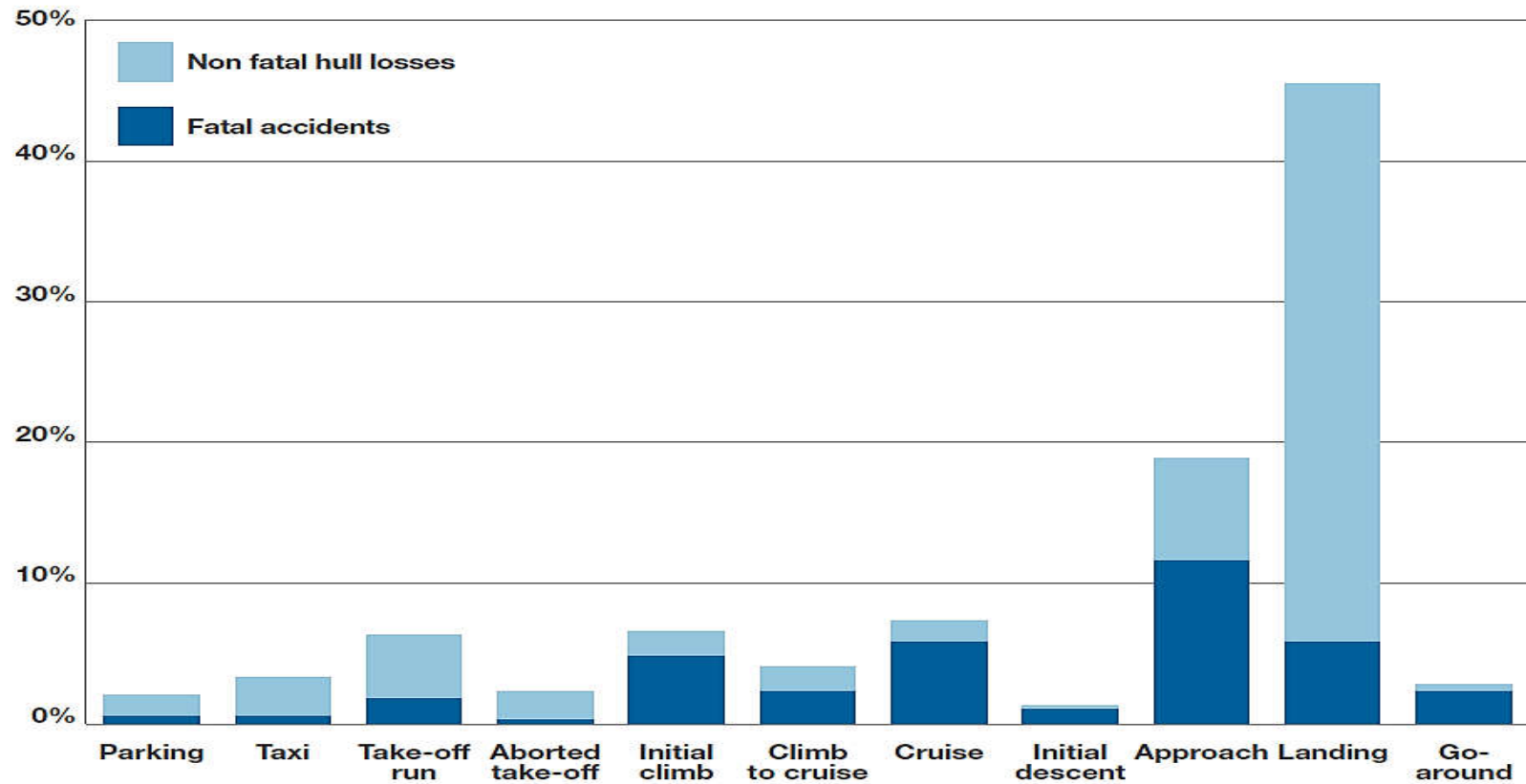
*Capt Ramesh Krishnan
AirAsia India*



**WORLD'S BEST LOW-COST AIRLINE
YEARS RUNNING**



STATISTICS 1998-2017

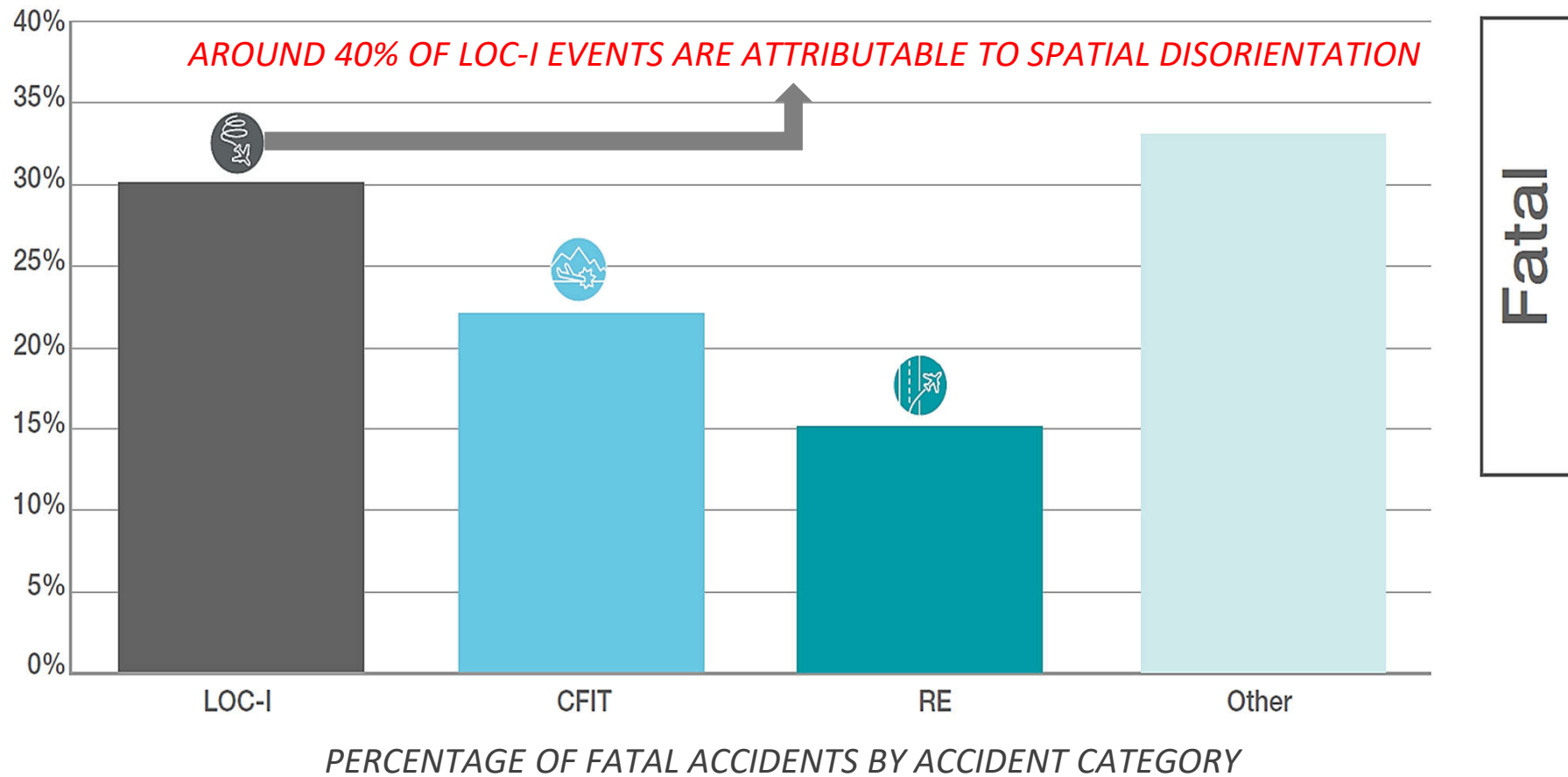


ACCIDENTS BY FLIGHT PHASE EXPRESSED AS A PERCENTAGE

Source: Airbus



STATISTICS 1998 - 2017



Source: Airbus



WHY DOES THIS HAPPEN?

The primary cause in such events has been identified as spatial disorientation due to the somatogravic illusion...

Spatial orientation is defined as the ability to perceive motion and three dimensional position and attitude in relation to the surrounding environment.

Conversely, spatial disorientation (SD) occurs when a pilot fails to properly sense the aircraft's motion, position or attitude.

