CEE 5614 Analysis of Air Transportation Systems Spring 2022

Assignment 5: Maneuvering Performance, ETOPS and BADA

Date Due: March 23, 2022 Instructor: Trani

Problem 1

Use the data for the transport aircraft similar to the Boeing 787-8 (http://128.173.204.63/courses/cee5614/cee5614_pub/boeing787_class.m) to answer this problem.

The aircraft is in cruise at FL 350 with a mass of 195,000 kgs and the fuel remaining at that point is 32,000 kilograms.

a) The aircraft has an engine failure over the ocean at the conditions stated above. Estimate the best altitude and Mach number to divert to an alternative airport. Explain your selection procedure. Avoid speeds that are on the back side of the drag curve

b) The closest alternative airport selected in the flight plan is located 900 nm from the engine failure point. Assume no wind conditions and ISA atmospheric conditions in the calculation. Estimate the travel time to the alternate airport and state if the flight can be operated as an ETOPS 180 (minutes) flight. Assume the alternative airport is at sea level.

c) Do not perform computations. State what would be different if the aircraft has a failure of one engine and also a pressurization failure.

d) If the aircraft flies over high terrain near the Dhaulagiri (see article in https://en.wikipedia.org/wiki/Dhaulagiri) as the engine fails, what actions would the pilot have to take to avoid an accident?

Problem 2

Use the BADA model data for the Boeing 747-8 (see page 160 of notes - aircraft performance 2) to answer the following question:

a) Estimate the fuel burn for the aircraft for a 2.4 minute hold at 18,000 feet with 413 knots indicated airspeed.
b) How does the fuel used in the 2.4 minute hold compares to the example covered in class (for the Boeing 767-300)?
c) Estimate the fuel burn in the landing phase (Flaps 30 degrees) using the BADA parabolic drag polar for landing (LD label in the gray polar file). The aircraft flies at 160 knots at 1,500 feet. Assume ISA conditions. Show your calculations. **Note**: **in the landing phase, the cruise correction factor is not needed.**

Problem 3

Use the Boeing 787-8 class aircraft to solve this problem. The file for the aircraft is found at: http://128.173.204.63/courses/cee5614/cee5614_pub/boeing787_class.m. The aircraft climbs from the same airport described in the Maneuvering Performance notes. Airport elevation is 1,200 meters above mean.

a) The aircraft suffers an engine failure at 50 meters above the airport elevation while flying at 185 knots indicated airspeed. The aircraft mass is 205,000 kilograms. Assume flaps 10 degrees and an increment of 0.013 in the drag coefficient due to flaps (C_{df}).
b) Can the aircraft satisfy the 1,000-foot obstacle clearance for hill # 3?
c) Explain the payload impact while operating from airports with significant terrain around an airport.