Go Around Human Factors

Dr Wayne Martin,
BAvMan, MAvMgmt, MBus, PhD, FRAeS

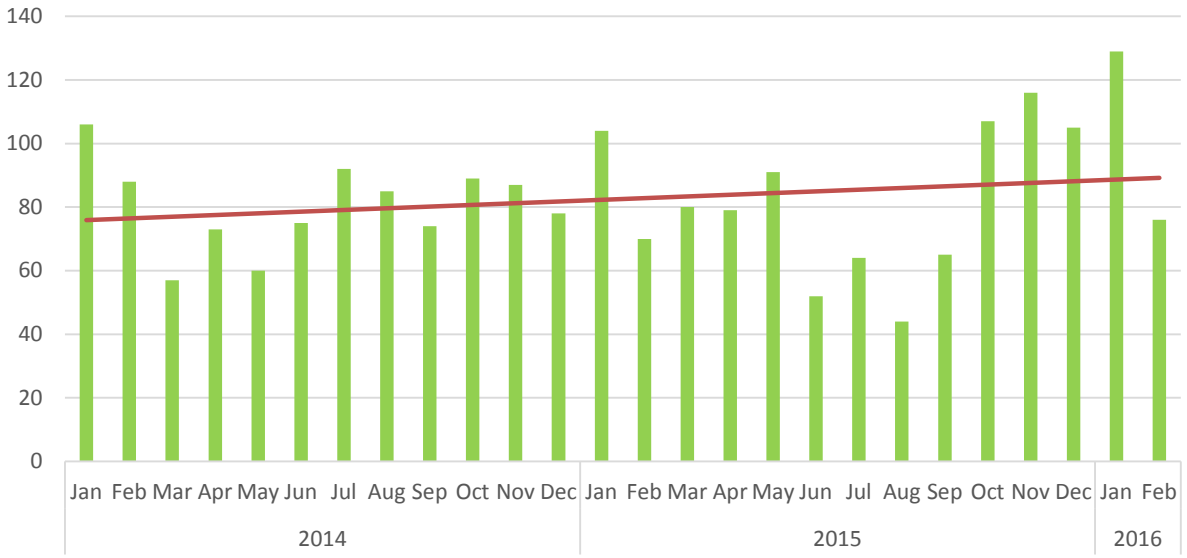
Topics

- Go Around Prevalence
- The Go Around Procedure
- Threats and Errors Associated With Go Arounds
- Stable Approaches
- Cognitive Processing
- Decision Making Inertia
- The Effects of Surprise

Go Around Prevalence

Go Arounds are a relatively uncommon occurrence which may be initiated by either ATC or by Pilots.

Go Arounds 2014-2016
Radar Towers (AD, BN, CS, ML, PH and SY)



Go Around Prevalence

Go arounds are regarded by manufacturers and operators as a ‘normal’ procedure, however they are very rarely practised.

The average short haul pilot would generally experience a go around once a year, whereas a long haul pilot would possibly only go around once every five years.

Go arounds and missed approaches in the sim are generally practised on one engine, where procedures are significantly different and things happen way more slowly.

Go Arounds 2014-2016
Radar Towers (AD,BN, CS, ML, PH and SY)

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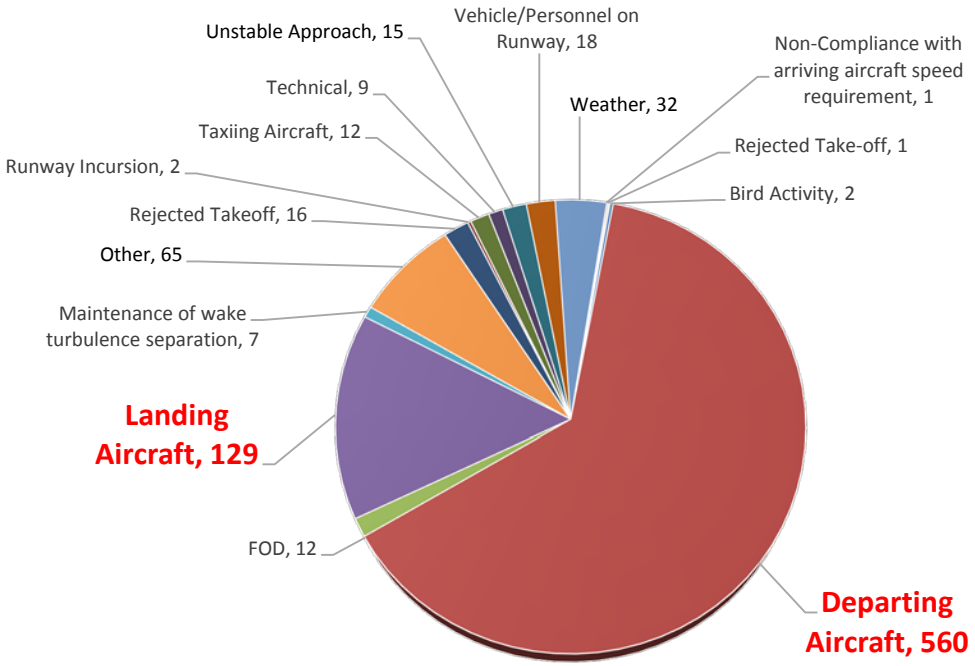
Go Around Analysis – ATC Initiated



Go Arounds 2014-2016
Radar Towers (AD,BN, CS, ML, PH and SY)

