Approach Operations and the Energy Management Challenge

Kevin M. Smith, United Airlines (ret.), and United States Navy (ret.), Mesquite, NV, USA

ABSTRACT

This article presents vital approach energy management data that has been flight tested. This important background information may be of considerable interest to those involved in designing solutions for the approach and landing safety problem. This data can easily be uploaded to a “Smart Cockpit” feature so that flight crews can have this information presented when it is most needed. Limiting parameters for a stabilized approach are presented. The flight crew must be aware of certain stabilization targets so as to make a more informed decision concerning the go-around or land decision. Aerodynamic factors such as weight and airspeed effects are covered to provide the necessary understanding of the dynamic stability challenge. Deceleration distances versus approach airspeeds have been operationally examined. These profiles include level flight deceleration, level flight maximum deceleration, three-degree maximum rate deceleration, high-speed descent, low-speed descent, and the concerning “slam dunk” turn.

KEYWORDS

Approach Energy Management, High-Speed Descent, Level Flight Deceleration, Level Flight Maximum Deceleration, Low-Speed Descent, Slam Dunk Turn, Smart Cockpit, Three-Degree Maximum Rate Deceleration

INTRODUCTION

This article addresses energy management during approach operations. This is an area of critical operational concern. An ever-increasing number of incidents of destabilized approaches over the course of the last decade have raised considerable concern. This coupled with the recent increase in approach and landing accidents is alarming. Elsewhere is discussed the work of the Go-Around Safety Forum which conducted their business in June of 2013 at EUROCONTROL Brussels. Their conclusions are consistent with the conclusions of others—to at once improve the flight crew’s dynamic situation awareness and optimize the operational decision making (ODM) with respect to the approach instability onset go-around decision. It has been estimated that industry wide, four percent of all approaches are conducted in unstable conditions. In the aggregate, this is an extraordinary large number; thus, the purpose of this article.

The overall mission objective of the Air Transport Mission is to plan and execute a mission such that it arrives at the destination with important safety margins intact. One of the most important safety margins is the one that targets approach stability. Large, high performance aircraft must achieve a state of dynamic stability prior to conducting the landing maneuver. Dynamic stability can be defined as non-divergent vehicle motion. Under certain conditions a vehicle may become unstable and subsequently experience catastrophe. If stability cannot be maintained, safety is compromised. Stability parameters have been specified by the operational community for some time. Ensuring that these dynamic (kinematic) parameters are met on every flight is the goal of every airline pilot.

DOI: 10.4018/IJASOT.2016070101

Copyright © 2016, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.
Approaches should always be planned for safety and comfort in mind. Since speed ranges on modern aircraft is large, speed management is often a challenge. Target airspeed and the deceleration capabilities of the aircraft are important and require considerable attention by the flight crew. That this occurs in an already high workload environment is concerning. Providing pilots with the proper tools as well as the proper training is one of the most important challenges facing the aviation industry. This article will provide some important background information that may be of considerable interest to those involved in designing solutions for the approach and landing safety problem.

FLIGHT OPERATIONS

Conducting flight operations is exacting in nature. The major objectives are to arrive at the destination airport and fly an approach and landing where safety is paramount, passenger comfort is considered, and other safety parameters such as fuel reserves are maintained. Also, economy and schedule reliability are considered. Unfortunately, things often do not proceed as desired. Operations are disrupted by many variables such as deteriorating weather, high levels of traffic, and most importantly, air traffic control (ATC) flow requirements that are incompatible with dynamic stability requirements.

However, hard safety parameters exist to ensure a safe operation. One of these hard safety parameters is the approach stabilization limits. These must not be violated, since they are hard limits. Taking extraordinary measures to recover from an unstabilized approach is unsafe.

Limiting Parameters

Limiting parameters for a stabilized approach are well documented. These are presented here.

Prior to the final approach fix (FAF):

- The landing gear must be down;
- The final descent checklist must be completed;
- Landing clearance needs to be obtained;
- Traffic needs to be observed.

These are approach stabilization limiting parameters:

- Final flaps selected;
- On profile (three-degree glideslope or equivalent);
- Airspeed within 5 knots (kn) of target airspeed;
- Rate of descent not greater than 1,000 FPM;
- Engines at the approach power setting;
- Pitch attitude target achieved.

If the approach is not stabilized at 1,000 feet (for large aircraft) during an instrument approach or becomes unstable, a go-around must be executed.

Energy Management and Approach Planning

The airplane deceleration characteristics should be common knowledge by all crews. The goal is to safely, competently, and comfortably fly the approach. To facilitate a well-flown approach, crews should provide ATC with early notification of the inability to accept a clearance that will not facilitate a timely establishment of the dynamic stabilization parameters. Waiting until the last minute to notify ATC of stabilization concerns is poor planning. If dynamic stability has not been achieved, a go-around and vectors for another approach are the safest and only appropriate course of action. It therefore is important for the flight crew to be aware of certain stabilization targets so as to make a more informed decision concerning the go-around or land decision.
Assessment of the Engines-Out Flight Performance of a Commercial Jet
www.igi-global.com/article/assessment-of-the-engines-out-flight-performance-of-a-commercial-jet/138608?camid=4v1a

Semantic Analysis and Text Summarization in Socio-Technical Systems
www.igi-global.com/chapter/semantic-analysis-and-text-summarization-in-socio-technical-systems/196099?camid=4v1a