Unfortunately, the probability of a pilot experiencing SD during his/her career is on the order of 90-100 percent. If the SD is not recognized quickly, it can lead to LOC.



HOW DOES THIS HAPPEN?

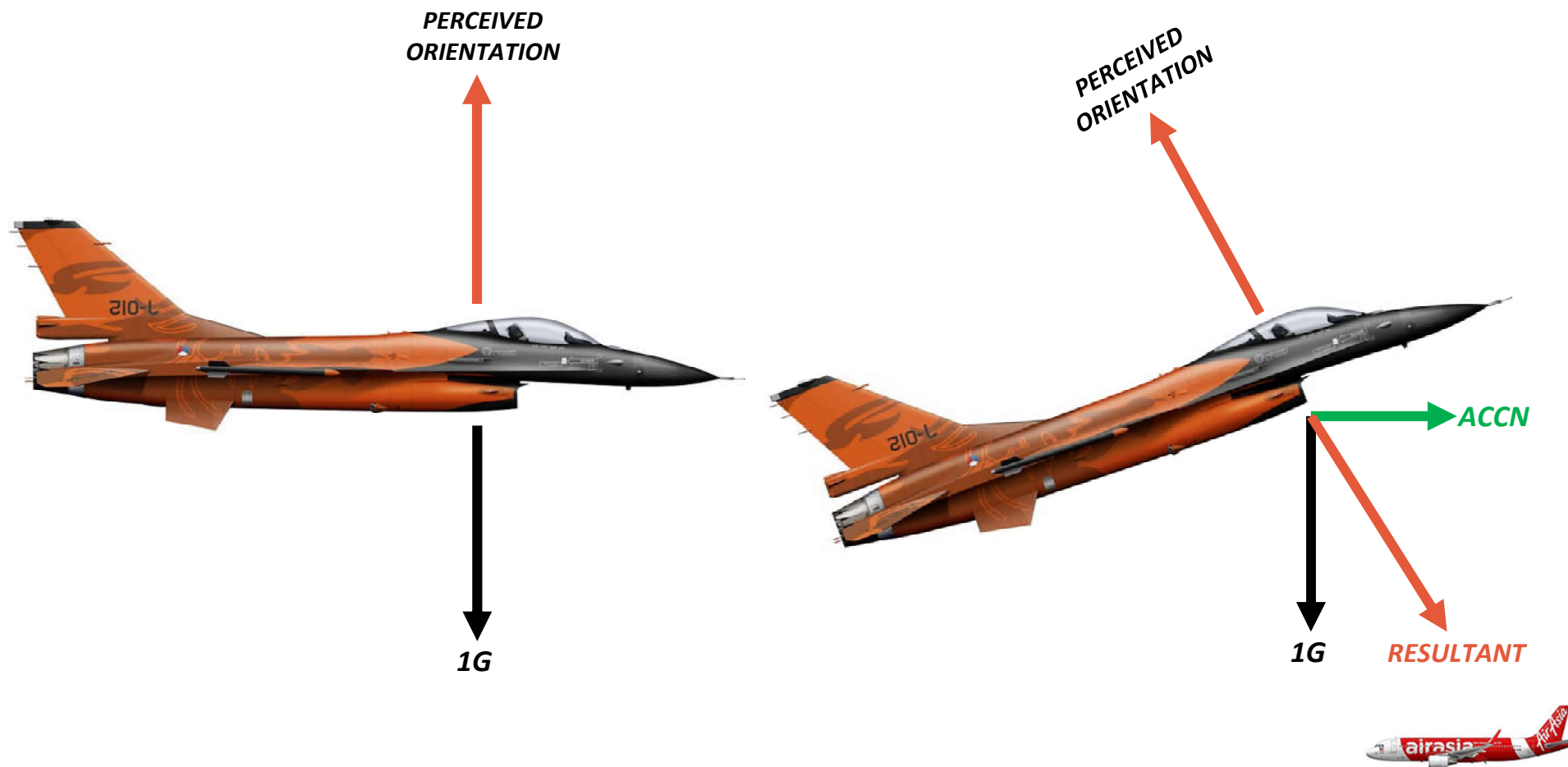
There are three sensory systems used by humans to orientate themselves:

