A rapid decision aid for diversion safety assessment for safer and more efficient approach and landing operations

Patent application pending

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Approach and Landing Safety and Efficiency Challenges in Changed Landing Parameters Situations

Safety Hazards and Operational Inefficiency Involved in Continued Unstable Approaches and Delayed Recognition of Go Around

40% of approach and landing accidents due to continuing unstable approaches.—FSF Nov 1998/Feb 1999

4 % Approaches are Unstable
Only 3% (of 4%) Execute Go Around
97% (of 4%) Continue with Unstable Approach
--Capt. Bill Curtis (FSF, 2013)

ATC runway changes cause too steep or "slam-dunk" approach with no other alternative to go-around. – FSF "Killers in Aviation" 1999

1 in 10 Go Around Ends with Hazardous Outcomes
--FSF 2013

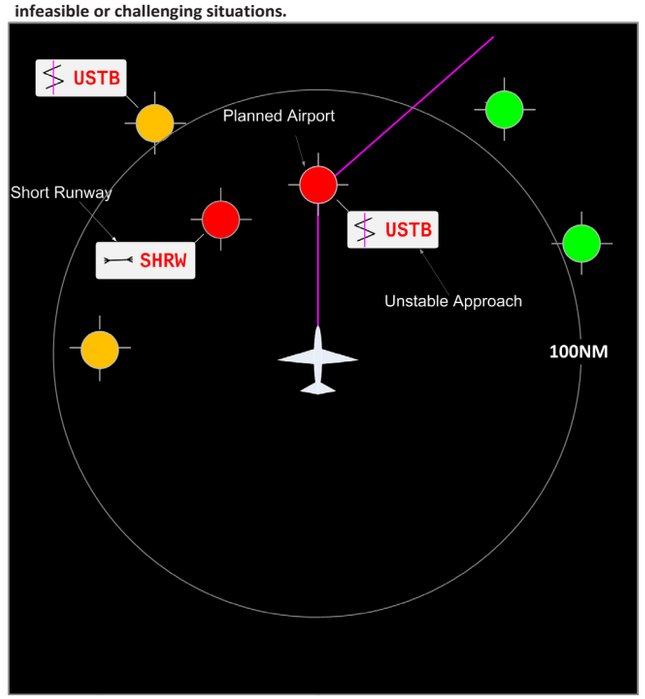
220 Diversions from 2004 to 2008. – Valani R, aviat space environ med.
1829 In Close Approach Changes by ATC ended with problems. – NASA, NAOMS

- Responding to changes in landing parameters (runway, airport, approach, winds/weather, runway conditions etc.) and taking GO-NOGO decision is always a high workload situation as landing feasibility evaluation is a mental process, without sufficient decision aids in multi parametric, rapidly changing flight and external situations. Many a times bringing pilots to task saturation.
- Involved high workload and lack of decision and situation awareness support impairs pilots' ability to assess options (alternate airport, runway or approach type) even if they recognize risks in changed landing parameters, and pilots tend to continue the approach/landing with the intuition and guesswork.
- Such non parametric and non-informed guesses pose great risks of unstabilized approaches, runway excursions, hard landings and other safety hazards. It also induces fuel overheads due to lack of tactical planning support to avoid Go-Around and lack of situational clarity to negotiate landing parameters with ATC.
- Monitoring of landing parameters external to flight deck (e.g. approach and runway availability, runway condition, weather, winds and landing minima etc.) and re-evaluating planned landing safety and feasibility is a challenge in already high workload approach and landing operations, affecting overall safety and operational efficiency.

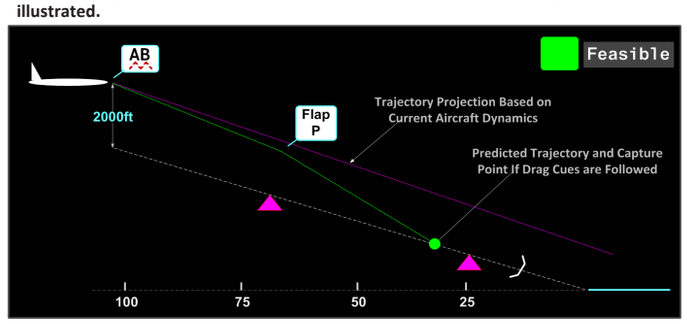
Apart from Reduced Safety in changed landing parameters situations, pilots tend to fly sub-optimal, depriving benefits of FMS optimizations available in managed descends.

The Solution: A Rapid Diversion Safety and Operational Efficiency Assessment Decision Aid

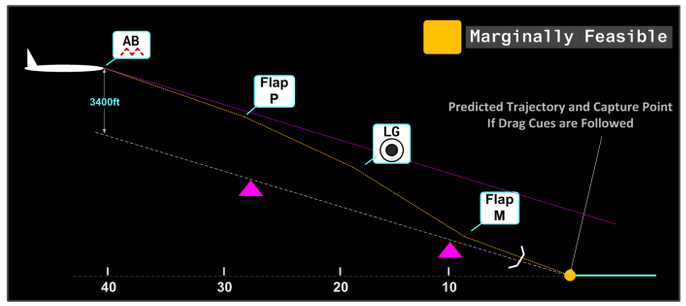
1 Automatically recognizes diversion situation, and adapts map view to provide rapid decision aid for quick landing safety, feasibility and options assessment. Intuitive color coded airports convey associated landing safety ratings based on various parameters like energy dissipation feasibility and involved workload, fully managed vs. sub-optimal vertical path modulations requirements, terminal weather/winds, and runway conditions. Also shows justification legends for infeasible or challenging situations.



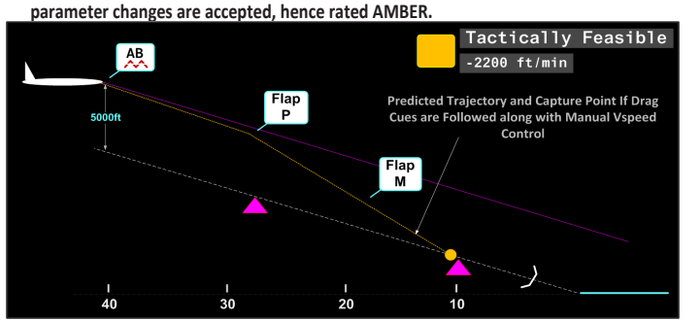
2 For pilot selected airport, landing safety and feasibility assessment is depicted on Vertical Situation Display (VSD) in temporary flight plan. Theoretical Descend Path is calculated from changed runway/approach. Vertical energy management and dynamic drag device deployment decision aids to stabilize and converge to TDP is illustrated.



3 Marginally Feasible: With all the drag devices deployment plan, aircraft will be stabilized at least at the final landing gate, but involves crew workload to reach stabilization criteria as well as aircraft will never converge to TDP. Involves considerable workload if proposed landing parameter changes are accepted, hence rated AMBER.



4 Tactically Feasible: Convergence to TDP and stabilization not feasible with managed vertical trajectory. Pilot can make the situation feasible with manual vertical speed control by disengaging VNAV and using Vspeed to modulate convergence to TDP along with drag devices deployment to dissipate energy. Involves considerable workload if proposed landing parameter changes are accepted, hence rated AMBER.



5 Infeasible Situation: With all the drag devices deployed, aircraft can overshoot runway threshold and stay unstabilized. Provides early warning on go-around situation. Pilot can evaluate MA or alternate airports while still at sufficient altitude avoiding fuel overhead and risks of delayed go around or runway excursions. Involves high risks if proposed landing parameter changes are accepted, hence rated RED.