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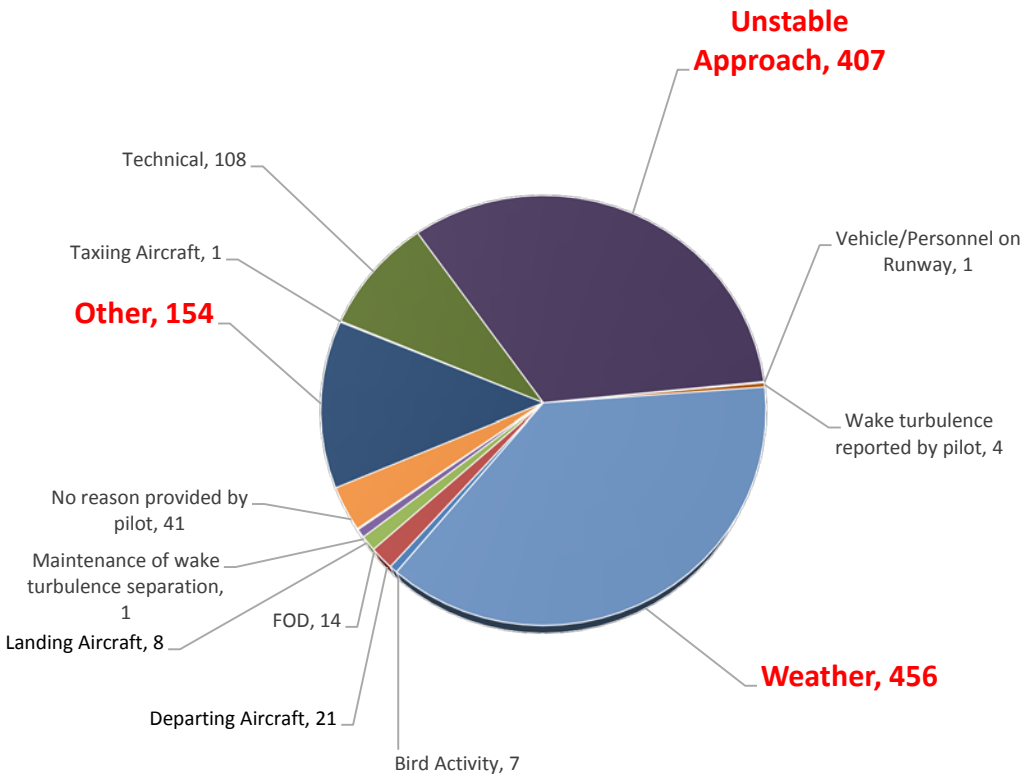
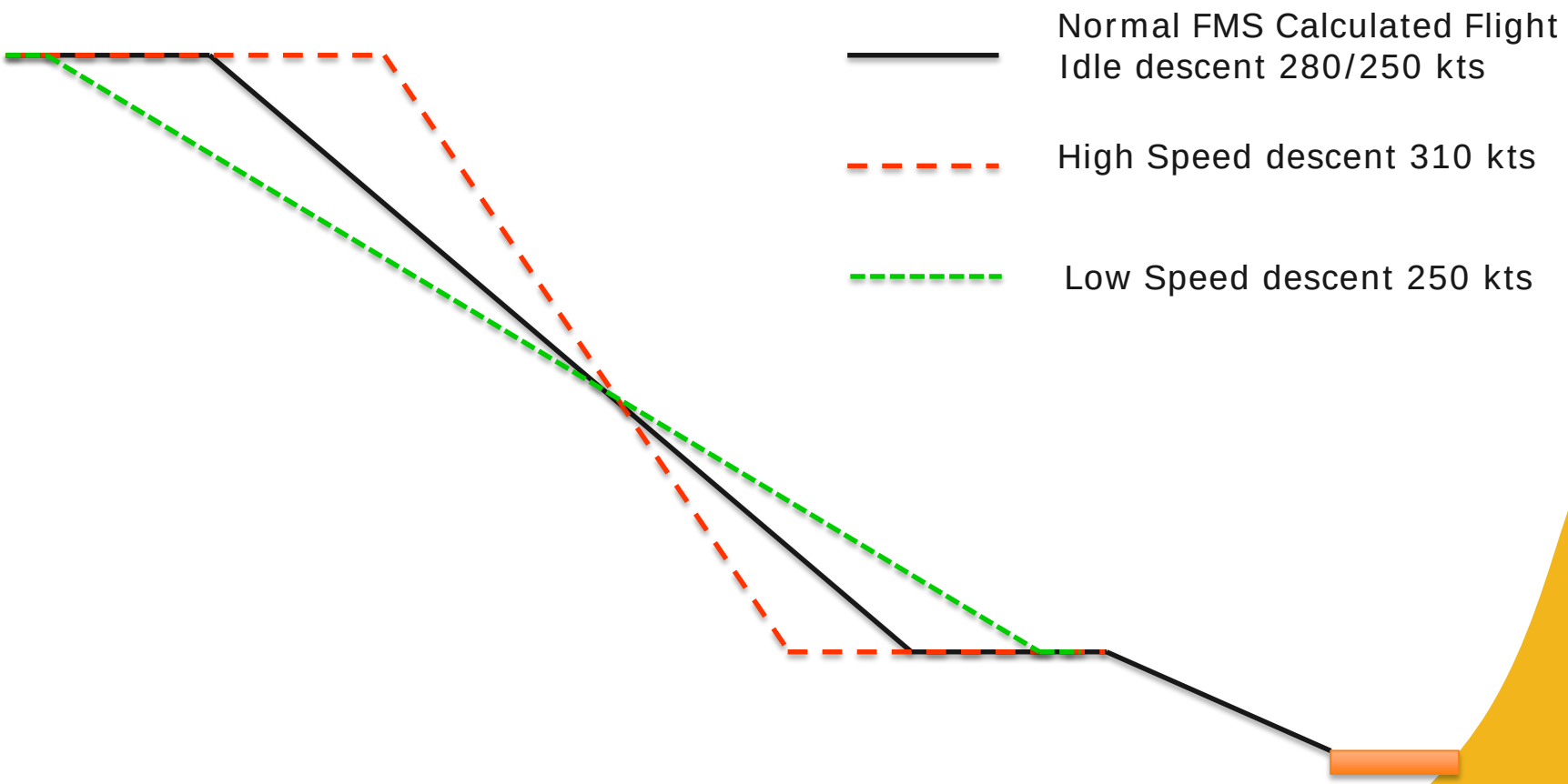
Go Around Analysis – Pilot Initiated