- ❖ **VISUAL** (*Primary*)
- ❖ **VESTIBULAR** (*Inner ear organs*)
- ❖ **PROPRIOCEPTIVE** (*Seat of the pants...*)

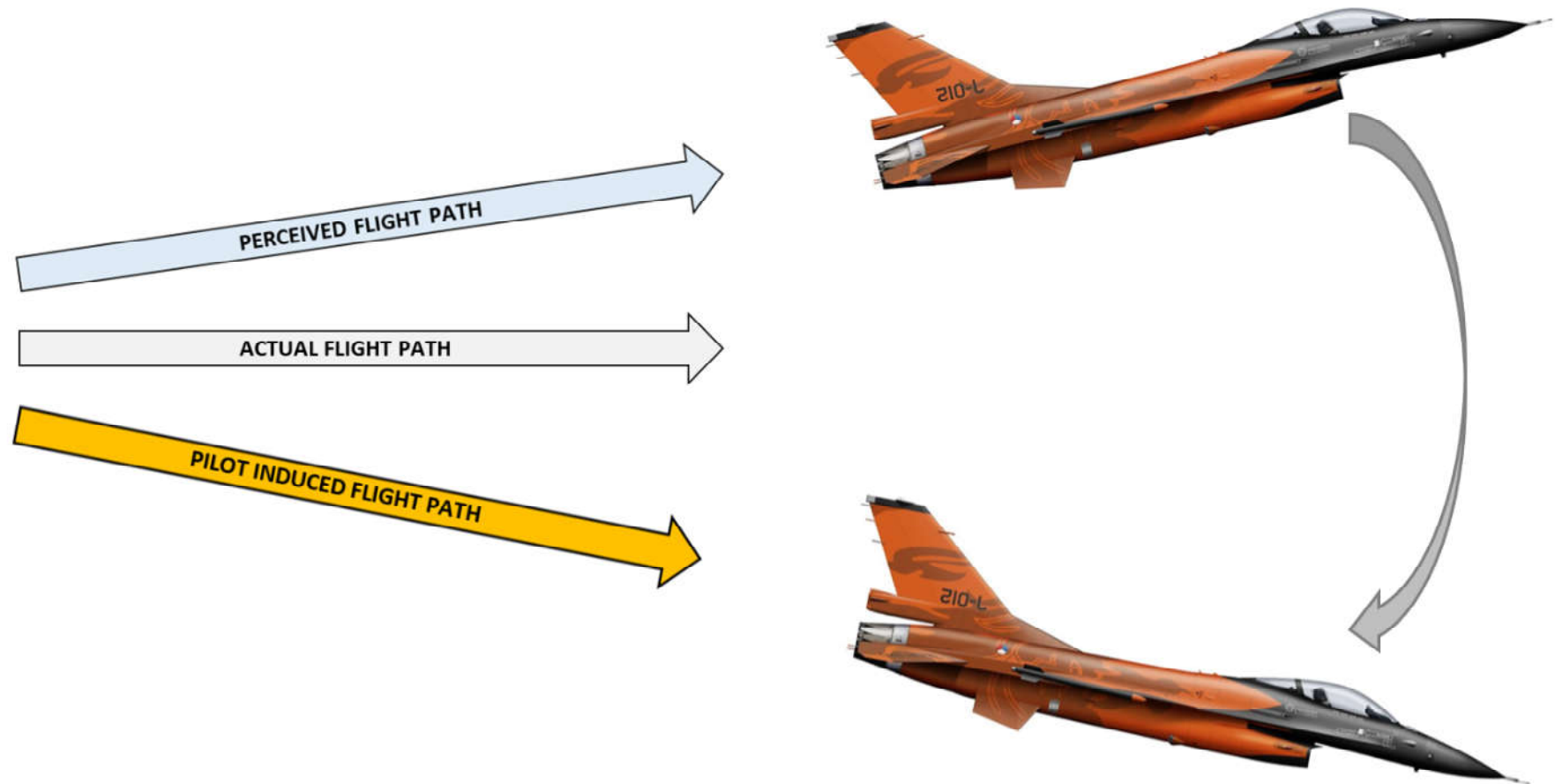
A rapid acceleration, such as experienced during an improperly executed go-around creates the somatogravic illusion of being in a nose-up attitude, especially in situations without good visual references. The disoriented pilot may push the aircraft into a nose-low or dive attitude.



