Go-Around Decision and Maneuver: How To Make It Safer?

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Introduction

To go around is the best decision a pilot takes whenever the safety of an approach or a landing appears to be compromised. This policy has been promoted for years by airlines and the whole air transport industry with limited success. Dedicated efforts to better understand and improve the decision making process still remain to be done. At the same time, the maneuver which follows such a decision is often considered as a normal and well-trained procedure which does not need more attention. This is not exactly true. The analysis of safety occurrences and their numbers when compared to the go-around maneuver really flown show a concerning trend which leads to an opposite conclusion. Both the go-around decision and go-around maneuver need to be examined carefully.

1. The Go-Around Decision

A quick look at Air Safety Report (ASR) and airport database shows a rate from one to two go-arounds per thousand arrivals. The main reasons for these go-arounds are related to ATC and weather. An IATA study covering nearly 5,000 go-around ASRs identified the following three most cited factors: traffic management issues (34%), meteorological factors (22%), and unstabilized approaches (16%).

A more detailed analysis gives a great variety of circumstances such as lack of visual reference at low height, approach not stabilized at the 1,000/500 ft floor or destabilized below, crosswind or tailwind over limits, severe turbulence, wake turbulence, wind shear, deep landing, bounced landing, EGPWS alarm, instrument failures, runway obstruction, runway or airport confusion, etc. Potential accident families involved are runway excursion, CFIT, runway collision and loss of control.

ASRs and airport databases tell us why and how often go-arounds have been initiated, rarely why and how often this decision has failed to be made when the situation required doing so. Each year, between 30 and 40% of fatal accidents take place under such circumstances. Understanding better why go-arounds are *not* decided is essential for improvement. Specific improvement could be found in many causes for go-arounds listed above.

Among all approach or landing accidents where a lack of go-around decision has been identified, weather-related scenarios are dominant. In most of the cases, convective weather associated with degraded visibility, rapidly changing wind and runway braking action capacity is involved. A close look at this type of events helps us to understand many aspects of crew failures to discontinue an approach.

The Canadian Transport Safety Board states in one of its investigation reports: *"These accidents happened during day and night approaches and involved well-trained crews. … Thorough accident investigations into similar accidents, along with very well thought-out conclusions, findings, and recommendations, have not made much of a dent in the number of such accidents, which continue to happen around the world. In fact, 20 such accidents to large commercial operators have occurred in the last five years. Furthermore, a number of recent incidents, with similar factors involved, clearly had the potential for catastrophic results.…"*

1.1 Initial Part of the Approach

During the initial part of the approach, the time pressure is generally moderate. Workload could be high but crews have still some time to work as a team, to communicate, to acquire additional weather information, to evaluate them and be mentally ready at any time to discontinue or not the approach. The decision will then depend mainly on the nature and relevancy of information provided to the cockpit, more specifically those related to decreasing horizontal visibility or cloud base height, possible tailwind and degraded braking action. Obviously and ultimately, the effectiveness of the decision will also depend on the crew capacity to address properly this information.

Horizontal visibility

Relevant information involves heavy rain showers which could reduce locally the horizontal visibility below the minimum required for a Cat 1. From past accidents and incidents, it appears that visibility measures, when reduced by heavy rain showers, are not transmitted to the pilots the same way as during LVO (Low Visibility Operations) with fog. As a consequence, a crew may continue an approach without being aware that horizontal visibility he will face at or beyond the runway threshold is less than the minimum required.

Water on the runway and braking action

Relevant information involves also the quantity of water on a runway and its consequence on braking action. During very heavy rain showers, runways could become "contaminated" in a few minutes. Flight Crew Operating Manuals (FCOM) present certified landing distances charts to be used by crew. It starts from the thickness of the water. In several occasions the results should have led the crew to discontinue an approach. But water thickness measures are never reported to the crews. It is up to the pilots to understand that a rain shower, depending on its intensity, could mean "contaminated runway." For this reason if heavy rain showers are reported or if any doubt exists about the braking action, several airlines require additional margin whenever the landing distance required is to close to the landing distance available.