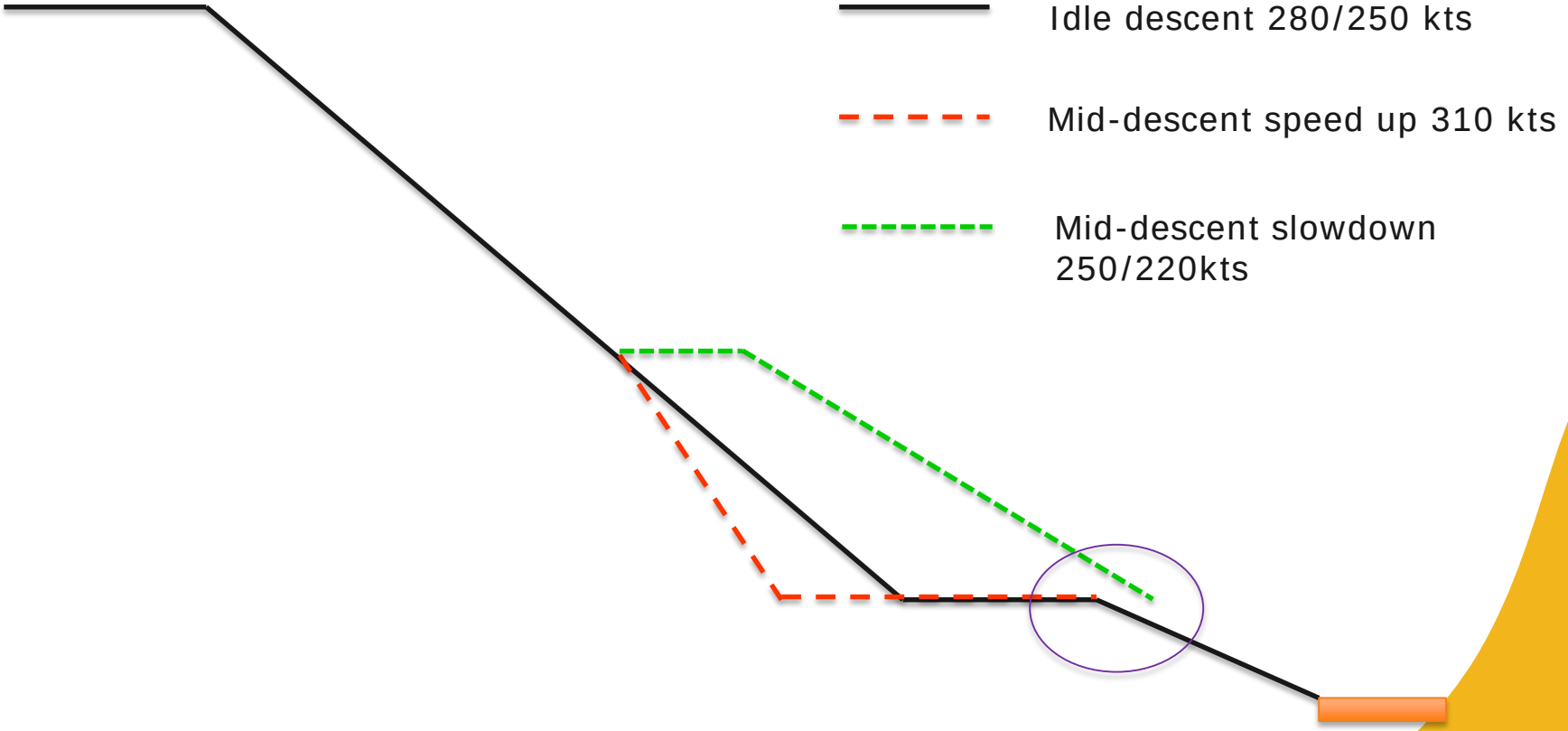
Go Around Causes

Energy Management



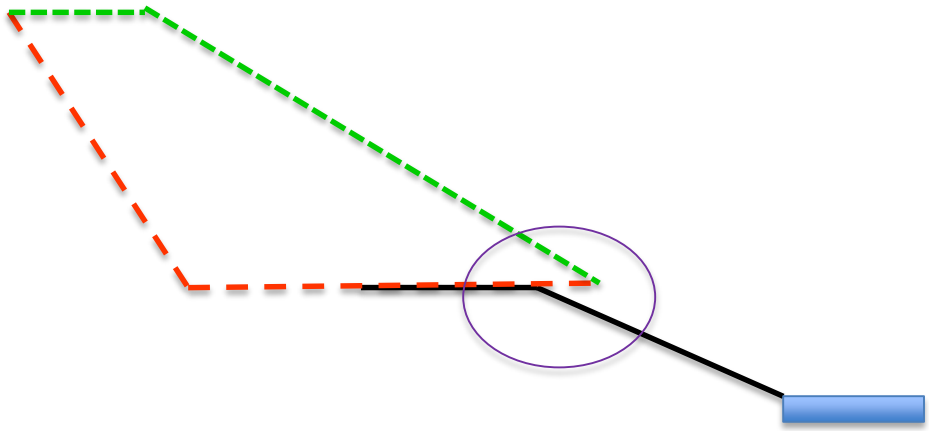
Go Around Causes

Energy Management – ATC Intervention



Go Around Causes

Energy Management



Reasons for being high and/or fast:

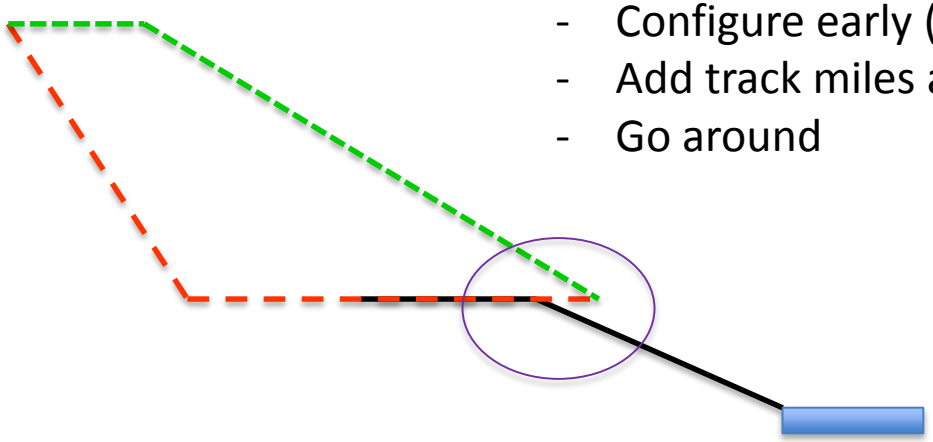
- Less track miles than expected
- Unexpected tailwind on descent or during deceleration phase
- Held high and/or fast by ATC
- Slowed down by ATC
- Ineffective speed brake

Go Around Causes

Energy Management

How to fix being high and/or fast:
(in order of preference)

- Increase speed
- Use speed brake
- Configure early (maybe)
- Add track miles and/or orbit
- Go around



Being high and/or fast will ALWAYS add complexity and stress for the pilots!

Complexity is a major threat to safety.

Go Around Procedures

Go around procedures vary significantly between types, between operators and even between individual fleets.

The following is a typical manually flown late go around procedure for a B777 entering the visual circuit at 1500ft

Go Around Procedures

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Pilot Flying	Pilot Monitoring
• Calls ‘Go Around’; Pitches Up to 15°	• Calls ‘Checked’
• Calls for Go Around Flap e.g., ‘Flap 20’	• Selects Go Around Flap
• Hits TO/GA switches	• Checks that thrust increases to Go around thrust
• Calls Flight Mode Annunciations e.g., ‘Thrust, TOGA, TOGA’	• Confirms and Calls ‘Checked’
• Follows flight director commands circa 20-25° nose up (2000fpm-5000fpm ROC)	• Monitors flight path, speed, configuration • Calls ‘Positive Rate’ when climb is confirmed
• Calls ‘Gear Up	• Selects Gear up
• Calls ‘LNAV’ through 50 feet as Automatics provide missed approach track guidance	• Monitors flight path, speed, configuration • Calls ‘400ft’

