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Pilot Decision Making and Go-Arounds

Disclaimer

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Michael Gillen IASS, 2016

Introduction

- Phase of flight accident data indicates that the approach and landing phases represent one third of fatal airline accidents (Boeing, 2012).
- Many of these accidents have an unstable approach as a major link in the accident chain (Boeing, 2012).
- Industry data suggests that pilots rarely execute a go-around from an unstable approach even though required to do so by company policy.
- According to the Flight Safety Foundation, only 3-4% of approaches are considered unstable; however, of that number, only 2-3% of pilots decide to execute a go around (Flight Safety Foundation, 2016).

Cognitive Processes – Why?

- Training and Unusual Events
- Risk in Decision Making
- Divergence from SOPs (why)
- Planned continuation error / bias
- Emotion and decision making
- Decision behavior
- Normalized Deviations

Training and Unusual Events

- Accident reports describe many situations where pilots responded to abnormal events in ways that were unexpected from the way that they were trained (Casner, Geven, & Willliams, 2012).
- Unfortunately, training and testing of professional airline pilots have become somewhat routine and predictable.
  - Flight crews know what to expect as they see the same maneuvers at each training event
- Study by Casner - Pilot responses to the routine events showed little variability.
  - In contrast, pilot responses in the unexpected maneuvers showed great variability from pilot to pilot (Casner, Geven, & Willliams, 2012).
  - The results of the study showed that most pilots generally experience the same sequence of abnormal events, presented under similar circumstances.

Training and Unusual Events – Cont.

- Casner suggests that such training can lead to shallow and memorized understandings of problem situations which in turn do not lead to an ability to transfer this training to different encounters in actual operations (Casner, Geven, & Willliams, 2012).
- The end result of the study was that pilots struggle to recognize unexpected situations with the result of considerably delayed responses (Casner, Geven, & Willliams, 2012).
- A missed approach can usually be considered and unexpected event.

Risk in Decision Making

- Risk assessment feeds into decision-making in two different ways.
  - First, during the assessment of the precipitating event.
  - Then in evaluating potential courses of action (Orasanu, J., 2001).
  - Risk involves both probability and magnitude.
- Risk is highly dependent on the pilot's reference point and depends on the amount of experience that a pilot has with a particular situation (Slovic, P., 1987).
- The more a pilot is familiar with a situation, the less risk that is perceived.
  - Repeated successful landings from unstable approaches.

Risk in Decision Making

- NASA study showed how pilots framed the situation seemed to influence their decisions (Orasanu, J., 2001).
  - When the pilots framed the factors in their risk analysis as negative, they generally took a cautious approach.
  - When they discussed the factors as less negative, they often continued with their original plan.
- Continuations were usually accompanied by a strategy to mitigate the risk as a condition of continuance (Orasanu, J., 2001).
  - Primary indication of PCE

Risk Analysis and Go-Arounds?

- The transition from stable to unstable represents a failure of the systems in place to prevent such an occurrence (Moriarty, D., Jarvis, S., 2014).
- When assessing whether an approach will be stable, two different pilot groups appear.
  - One group of pilots tends to prefer to assess well before reaching the minimum stabilization height(s) / gates.
  - Second group of pilots tend to continue to the minimum height(s) / gates before making a decision (Moriarty, D., Jarvis, S., 2014).

Risk and Go Arounds?

- The pilots who assess well in advance can be described as strategic in their thinking and analysis. These pilots are somewhat more biased to discontinue an approach if it becomes unstable.

- Pilots who continue to minimums before making a decision are more tactical in nature and will tend to accept more deviations from standards and are thus more biased to continue the landing.

Divergence from SOPs - Why?

- Divergence from written procedures is mirrored by the principle of the Efficiency-Thoroughness Trade-Off (ETTO) as described by Hollnagel (Hollnagel, E., 2009).
  - The theory concludes that in many work situations, strict adherence to written procedures is detrimental to efficiency (Hollnagel, E., 2009).
  - The theory further contends that human work is successful because humans are capable of adapting their work practices to overcome procedural inefficiencies (Hollnagel, E., 2009).
- Hollnagel's work can be paired with plan continuation bias to create a compelling reason to continue an unstable approach.

Planned Continuation Error / Bias

- Pilot's responses to a survey report they rarely adhered strictly to the recommended standard approach profile (Moriarty, D., Jarvis, S., 2014).
- A reason as to why pilots may continue to land when a go around should be executed can be described as a fixation goal (the goal of the flight is to land at the destination).
- What are the signs of PCE?

