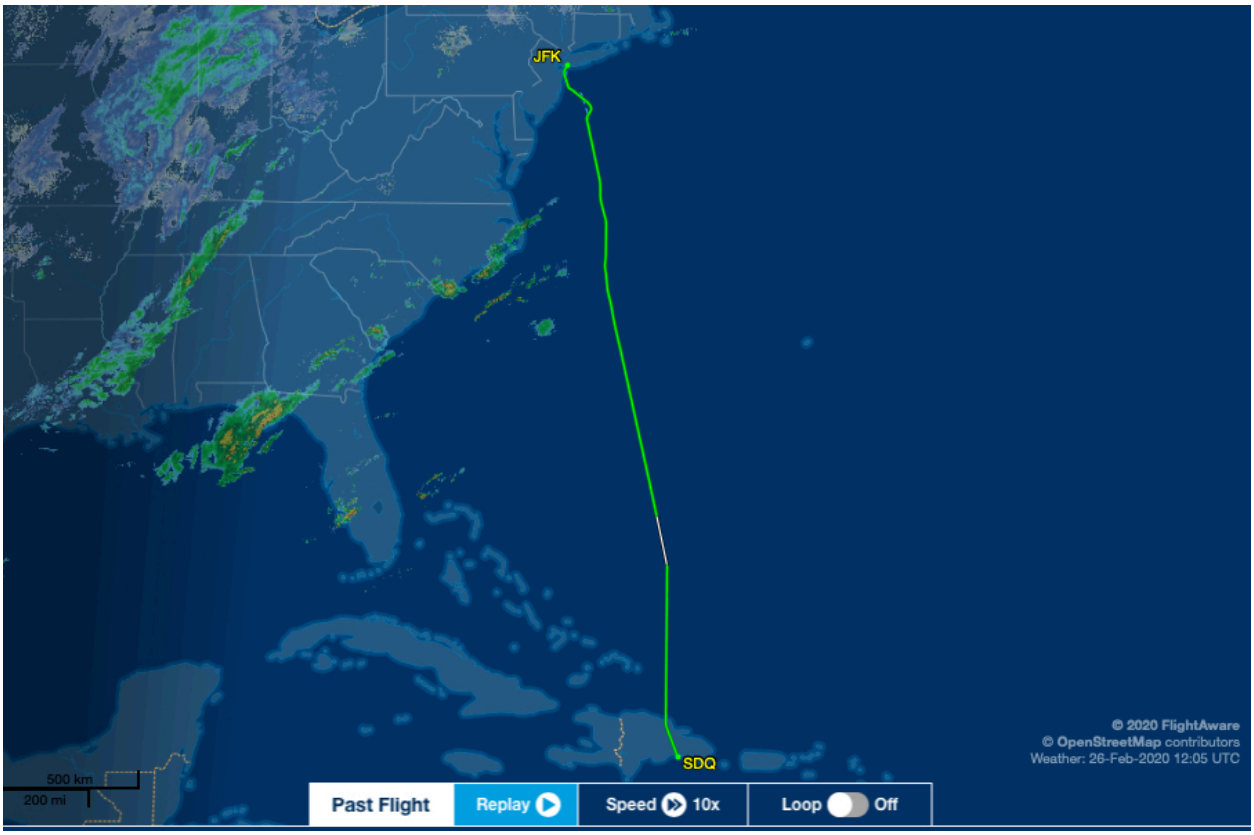
Assignment 5: Air Transportation Systems Analysis

Date Due: March 6, 2020 Instructor: Trani

Problem 1

To do this problem, use the Boeing 737800 class aircraft file from the web site (http://128.173.204.63/courses/cee5614/cee5614_pub/Boeing737800Jet_class.m). An airline plans a flights from Santo Domingo, Dominican Republic to New York (JFK) using the selected aircraft (see graphic).



a) Use the unrestrictedClimbAnalysis.m Matlab script to estimate the mass of the aircraft at the Top of Climb (TOC) point. The aircraft takeoff weight is 72,000 kg. with 19,000 kg of fuel. Use the default climb speed profile provided in the aircraft data file. Use ISA+20 atmospheric conditions in your climb calculations (Santo Domingo has summer temperatures well above ISA conditions). Select the TOC altitude so that the aircraft at the TOC point has an initial 500 ft/min climb capability.

b) Use the unrestrictedDescendAnalysis.m Matlab script to estimate the fuel used from the Top of Descent (TOD) point to the destination airport. For an initial estimate assume the aircraft starts its decent from an altitude 2,000 feet higher than the TOC altitude found in part (a). Typically, in medium distance flights like this one we can expect one step climb in cruise. Estimate the descent distance (assume ISA conditions for the descent).

c) Estimate the fuel used in cruise for this flight if the airline dispatch recommends Mach 0.77 for the cruise Mach Number. For now, assume the cruise altitude does not change.

d) Estimate the fuel used in cruise if the aircraft is allowed to climb once at a point 750 nm from the TOC point. Following air traffic control rules, the climb needs to be 2,000 feet because we comply with so-called hemispherical rules.

Problem 2

This is a continuation of Problem 1.

a) If the aircraft has an engine failure at a point 500 nm from the TOC point, estimate the best altitude and Mach number to divert to an alternative airport. Explain your selection.

b) Identify two feasible airports (along the US Coast) that can be used as alternate airports (other than the departure airport).

c) Estimate the travel time to the two alternate airports selected in part (b) and state if the flights can be operated as an ETOPS 120 (minutes) flight.

Problem 3

Refer to the sample problem demonstrated in class for the Boeing 767-300 (see performance notes 2 - page 180).

a) Find the fuel consumption (kg/min) for the aircraft while cruising at 34,000 feet and Mach 0.80. Assume the aircraft has a mass of 164,000 kilograms.

b) Repeat part(a) if the pilot flies the aircraft at Mach 0.82 instead. Comment on the results.