Go Around Procedures

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Pilot Flying	Pilot Monitoring
• Calls for Roll Mode e.g., 'Engage heading Select'	• Selects Roll Mode • Advises ATC • Responds to ATC Instructions
• Calls for level off altitude to be set e.g., "set 1500 feet'	• Selects Altitude in Altitude Selector • Calls '1500 feet set'
• Checks altitude set and calls 'checked'	• Monitors flight path • Calls '1000 feet to level off'
• Calls 'Checked' • Calls flight mode annunciator changes e.g., 'Speed, Alt'	• Confirms and Calls 'Checked'
• Calls 'Set Flaps Up Speed' • Pitches down to follow flight director, monitors speed	• Sets Selected Speed to Flaps Up Speed'
• Calls 'Flaps 5' at retraction speed	• Selects Flap 5
• Calls 'Flap 1' at retraction speed	• Selects Flap 1

Go Around Procedures

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Pilot Flying	Pilot Monitoring
• Calls ‘Flap Up’ at retraction speed	• Selects Flap up
• Levels off at 1500 feet’	• Monitors flight path • Selects After Take Off checklist on Bottom DU
• Follows heading assigned by ATC	• Monitors flight path
• Calls ‘After Take Off Checklist’	• Completes After Take Off checklist
• Engages autopilot if not already engaged • Calls ‘Autopilot Engaged’	• Calls ‘Checked’ • Monitors Flight Path
• Considers the following: - intentions (divert, second approach); reasons for MAP? - fuel remaining - talking to Cabin Crew & Pax - getting FMC set up for next approach/divert - re-briefing approach	• Monitors Flight Path • Assumes control if necessary • Gets set up for second approach

Threats and Errors

Threat and Error Management is a framework of strategies for managing the myriad of threats that could affect flight safety and the errors which all human beings make.