Emotion Decision Making and PCE

- The decision to continue can be defined as a PCE error (Orasanu et al., 2001).
- PCE can be tied to many cognitive and psychosocial aspects.
  - Reduced updating abilities in working memory.
  - Task commitment issues
  - Psychological stress.
  - Poor risk assessment (Dehais et al., 2011).
- Another contributing factor to PCE may due to the large range of perceived adverse consequences associated with the decision to go around (Causse et al., 2011).
  - What are some of these consequences?

Emotion affecting Decisions

- In a landing phase decision, decision-making processes are generally based on rational and concrete elements.
  - Aircraft speed, configuration, and weather conditions.
- Increasing emotional pressures can alter the rational reasoning by shifting decision-making criteria.
- Shift from safety rules to subjective analysis (Causse et al., 2013).
  - PCE / divergence from SOPs

Emotion Affecting Decisions

- Neuroimaging data also showed that PCE behavior was underpinned by the contribution of emotion and reward during the decision-making process.
  - Support the hypothesis of possible temporary impairment (Causse et al, 2013).
  - Some pilots cannot describe why they chose to continue the approach.
- The study concluded, in part, that PCE could be the result of the different aversive negative consequences associated with the go-around decision (Causse et al, 2013).
  - Fuel, schedules pressure, company reports
  - Failure, and unfamiliar flight regime

Decision Behavior

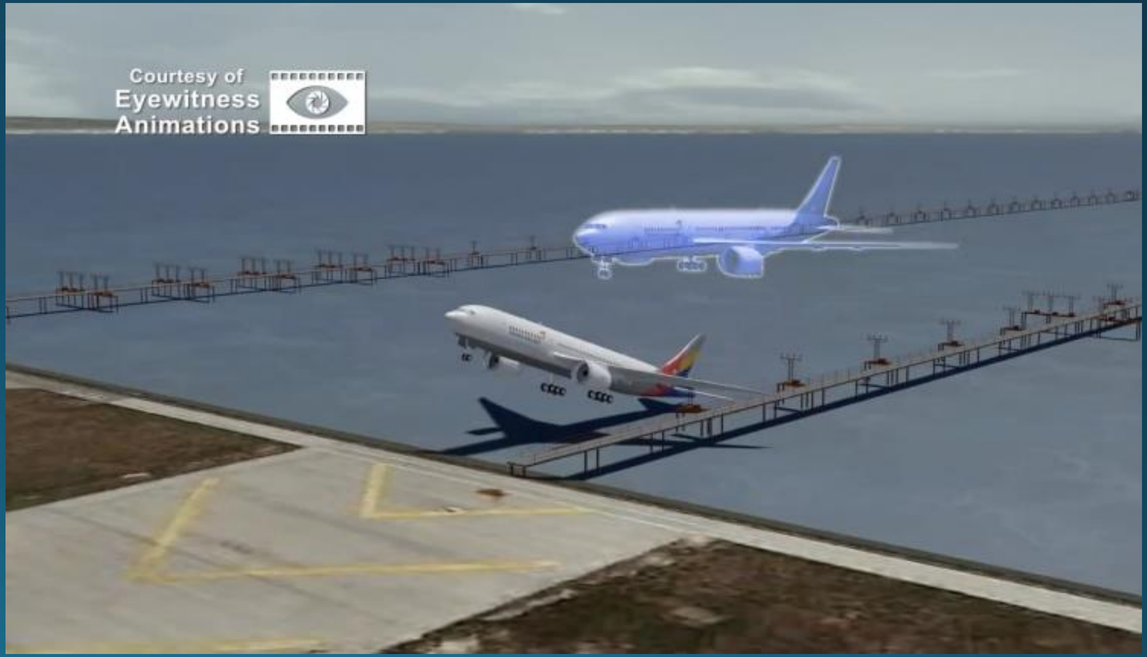
- In unfamiliar situations when proven rules are not available, behavior may be goal-controlled (Rasumusen, 1983).
- Coping with complexity is largely due to the availability of a large repertoire of different mental representations of the environment from which rules can be generated ad hoc (Rasumusen, 1983).
- Purposeful behavior is based on a pilot's perception of an event and is experiential knowledge of similar situations.
- Human behavior can be characterized by three levels of constraints or performance levels. The levels make use of pattern matching processed and are defined as skill based, rule based and knowledge based performance.

Normalized Deviations

- FSF reports that a specific situational awareness profile emerges for pilots when they elect to continue with an unstabilized approach (Smit et al, 2013)
- The behavior was characterized by a minimization of situational threats as it relates to the approach profile (Smit et al, 2013).
- Pilots tend to selectively ignore or rationalize their situational awareness competencies and, in so doing, dulled their sensory and cognitive processes when assessing and evaluating operational risks (Smit et al, 2013).

