

Assignment 6: Cost Models, Air Traffic, and Runway Operations

Date Due: April 3, 2023

Instructor: Trani

Problem 1 Aircraft Development Cost Model

Use the aircraft cost development model and the Transonic Truss-Braced Aircraft file provided in class to answer the following:

- a) Find the unit production cost if 1000 units of the aircraft are sold worldwide. Assume the maximum mach number at FL 370 is 0.73.
- b) Show a parametric plot of unit costs versus quantity produced from 400 to 1000 units.
- c) Assume a stretched fuselage version of the TTBA is produced with OEW at 43,000 kgs, Mach 0.72 and a more powerful engine with 27,000 lbs. of thrust (at sea level ISA conditions). Find the new unit cost for the same 1,000 units produced. Comment on the sensitivity of the unit cost to the parameters changed.
- d) Compare the predictions of the model with list prices included in the class notes. Is the model reasonable?
- e) Compare the cruise fuel consumption of the TTBA aircraft flying at Mach 0.72 and FL 370 with a Boeing 737-800 aircraft (http://128.173.204.63/cee5614/cee5614_pub/Boeing738_class.m) flying at Mach 0.76 and FL 370. In both cases assume the aircraft start the cruise segment with a mass 10% below the maximum takeoff weight. Perform the calculation at the TOC point. Comment on the answers obtained and put an economic context into the solution by estimating the annual savings at \$2.75 per gallon.

Problem 2 (Basic ATC and Runway Separations)

Answer briefly the following ATC-related questions.

- a) An Airbus A321neo cruises at Mach 0.76 at FL 350 over Las Vegas (Nevada). Name the ATC service that oversees the flight.
- b) For part (a), is the aircraft flying East or West. Comment.
- c) Find the minimum separation between two runways able to operate simultaneous instrument landing procedure arrivals with a Precision Runway Monitor (PRM) radar.
- d) Use Google Earth and the FAA airport diagram to familiarize yourself with the runway configuration at Chicago O'Hare airport. Can runways 27R and 27L be operated independently for instrument approach arrivals? Comment on the rule used.
- e) Can ORD airport operate three simultaneous arrivals in Westflow (flying to the West) in instrument conditions? Name the runways selected in south flow operations.

Problem 3 Basic ATC

An Airbus A350 flying over the North Atlantic at position 56 North and 45 West of Greenwich contacts ATC to request a flight level change.

- a) Name the technology used by the pilot to contact ATC.
- b) What is the time latency specification for the message to go from pilot to controller and return to the pilot?
- c) Briefly describe what is the difference between SID and STAR routes used in air traffic control procedures in the terminal area.

Problem 4 Performance-Based Navigation

Read the article on Performance Based Navigation (https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap1_section_2.html) and answer the following:

- a) Explain the difference between RNAV procedures and PBN procedures.
- b) For approach segments to an airport, what is the level of accuracy (RNP) expected?
- c) What is the RNP value for enroute operations (domestic)