A **threat** is 'any external factor which adds complexity, which must be managed by the flight crew to maintain safety'

An **error** is 'an unexpected deviation from expectations'

Errors may include slips, lapses, omissions or mistakes.

Threats and Errors

Common threats include:

- Terrain
- Weather
- Other aircraft
- Ground staff
- Engineers
- Passengers
- Time pressure
- Aircraft malfunctions

The biggest number of threats to flight safety (from LOSA data):

- **ATC**

Threats and Errors Associated With Go Arounds

IATA 2015 study of 36 LOCI accidents 2010-2014

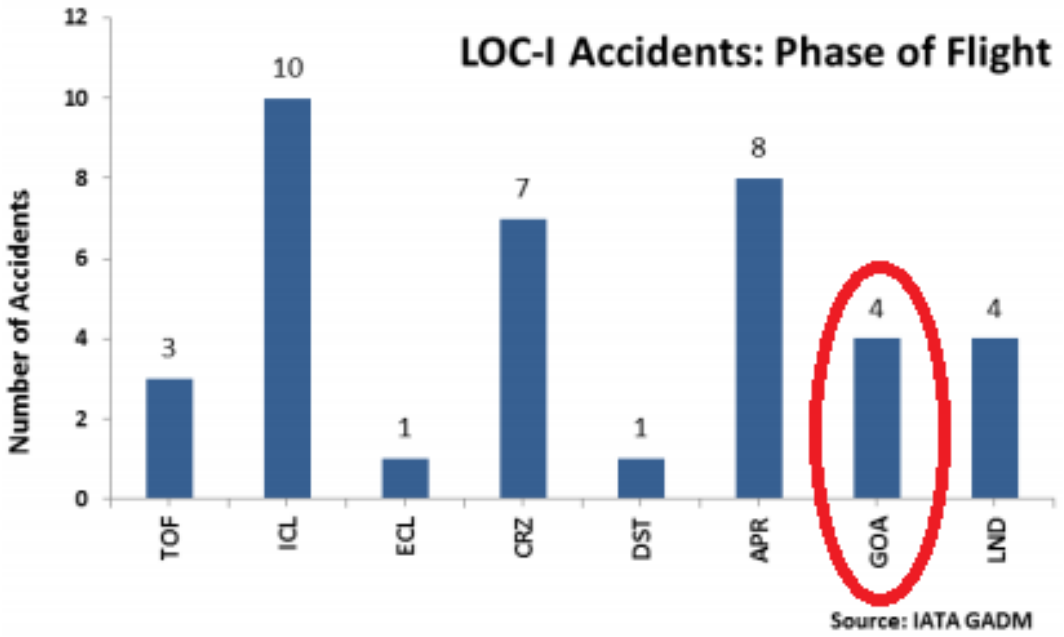

Figure 19: LOC-I Accidents by Phases of Flight 2010 - 2014

11% of LOCI accidents occurred in the Go around phase

Threats and Errors Associated With Go Arounds

BEA Study, 2012

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Specific difficulties encountered in flight

On average, 60% of the pilots indicated that they had encountered difficulties during a GA.

365 pilots (44 %) provided a description of the difficulties encountered during their GA. Almost half of these pilots (42% - 153) also indicated that they had encountered difficulties during simulator sessions.

Difficulties expressed	***not or a little difficult as a %ge***	***difficult or very difficult as a %ge***	***no answer as a %ge***
Getting and maintaining pitch angle	66.8	11.6	21.6
Thrust management	53.2	28.8	18.0
Horizontal flight path management	48.9	28.8	22.3
Vertical flight path management: go-around altitude capture	35.2	49.0	15.8
Aircraft configuration management	44.2	38.5	17.3
Autosystem management	36.5	46.2	17.3
Trim management	61.3	4.9	33.8
CRM: decision making	51.4	26.9	21.7
CRM: task sharing	61.4	15.9	22.7
CRM: compliance with SOP	47.9	32.6	19.5
Visual scan management/focussing	39.7	37.3	23
Coping with acceleration-related spatial disorientation	58.9	14.2	26.9
Coping with the modification of the flight path on ATC request	38.9	37.8	23.3

Aeroplane State Awareness during Go-around (ASAGA)

In 2011, the BEA met with teams from CAST, the NTSB and the FAA. They decided on a new category of aircraft accident. The term Aeroplane State Awareness during Go-Around (ASAGA) was proposed. Common issues in their combined study included:

- Position of the horizontal stabilizer trim when close to the full nose-up position;
- Insufficient CRM, notably with regard to the contribution from the Pilot Monitoring
- Unfamiliarity with automatic systems;
- Spatial disorientation;
- Somatogravic illusions;
- Interference from ATC.

Stable Approaches

Unlike turboprop aircraft which use a ‘gradually reducing speed regime on final, jets rely on a stabilised speed and profile for the last 1000-1500 feet.