Reducing Landings from Unstable Approaches

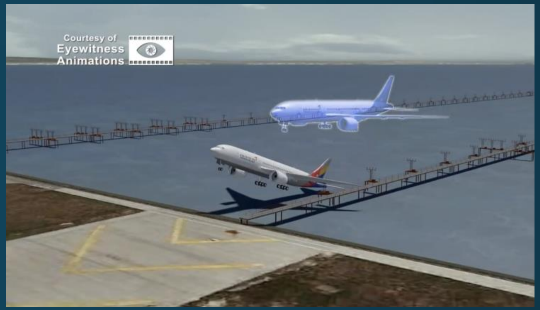
- Discussion
- Flexible stabilized approach criteria
- Conclusions



Discussion

- There are many reasons why pilots decide to land from an unstabilized approach. Some can be attributed to PCE, however this is not the cause but the result of the decision making process.
- Pilots often weigh the risks of a go around vs. the risks of landing. These decisions are made in real time and include multiple factors that influence crew decision making.
- Reinforced behavior from previous successful unstable approaches pattern tends to lead the pilot to the conclusion that landing from an unstable approach often has few negative consequences.

Discussion



- Knowledge structures, emotion, and behavior modeling all lend explanations as to why crews do not choose to go around, however, they do not offer concrete solutions to help mitigate the issue.
- Airlines do not have a variable descriptions and requirements for stabilized approach criteria and therefor have established solid and concrete minimums.
  - These policies do not match what happens in the actual operation as seen by the number of go arounds vs landings from unstable approaches.

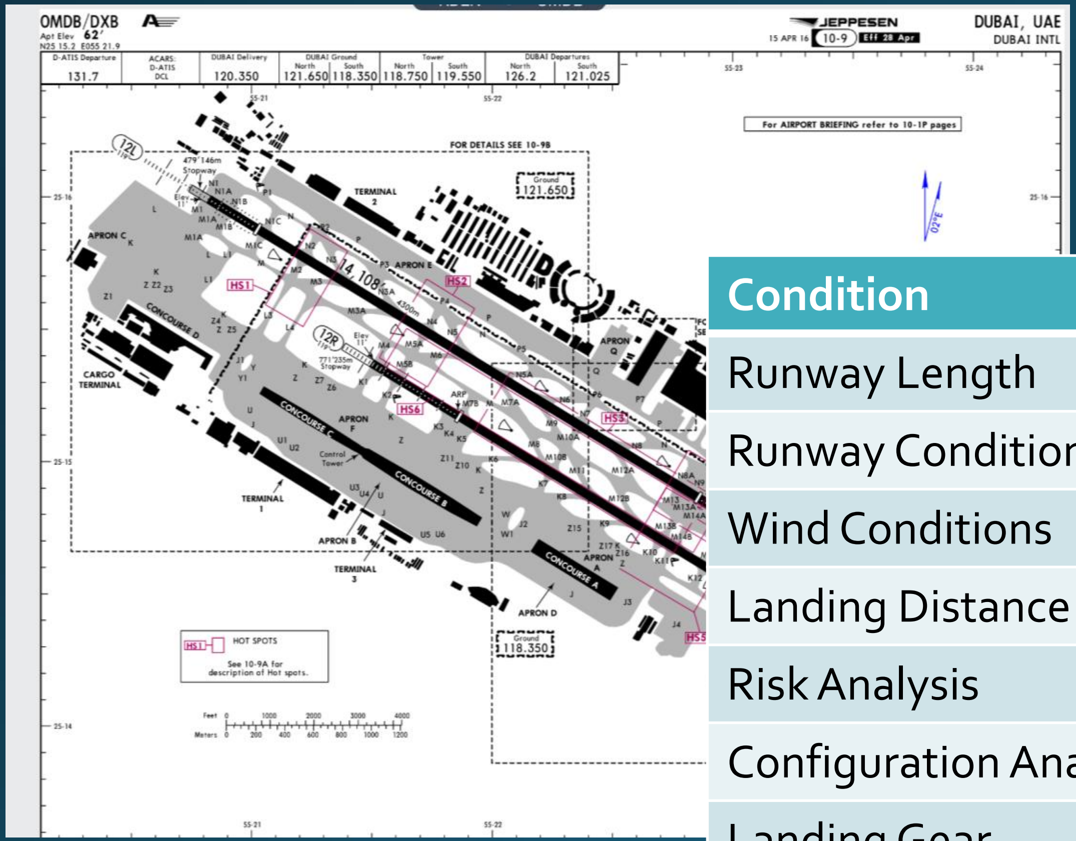
Risk-based Analysis

- Perhaps the solution lies in more flexible stabilized approach criteria that takes into account current conditions such as weather, wind, and runway length.
- Trends pilots towards strategic based reasoning.
- In addition, a multi-faceted approach to go arounds is required. Verbal announcement of aircraft trends at a pre-determined heights might be helpful.
  - These trends should include items such as airspeed, sink rate, configuration, and vertical profile.
  - Inclusion of these trends may encourage go-arounds from unstable approaches by providing concrete verbal cues of the aircraft's profile and energy state.
  - Should be part of every arrival briefing.

