

Assignment 3: Runway Length and EMAS Design

Solution

Instructor: Trani

Problem 1

A new airport to be constructed in the State of Vermont would like to request your services to estimate the runway length requirements to support regular operations using the aircraft shown in Table 1. The new airport is to be located in a 3,200 acre parcel located 1,000 feet above sea level conditions. The new airport will be near Burlington, VT. Use the design temperature for Burlington, VT in your analysis.

Table 1. Aircraft for Airport in Problem 1.

Aircraft	Engine	Remarks
Boeing 747-8F 987,000 MTOW Freighter aircraft	GEnx 2B engines	To be used in routes of up to 5,000 nm to Alaska and Eastern Europe
Boeing 757-200 230,000 MTOW Passenger aircraft	Rolls Royce RB211-535C Engines	To be used in routes of up to 2,500 nm to the US West Coast

- a) Find the runway length needed to operate both aircraft in the types of routes stated in the table. Use standard two-class cabin configurations stated in the Boeing APM documents (when applicable). Factor in 3,000 kg of belly cargo for the Boeing 757-200 and as much cargo as practically possible for the Boeing 747-8F freighter. Decide the runway length for the new airport. In your solution state the figures used in the Boeing APM documents.

Boeing 747-8F (Make sure is the freighter version)

OEW = 197,131 kg (434,600 lb)

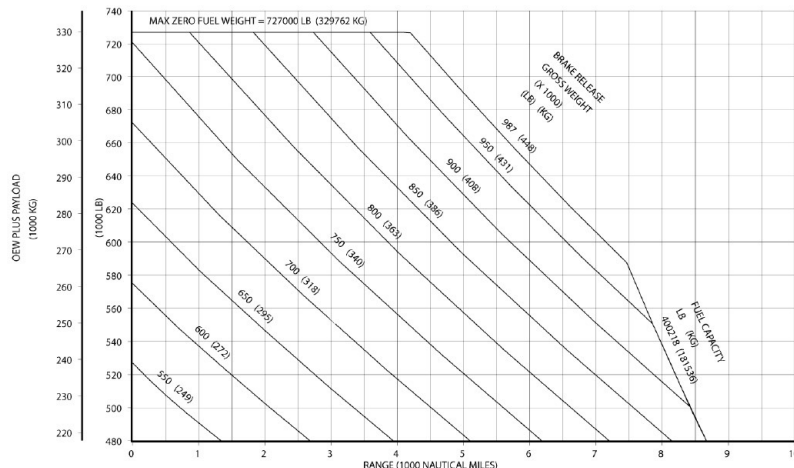
MTOW = 987,000 lb

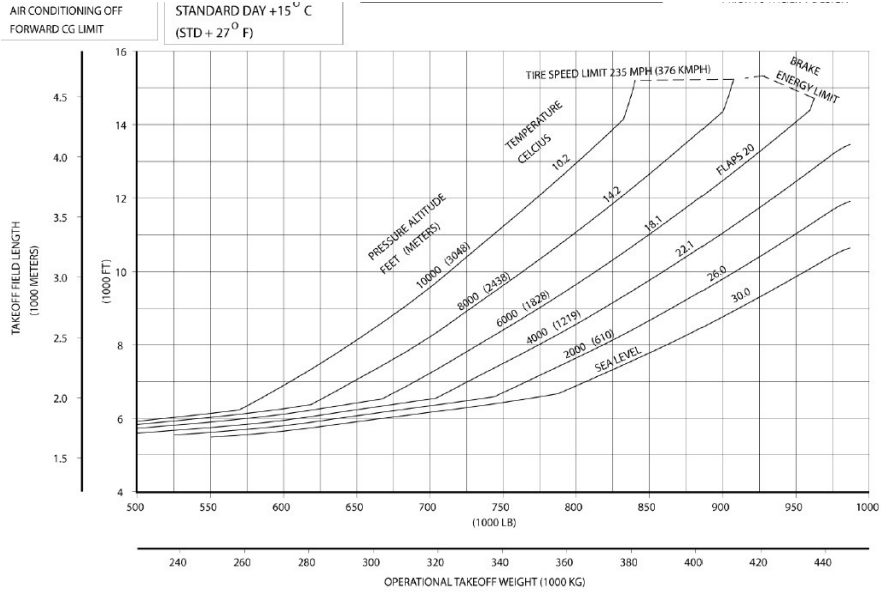
Design Temperature (Burlington, VT) = 79 degrees F (weather underground.com) or 26.1 deg. C

At 1,000 feet elevation ISA conditions = 55.4 degrees F (13 deg. C)

Therefore the design conditions for the airport is ISA + 24 degrees F (or ISA + 13 deg. C).

Look at payload-range diagram. OEW + PYL = 690,000 lb. for R=5000 nm and MTOW.





Runway Length required for MTOW from 1,000 foot elevation airport is 11,000 feet.
Check for landing requirements.

Problem 2

The San Diego International Airport would like to request your services to estimate the runway length requirements needed to operate a new nonstop service San Diego to Tokyo Narita Airport (Japan) using Boeing 777-300ER. The airline in question has Boeing 777-300ER powered by two *GE90-115BL* engines rated at 115,300 lb. of thrust.

- a) Find the route distance from San Diego (SAN) to Narita (NRT). Use a 5% detour factor above the Great Circle Distance (GCD).
- b) Find the runway length needed to operate this non-stop service from SAN. Assume the aircraft has a two class configuration and you would like to provide maximum flexibility to the airline.
- c) Look at the existing runway conditions at SAN. Do you need a runway extension? Comment.
- d) With the existing runway and full passengers (no cargo) how far can the Boeing 777-300ER fly under the design temperature conditions? Explain.

2)

B 777-300ER

Maximum taxi weight : 777,000 (lb)

MTOW = 775,000

OEW = 370,000 lbs

two possibilities

42 + 237

56 + 283

Usable Fuel = 145,538 kg

2 class configuration : (42 + 237) → P. 9

PXL = Max pass = 279 × 220 lbs = 61,380 lb

DTW = OEW + PXL + FW

431,380 lbs

Range = 5071 miles

DTW = 600,000 lbs

chart 3.2.2
page 38

SAN air port Elevation :

279

298

301

294

370

P. 99 chart 3.3.10

RL = 6,200 ft

RL for take-off

Account for slope

On landings only when necessary account for wet pavement.

RL at San Diego 9,400

DTW = 740,000 lbs below MTOW → 8,000 Nm

Problem 3

La Guardia Airport is exploring the installation of an Engineered Materials Arresting System for several runway ends. Use Google Earth to identify the situation.

- a) Find the length of the EMAS system to contain a Boeing 757 departing DCA and complying with FAA runway safety standards. Refer to FAA AC 150/5220-22A available on our home page. Use the recommended FAA design speed for EMAS systems.
- b) Can the proposed EMAS installed in the available RSA for runway ends 13 and 22? Explain.
- c) Given the dimensions of the EMAS constructed at runway end 31, estimate the maximum speed of a Boeing 757 that could be contained with the existing EMAS length. Explain your analysis.

3) EMAS 450 ft use figure A2-4

b) It cannot be installed on runway 13-22

c) Max speed 55-60 knots

320-340 ft