THE SOMATOGRAVIC ILLUSION



THE SOMATOGRAVIC ILLUSION



THE SENSORY PERCEPTION OF THE 'PITCH-UP' MAY LAST FOR UP TO 30 SECONDS...



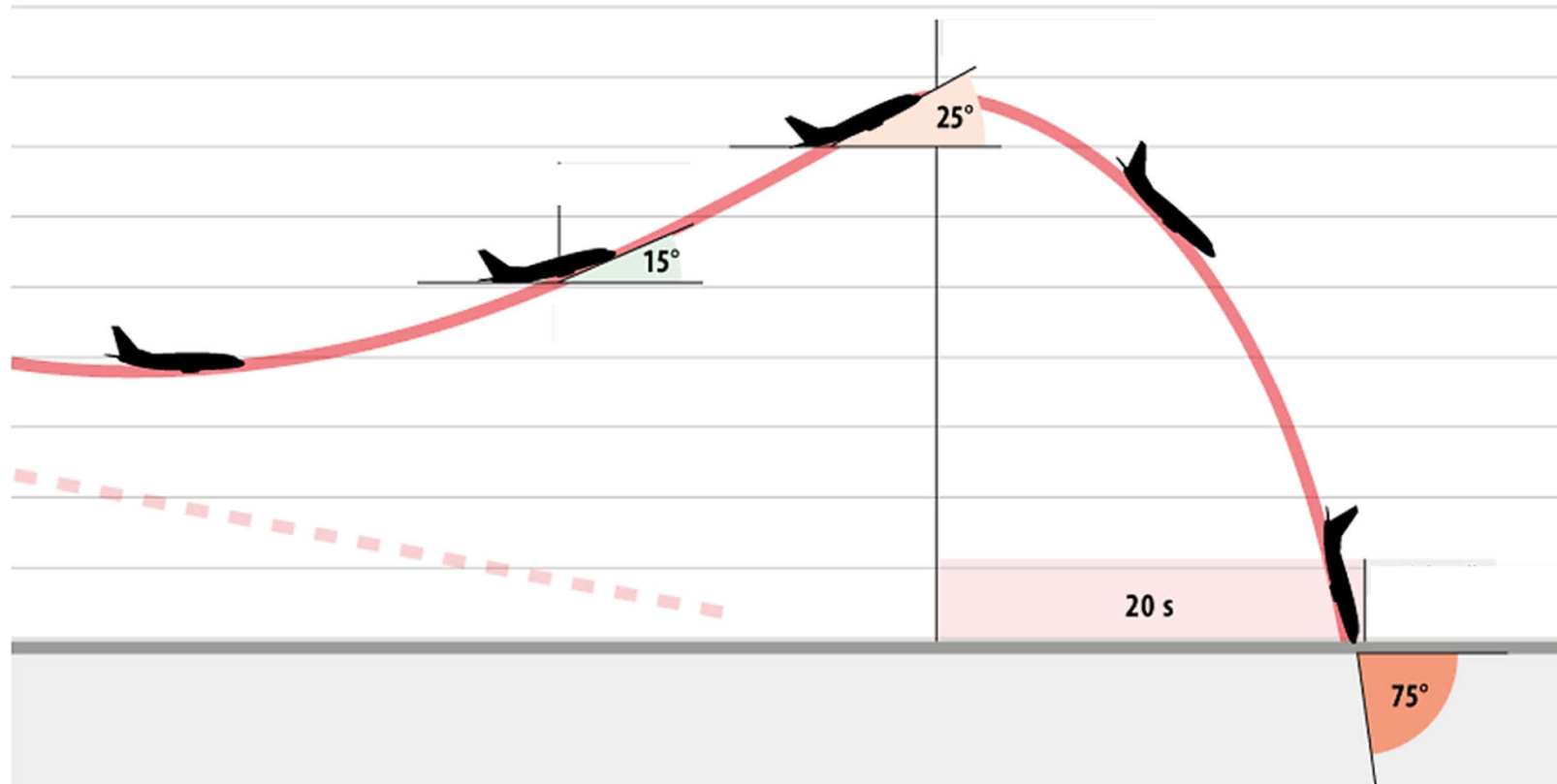
KAZAN – 17 NOV 2013



ROSTOV – 19 MAR 2016



TYPICAL LOC-I (GO-AROUND) PROFILE



WHY ARE PILOTS SO SUSCEPTIBLE?