Risk Based Approach Criteria

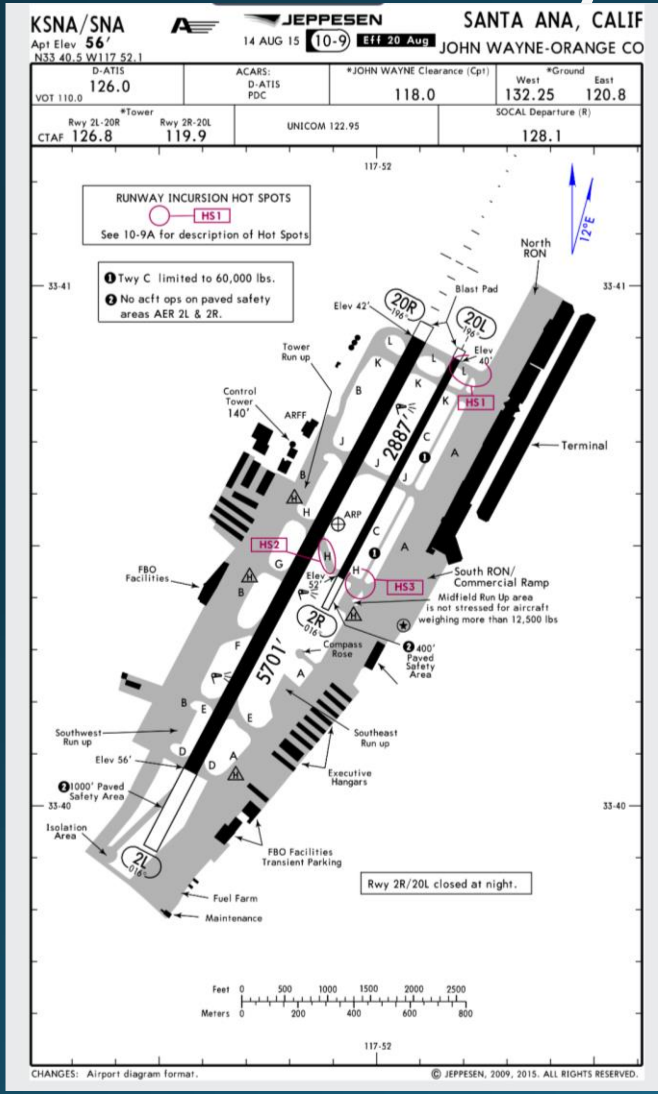
- Risk to be analyzed during and discussed during every approach briefing
  - Significant factors ranked low, medium, and high
    - Process is simple and quick to complete (can be computerized)
  - Factors determine overall risk as it relates to landing distance
  - Configuration, speed, and altitude limits all discussed.
- Specific go-around criterial discussed during the briefing
  - Reduces PCE (changing the criteria)

Risk Analysis –Example 1 OMBD



Condition	Condition	Risk
Runway Length	14,500 feet	Low
Runway Condition	Dry	Low
Wind Conditions	Calm	Low
Landing Distance	5000 feet	Low
Risk Analysis		Low
Configuration Analysis	Final Flaps	By 1000 feet
Landing Gear	Down	By 1500 feet
Airspeed	Tolerance at 500 feet	-0 / + 15 kts
Altitude	At 500 feet	+100

Risk Analysis - KSNA



Condition	Condition	Risk
Runway Length	5700 feet	High
Runway Condition	Wet	Medium
Wind Conditions	Calm	Low
Landing Distance	5000 feet	High
Risk Analysis		High
Configuration Analysis	Final Flaps	By 1500 feet
Landing Gear	Down	By Final Approach Fix
Airspeed	Tolerance at 500 feet	-0 / + 5 kts
Altitude	At 500 feet	+50 feet

Conclusions

- Unstable approaches continue to be a risk in our industry
- Cognitive pressures tend to influence crews to continue an approach despite the knowledge of the approach being outside SOP limits
- Solution may be realized in flexible approach criteria
  - Designed to be discussed on every approach
  - Designed to fit within already established company approach SOPs
  - Easily added to standard approach briefing.

Questions

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