

Aerospace Engineering Master's Defense

Comparison of Commercial Aircraft Fuel Requirements in Regards to FAR, Flight Profile Simulation, and Flight Operational Techniques

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abstract

There are significant fuel consumption consequences for non-optimal flight operations. This study is intended to analyze and highlight areas of interest that affect fuel consumption in typical flight operations. By gathering information from actual flight operators (pilots, dispatch, performance engineers, and air traffic controllers), real performance issues can be addressed and analyzed. A series of interviews were performed with various individuals in the industry and organizations. The wide range of insight directed this study to focus on FAA regulations, airline policy, the ATC system, weather, and flight planning. The goal is to highlight where operational performance differs from design intent in order to better connect optimization with actual flight operations.

After further investigation and consensus from the experienced participants, the FAA regulations do not need any serious attention until newer technologies and capabilities are implemented. The ATC system is severely out of date and is one of the largest limiting factors in current flight operations. Although participants are pessimistic about its timely implementation, the FAA's NextGen program for a future National Airspace System should help improve the efficiency of flight operations. This includes situational awareness, weather monitoring, communication, information management, optimized routing, and cleaner flight profiles like Required Navigation Performance (RNP) and Continuous Descent Approach (CDA).

Working off the interview results, trade studies were performed using an in-house flight profile simulation of a Boeing 737-300, integrating NASA legacy codes EDET and NPSS with a custom written mission performance and point-performance "Skymap" calculator. From these trade studies, it was found that certain flight conditions affect flight operations more than others. Non-optimal flight performance can cause a 1,000 NM mission to experience upwards of \$500 from one single off-design parameter. With weather, traffic, and unforeseeable risks, flight planning is still limited by its fail safes. From this study, it is recommended that air carriers increase focus on defining policies better to improve the end practice. As well, air carriers should create a larger drive to implement the FAA's NextGen system and move the industry into the future.



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