- ❖ *PROBLEM IS UNIQUE AS THERE MAY BE NO APPARENT CAUSES (MECHANICAL PROBLEMS) OR SECONDARY INDICATIONS (WARNINGS/CAUTIONS ETC.)*
- ❖ *OCCURS AT A VERY LOW ALTITUDE GIVING THE PILOT VERY LITTLE TIME TO RECOGNIZE THE FACT AND TO RE-ORIENTATE.*
- ❖ *THE RESULTANT LONGITUDINAL G-FORCES CAN BE UNUSUALLY HIGH DUE TO 'LIGHT AC WEIGHT – TOGA THRUST' COMBINATION AND CANNOT BE SIMULATED IN MODERN 6-AXIS FLIGHT SIMULATORS USING MOTION-CUEING.*
- ❖ *AIRLINE PILOTS HAVE NOT EXPERIENCED SUCH G-FORCES AND HENCE MAYBE LESS ACCEPTING OF THE FACT THAT THEY MAY BE DISORIENTATED.*

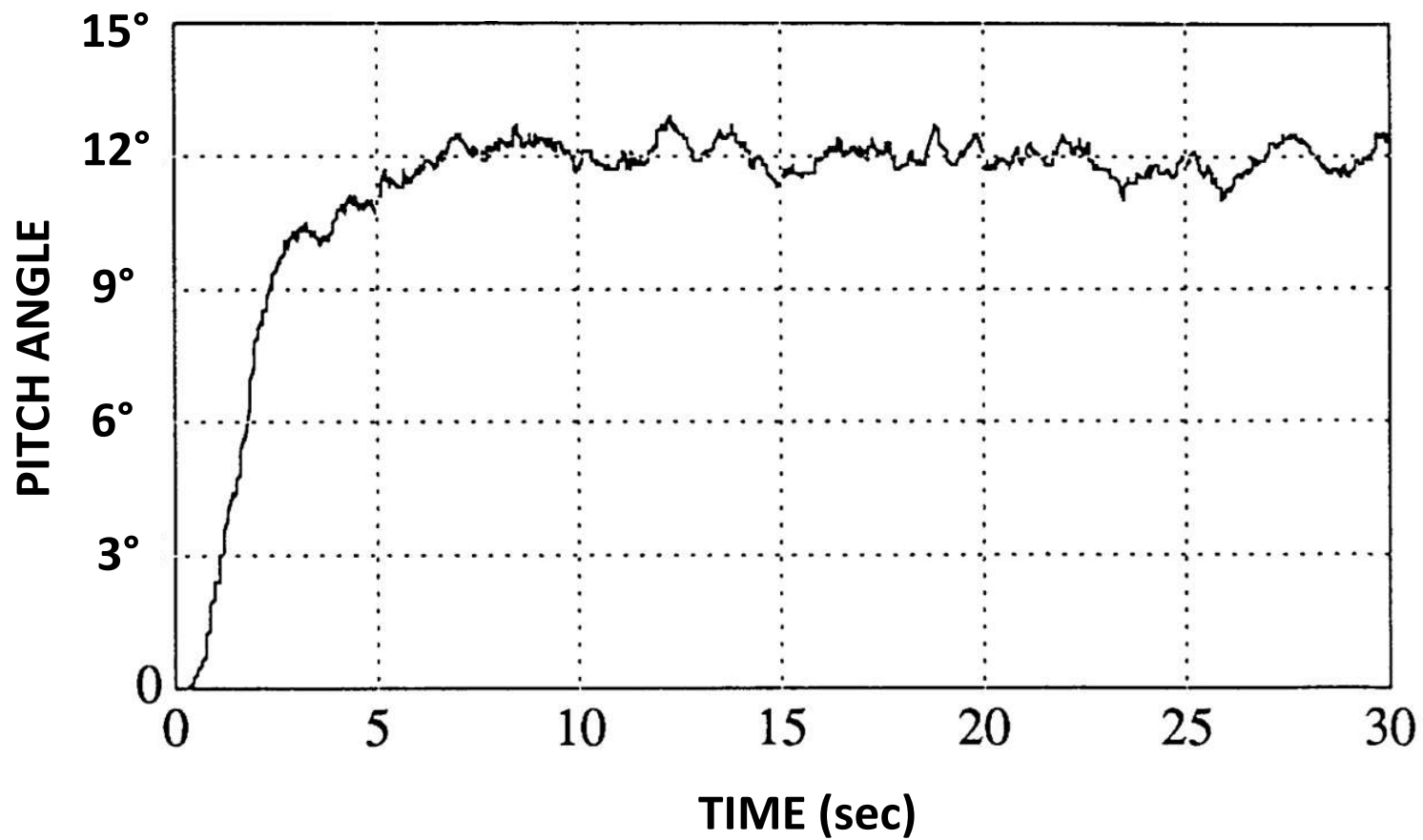


WHY ARE PILOTS SO SUSCEPTIBLE?