Tailwind

The same lack of information could be observed when the wind is rapidly shifting to a tailwind component. Even with light winds, any change from headwind to tailwind may have consequences on flight path of the aircraft and its landing performance. Again, combined with an unexpected reduction of visibility, the decision of going around is not assured. Any information of this type has to be provided as soon as possible. Information (in English) from a previous landing crew would be critical for other crews in approaching aircraft. Any airport equipment allowing more accurate and more reactive measures made near the runway threshold will also help a lot. A close monitoring of the wind display from the IRS is also important but it does not allow anticipating this type of situation.

1.2 Final Part of the Approach

During the final part of the approach, time pressure is getting much greater for the crew with little or no room for communication between pilots other than standard callouts. At or below DA/MDA, visual contact is established with the runway and the aircraft is flown manually. Most of the mental resources of pilot flying are invested in controlling the plane. At this stage both pilots tend to be focused on the landing.

Decision making process on short final with degraded environment

As explained previously, it happens that visual references become unexpectedly degraded on short final. Closer to the ground, below DA/MDA, with the approach lights and some runway lights in sight, a pilot may think he still has sufficient cues to continue the landing. In fact, the horizontal visibility may have reduced to a few hundreds of meters, which is not sufficient to detect and correct deviations accurately. In such situation additional resources are needed to keep visual contact with the runway and assess the flight path. Pilot corrections are delayed and become inaccurate. Very significant deviations can develop without being detected. The approach may become destabilized without enough resources for both pilots to reject the landing.

Many runway overrun or landing-short accidents are related to this type of situation. Because flight data recorders do not cover what pilots really perceive, accident investigation reports rarely address these aspects explicitly. As a consequence, lessons are partially learned. Simulator software design and training programs are not adapted in accordance and, in the end, many pilots have to face these situations for the first time in a real flight.

Ways of improvement

Several areas of improvement related to go-around decisions are clearly identified here. As there are at least two pilots involved, airline policy should encourage the use of all available resources by giving to the first officer or a third crewmember the possibility to call for a go-around. When he is pilot flying, the first officer should initiate a go-around as a normal pilot action. This must be well understood, accepted and trained to bring results. This policy has been adopted by many airlines, but not everywhere, and still needs to be emphasized.

Simulator software should include scenarios of visual references becoming degraded after DA/MDA and during flare to train the go-around decision.

New technology should be used as a decision aid to warn the pilots on short final whenever the aircraft energy (potential and kinetic) exceeds the landing performance related to the landing runway.

2. The Go-Around Maneuvers

By their nature, go-around maneuvers are performed at low altitude, low speed, and sometimes very close to the ground. This leaves little safety margin and time to react in case of deviation. A significant number of actions are to be performed in a short period of time. They are all related to important changes of attitude, thrust, flight path, aircraft configuration (flaps and gear) and pitch trim, each having to be carefully monitored.

Automation has brought additional checks related to AP/FD/Thrust mode which have to be read, checked and announced at the same time by pilots during the go-around. During the same period, ATC brings more workload by requesting information about the cause of the go-around and crew intentions, and sometimes giving frequency changes. Pilots' capacity to set priorities during this phase is critical. The old safety rule, "Aviate, navigate, communicate (in that order)" applies perfectly here.

All these factors explain why the go-around maneuver needs to be carefully addressed. The number of safety occurrences appears to be significantly high when compared to the number of go-around maneuvers. In most of the cases, these occurrences are attitude upset, some of them severe. The use of Systematic Flight Data

Monitoring programs should be encouraged to have a better detection and analysis of such events. Two main types of upset events can be distinguished:

- Upset resulting from a particular combination of go-around thrust, speed and nose-up trim
- Upset resulting from a breakdown in cockpit instrument scan

Upset related to a particular combination of go-around thrust, speed and nose-up trim

These events are characterized by a lack of pitch-down control authority at the beginning of the go-around. They represent a number of cases, some probably not reported. The most recent one happened in 2007 on a Boeing 737 after a go-around initiated from a very low-speed situation. The increase of thrust combined with the nose-up trim resulted in a near loss of control of the aircraft. Previous upset recovery techniques are going to be emphasized. QRH procedures have been recently redesigned from the lessons of this type of event in order to help the crew manage thrust and trim setting more efficiently. An important effort is presently being developed by manufacturers to reduce the risk of upsets of this type.