The requirements vary between companies, and by fleet, but generally in IMC there will be a requirement for the aircraft to meet stringent stable approach criteria by 1000-1500 feet, and by 500-1000 feet in VMC.

Stable Approaches

The following criteria are an example of the requirements for a stable approach:

- All approaches shall be stabilised by 1000 AFE
- Briefings complete
- Normal Checklists complete
- Aircraft in the correct landing configuration
- Correct lateral and vertical flight path
- Less than 1000fpm rate of descent
- Thrust setting appropriate
- Speed -5 to +10 from target speed

A ‘Stable’ or ‘Not stable’ call must be made by the PM at the stabilisation height.

The PF must initiate a go-around if the approach is not stable.

Stable Approaches

LOSA Collaborative data:

Unstable Approach Outcomes

Event	Outcome of the Event
4% of flights in LOSA Archive have an Unstable Approach	87% continued the approach and landed without issue
	10% continued the approach and landed long, short, or significantly off centerline
	3% executed a missed approach (9 of 337 unstable approaches observed)

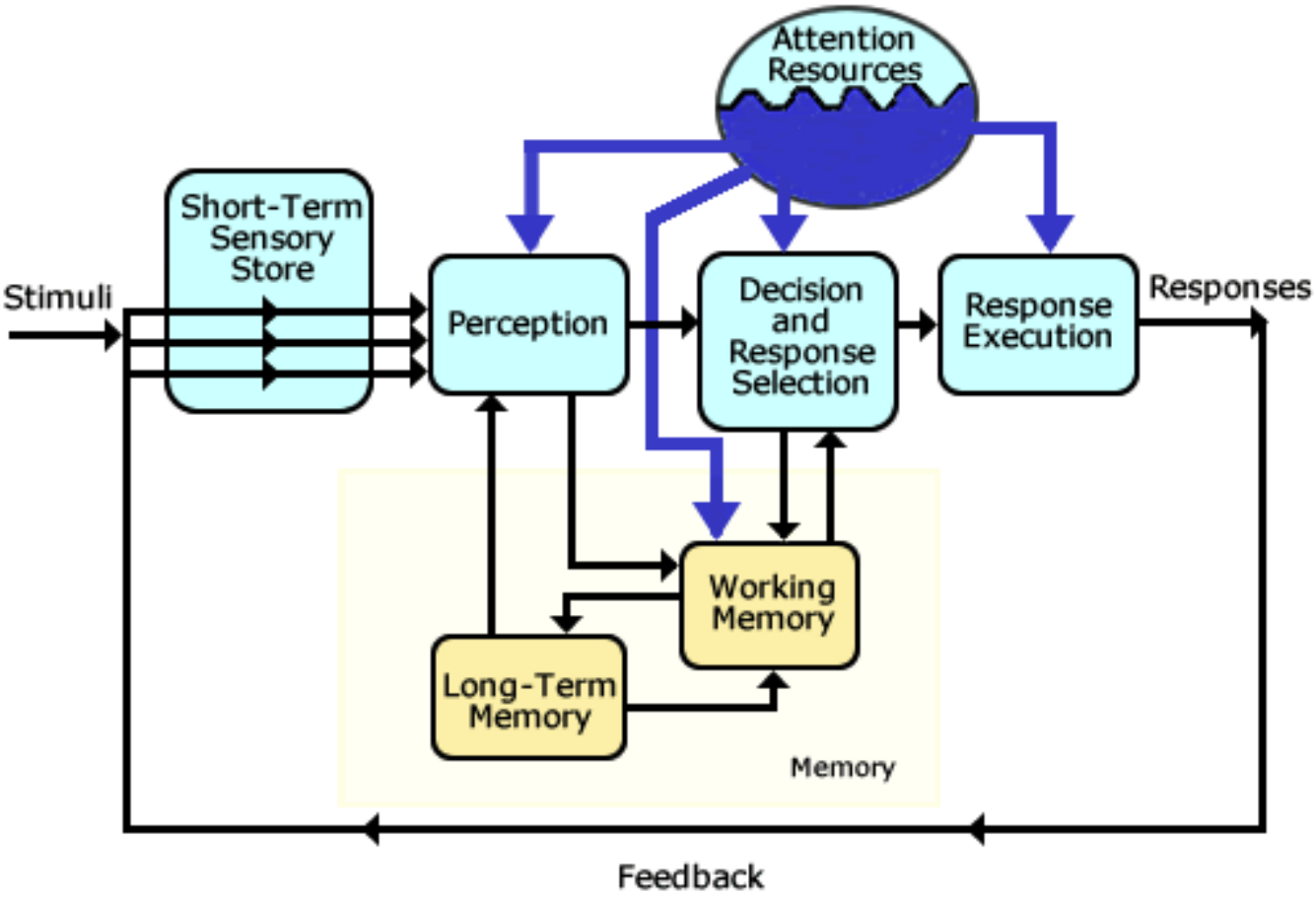
Stable Approaches?