- ❖ *THE NORMAL REACTION TO A RAPID UNCOMMANDED CLIMB IS OFTEN A SHARP 'PUSH-OVER'. THIS MAY RESULT IN CLOSE TO ZERO OR NEGATIVE G WHICH AIRLINE PILOTS MAY NOT HAVE EXPERIENCED IN THEIR CAREERS. NEGATIVE G CAN BE VERY DISCOMFORTING AND CAN CAUSE FURTHER CONFUSION AND DIFFICULTY IN OPERATING CONTROLS.*
- ❖ *THE ACTUAL ILLUSION MAY LAST UP TO 30" AFTER THE ACCN HAS SUBSIDED.*
- ❖ *BUILT IN FLIGHT CONTROL (ENVELOPE) PROTECTIONS MAY BE INEFFECTIVE AS THE ACTUAL FLIGHT ENVELOPE MAY NOT BE EXCEEDED AT ALL.*
- ❖ *IN FACT, MODERN FBW FLIGHT CONTROL FEATURES LIKE ATTITUDE HOLD, G-LOAD DEMAND ETC. MAY COMPOUND THE PROBLEM AS THE NATURAL PITCH UP TENDENCY OF THE AIRCRAFT MAY BE IRONED OUT/SUPRESSED LEADING TO GREATER LONGITUDINAL G-FORCES.*