Upset resulting from breakdown in cockpit instrument scan

In August 2000, after initiating a go-around at night, the pilot flying kept a prolonged pitch-down input, resulting in a dive from which the aircraft did not recover. An initial reaction to a GPWS “pull up” warning has been observed but its amplitude was insufficient (a full-back stick input would have been required).

In 2002, because of an unstabilized approach, the pilots of a Boeing 757 initiated a go-around. Approaching 2,500 ft, the altitude capture mode was activated earlier than expected. The pilot flying pitched down and kept a nose-down input until an extreme negative attitude was reached. The dive was recovered about 400 ft above the sea with a vertical acceleration of 3.6 g. The captain declared: *“I believe my First Officer acted as an active and co-operative crewmember throughout the flight, but in the final approach, due to the abnormally high workload, both of us became occupied handling details instead of looking at the whole picture. And when we suddenly got the altitude capture commands from our FDS, when both of us were mindset for a go-around, we became confused and later during the unbelievable nose-down pitch attitude, we became even more confused.”*

In 2007, the pilots of an Airbus A330 initiated a go-around at night due to tailwind on short final. The “altitude alert” and altitude acquisition mode appeared shortly, and the pilot flying pitched down to level off. The indicated airspeed increased towards VFE. But instead of keeping a leveled flight path, the pilot flying kept a prolonged pitch-down input. The attitude reached –9° with a vertical speed of 4,000 ft/mn. The GPWS activated and the climb was resumed. The minimum altitude was 600 ft over the sea. The total duration of the event was about 15 seconds. Here again, both pilots could not explain the pitch-down input and loss of altitude.

In all three events, pilots “ignored” extreme negative attitudes displayed on both ADIs. This reflects a lack of appropriate instrument scanning in each case. Rapidly increasing airspeed towards VFE had probably captured the attention of the pilot, and slowed or even interrupted the normal instrument scan. This breakdown in cockpit scan is at the beginning of many very serious spatial disorientations. In the absence of visual cues at night or in IMC, any significant longitudinal acceleration may create a wrong and powerful perception of climb attitude for both pilots while the aircraft is in reality descending with a nose-down attitude. Known as “somatogravic illusion,” this phenomenon combined with poor pilot instrument scanning could lead to important pitch-down input. When close to the ground, it could become impossible to recover.

Ways of improvement

In their paper "Cockpit Scan and Loss of Situational Awareness," Capt. John Ford and Cdr. Andy Bellenkes give some answers to this problems and suggest solutions: "*Considering how critical an effective scan is, it is surprising that the development of a good set of scan patterns is not given high priority during training; especially since one of the most commonly cited forms of visual problems associated with mishaps is the breakdown in cockpit scan; … This error has caused midairs and near-midairs, CFIT, inability to get onboard the ship [air carrier], spatial disorientation and numerous problems associated with loss of situation awareness."*

This article dedicated to cockpit scan on military aircraft is perfectly relevant for the type of occurrences described here. It helps also to understand several other safety occurrences related to inappropriate monitoring of AP/FD active mode during go-around.

Other ways of improvement have been suggested by the U.K. CAA in a 2004 communication: *"Operator experience suggested that most go-arounds are flown from positions not normally practiced during simulator training and checking. These include go-arounds from below decision height and from well above decision height close to the acceleration altitude. They may also take place when not in the final landing configuration and when not asymmetric as required by Licence or Operator Proficiency Checks (LPC or OPC). It was suggested that operators should review their training programs accordingly."*

It could be added that many airports in the world, including some major ones, are still publishing initial go-around altitudes as low as 1,000 ft. Such altitude constraints are difficult to meet; they bring additional workload and represent a factor of risk. Even if go-arounds are periodically performed during simulator sessions, we should not forget that short-range pilots fly less than one real go-around per year and long-range pilots, even less than one per five years.