AF358 Toronto

QF1 Bangkok

Cognitive Processing

Information Processing Model



Wickens, 1999

Cognitive Processing

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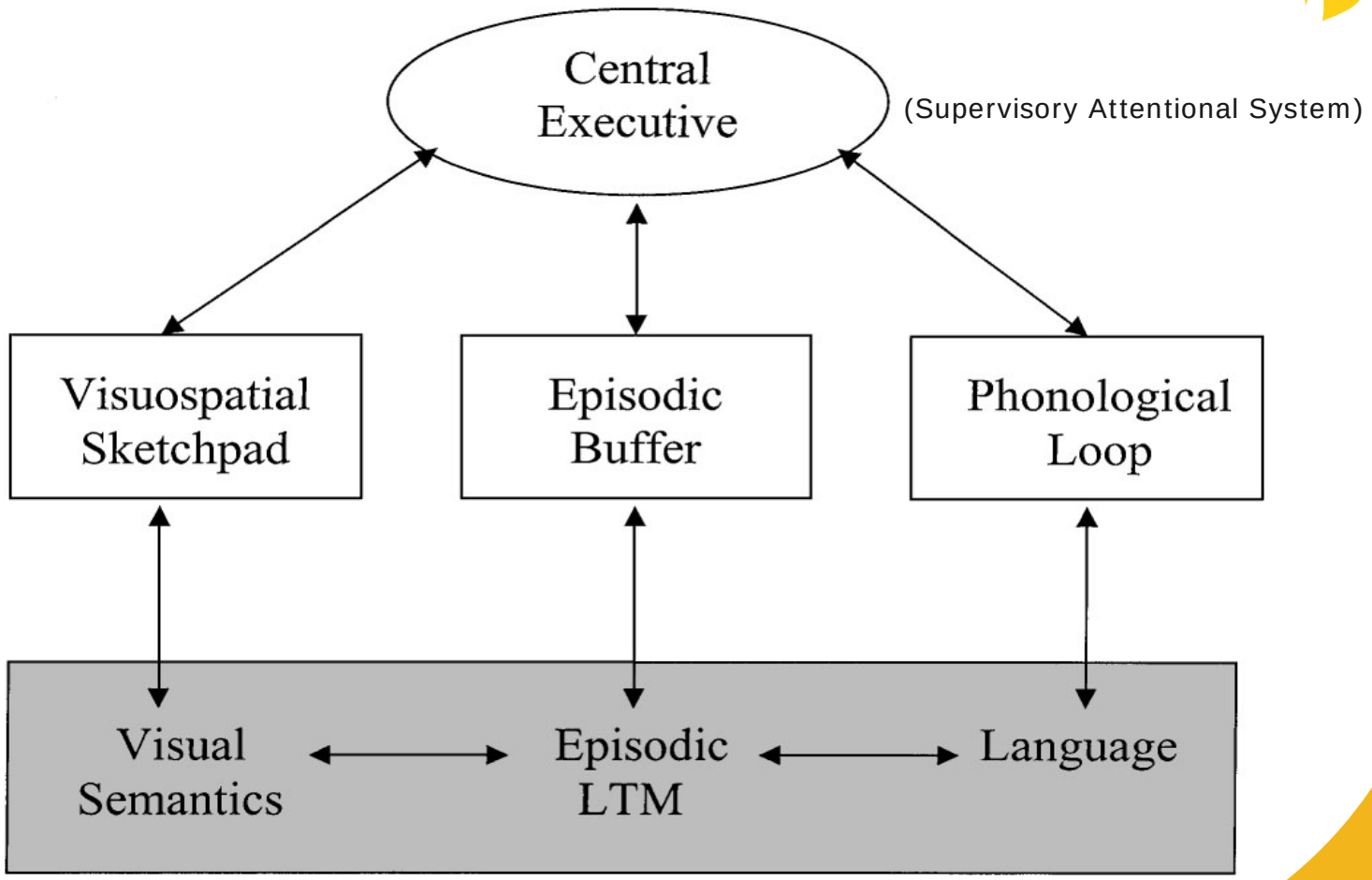
Working Memory



Baddeley, 2000

Cognitive Processing

Activation of Mental Schemas

Schemata are an organised pattern of thought or behaviour that organizes categories of information and the relationships among them.

The Go around procedure is a stored schema of skills, procedures and knowledge. It is activated into working memory from long term memory when required.

Baddeley, 2000

Cognitive Processing

Situational Awareness

‘Situational awareness is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and a projection of their status in the near future’ (Endsley, 1988)

Cognitive Processing

The Effects of Stress

- Cue sampling is reduced (Attentional Narrowing)
- Perceptual field is reduced
- Vigilance is decreased
- Working memory capacity is reduced
- Satisficing occurs
- Rigidity occurs in PS and DM (Perseveration)

Cognitive Processing

Attentional Tunnelling

Analysis of some accidents seems to suggest that the go-around phase leads to the phenomenon of attentional tunnelling where one pilot, or both, focus exclusively on a problem at the expense of general monitoring of the flight parameters.

Eye tracking data show that some piloting actions through the use of flight instruments generate strong attention "capture“.

Programming of the flight path from the FCU / MCP, flight path management using the flight director, and flap management in relation to speed limits (VFE) are those areas that produce either the longest attentional tunnelling time (i.e. exclusive fixations), or the highest fixation frequency, or both.

BEA, 2013

Cognitive Processing

Modification of the go-around flight path by ATC

Simulator experiments have shown that instructions given by the controller are not immediately taken into account by the crew at the beginning of the go-around procedure. Of the average of one minute it takes to perform a go-around, 30 seconds on average are necessary for crews for recall.