PITCH UP SENSATION IN THE DARK



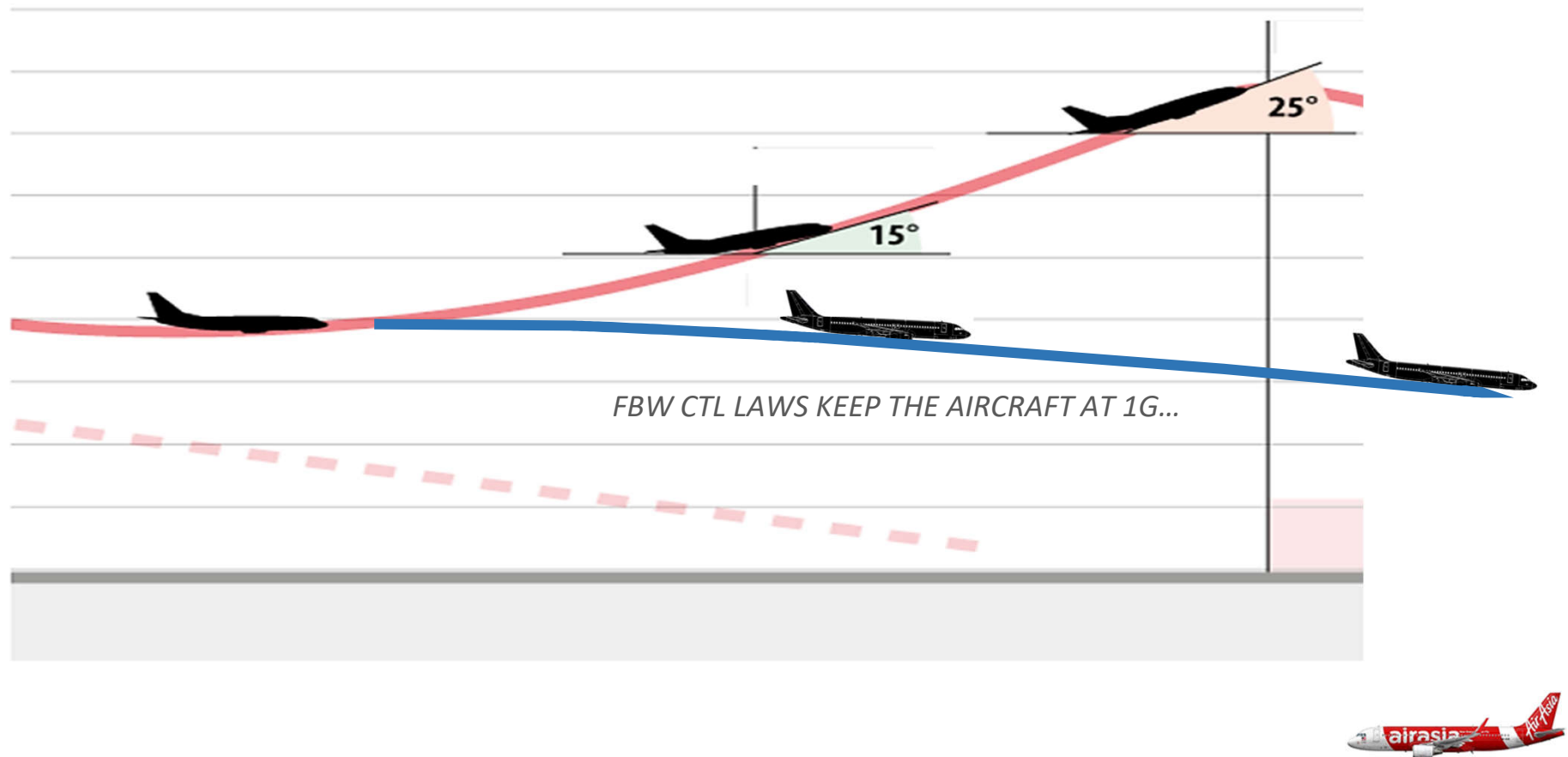
CONVENTIONAL AC RESPONSE (B737)



FBW AC RESPONSE (A320)



CONVENTIONAL Vs FBW AC BEHAVIOUR (STICK-FREE)



AVOID

- ❖ *AWARENESS TRAINING FOR PILOTS. KNOW THAT IT COULD HAPPEN TO YOU...*
- ❖ *TIME PERMITTING, PREPARE YOURSELF FOR THE GO-AROUND.*
- ❖ *ENGAGE THE AUTOPILOT BEFORE INITIATING THE GO-AROUND IF FEASIBLE...*
- ❖ *EXECUTE THE GO-AROUND 'HEADS DOWN.' THIS WILL REDUCE THE CHANCES OF SPATIAL DISORIENTATION.*
- ❖ *RE-EVALUATE AND MODIFY CURRENT TRAINING PRACTICES. YOU DON'T ALWAYS HAVE TO 'JUMP' AT THE GO-AROUND!*



DETECT

- ❖ *PILOT MONITORING TO BE FOCUSED ON THE PITCH & POWER. CALLING OUT THE FMAs ARE OF LITTLE USE IF THE FDs ARE NOT BEING FOLLOWED.*
- ❖ *CRM – IF UNSURE OF YOUR ATTITUDE, CALL IT OUT.*
- ❖ *PAY HEED TO OTHER INDICATIONS LIKE EGPWS/OVERSPEED WARNINGS ETC.*



RECOVER

- ❖ *ACCEPT THAT YOU MAY BE DISORIENTATED, TRUST YOUR INSTRUMENTS.*
- ❖ *ENGAGE THE AUTOPILOT ASAP, CALL OUT YOUR FMAs.*
- ❖ *PAY HEED TO OTHER INDICATIONS LIKE EGPWS/OVERSPEED WARNINGS ETC.*



TECHNOLOGY

- ❖ *PERFORMANCE TAILORING (SOFT GO-AROUNDS.)*
- ❖ *USE OF HEAD UP DISPLAYs (HUD)*
- ❖ *AUTOMATIC AUTOPILOT ENGAGEMENT FEATURE DURING GO-AROUNDS?*
- ❖ *MODIFIED FLIGHT CONTROL LAWS FOR GO AROUNDS?*



Thank You



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