Most crews do not recall the numbered values exactly. This is due to several reasons: on the one hand, crews are taught not to be disrupted by ATC (stand-by or not read-back), on the other hand, the number of actions to perform (retraction of flaps and gear, flight path management) take up all of the crew's capacities and leave them little availability to perceive and memorise ATC information.

BEA, 2013

Decision Making Inertia

Plan Continuation Bias

In a landing phase, decision-making processes are generally based upon rational elements like the maximum crosswind speed for a given aircraft.

However, emotional pressures can alter the rational reasoning by shifting decision-making criteria from safety rules to subjective ones.

Causse, Dehais, Peran, Sabatini & Pastor (2012)

Decision Making Inertia

Plan Continuation Bias

Having made a decision on a course of action, it can be quite difficult to subsequently overturn that decision and take another course of action.

The initial decision actually relieves some stress, and to have to reconsider another decision can mean revisiting this stressful state.

There is therefore an inherent bias to continue with the original course of action, even though it may be apparent that it is no longer the best one.

'Press-on-it is' is a common form of this.

The Effects of Surprise

Surprise, or startle has been strongly linked with causality in a number of aircraft accidents over the last decade.

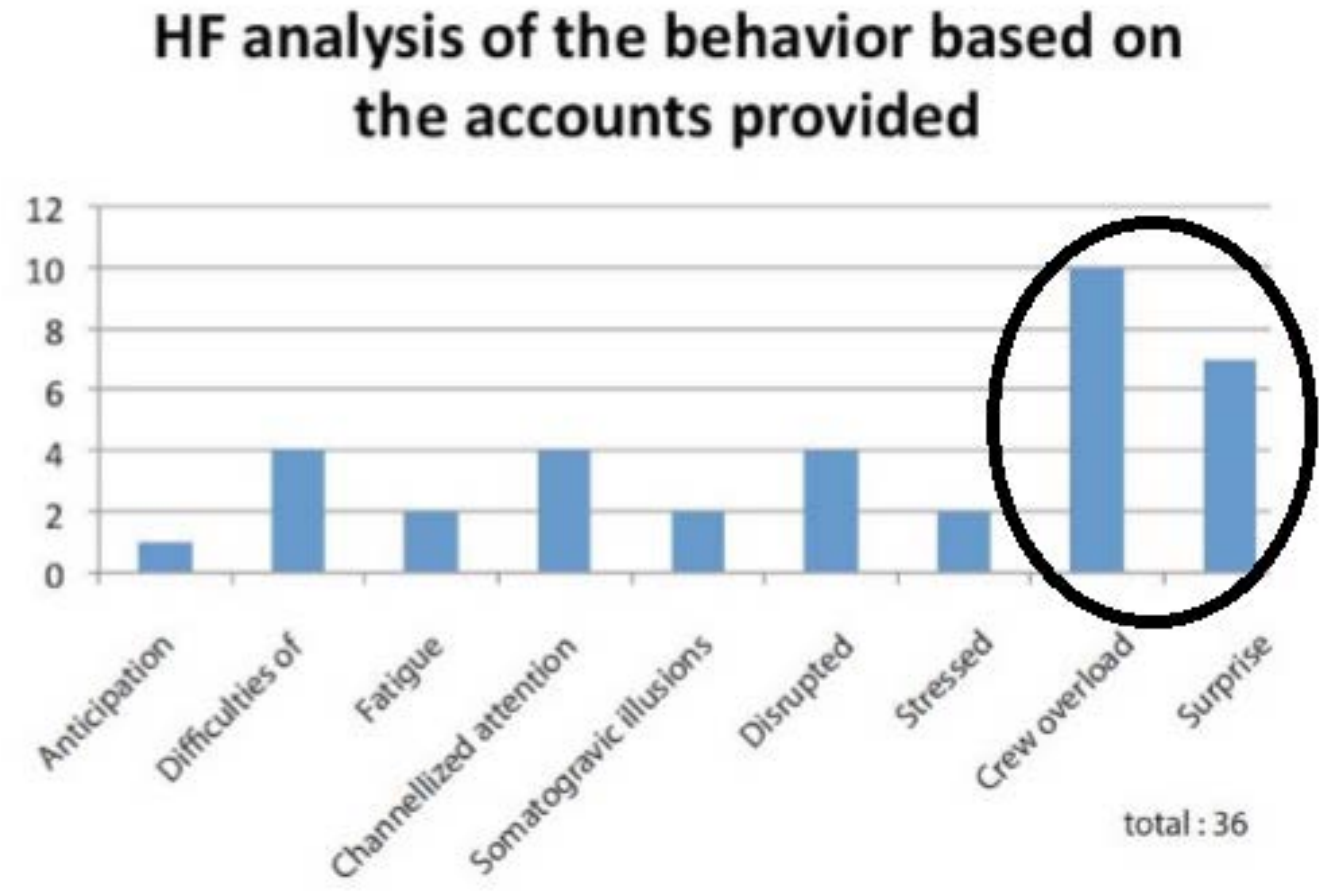
During the surprising event three things may occur, particularly if the surprising event is considered threatening:

1. The startle reflex – an aversive reflex which orientates the attentional mechanisms towards the startling stimulus

2. The 'Fight or Flight' Reaction – a rapid activation of the SNS to enable the body to deal with the emergency situation. Adrenaline, heart rate increase etc. are common

3. The acute stress response develops, with significant effects on information processing capabilities

Cognitive Processing



BEA, 2013

The Effects of Surprise

Potential for Non-compliance is high

Questions?