MAE 158 Recommended Homework 8
Winter 2022

From Anderson, *Aircraft Performance and Design*, Problem 6.8
From Shevell, *Fundamentals of Flight* Problems 15.11, 16.2, 16.3

Recall from last week's homework:

The Bede BD-5J is a very small single-seat home-built jet airplane which became available in the early 1970s. The data for the BD-5J are as follows:

- Wing span: 17 ft
- Wing planform area: 37.8 ft^2
- Gross weight at takeoff: 960 lb
- Fuel capacity: 55 gal
- Power plant: one French-built Microturbo TRS 18 turbojet engine with maximum thrust at sea level of 202 lb and a specific fuel consumption of 1.3 lb/(lb·h)

We will approximate the drag polar for this airplane by

$$C_D = 0.02 + 0.062C_L^2$$

Also assume:
Free roll time of 3 seconds
$\Delta C_{D,0,configuration} = 0.0124$
No reverse thrust
C_L on the runway = 0.1
$C_{L,MAX,\ Landing} = 2.7$
You may neglect ground effect.
$V_{REF} = 1.3V_{Stall}$, $V_{TD} = 1.15V_{Stall}$, $V_{flare} = 1.23V_{Stall}$

6.8 For the BD-5J (see Problem 5.1), calculate the total landing distance, starting with the clearance of a 50-ft obstacle, assuming the landing weight is the same as the takeoff gross weight. The runway is firm dirt with a brakes-on coefficient of rolling friction of 0.3. The approach angle is 4°.

15.11. If a DC-9-30, landing at a pressure altitude of 4000 ft at a weight of 85,000 lb, requires a FAR landing-field length of 4900 ft, what is the stalling speed, the approach speed over the 50-ft height, and the ambient air temperature? See Figure 14.15 for the DC-9 $C_{L_{MAX}}$ at the landing flap angle of 50 degrees, slats extended. Wing area is 1000 ft^2.

16.2. A fighter airplane is pursuing a target at 22,000 ft on a standard day at $M = 0.87$. The pilot has a pressure suit so that he can withstand a maximim load factor of 6g. What is the fighter's turn radius? What distance must be covered to complete a 180 degree turn? If the fighter has a wing loading of 58 lb/ft^2, what is the lift coefficient?

16.3. A transport flying at 39,000-ft pressure altitude at $M = 0.83$ makes a 180 degree turn. Temperature is standard. The pilot limits the bank angle to 25 degrees to avoid alarming the passengers. What is the turn radius and the time to complete the turn?

For problem 15.11:

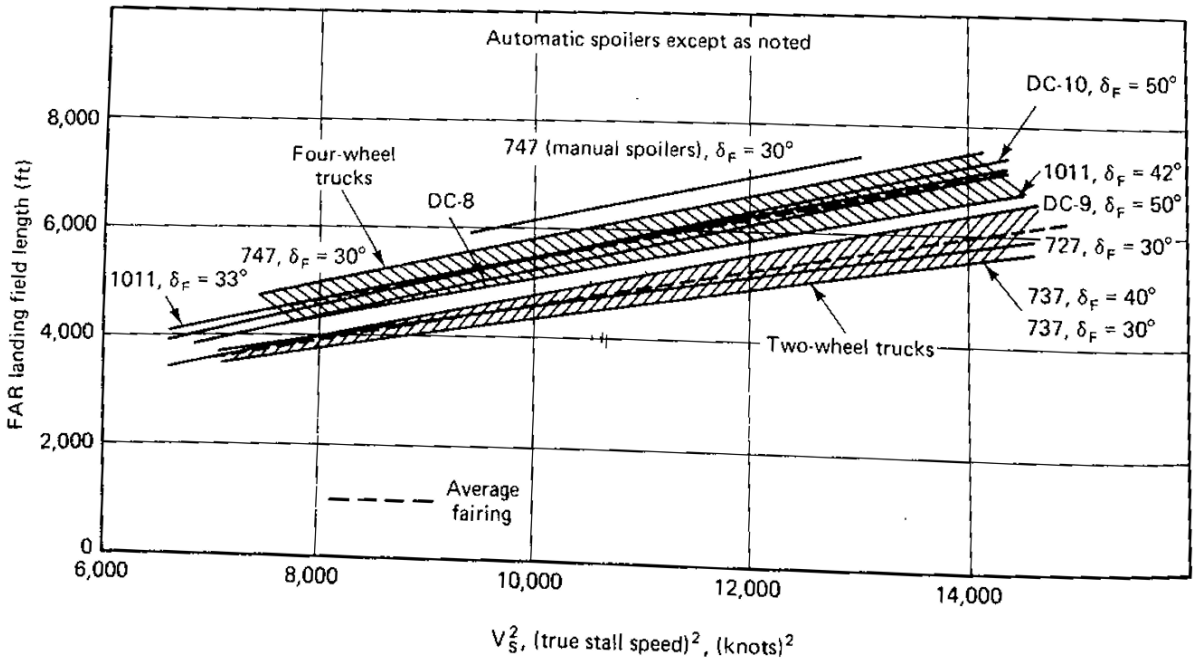
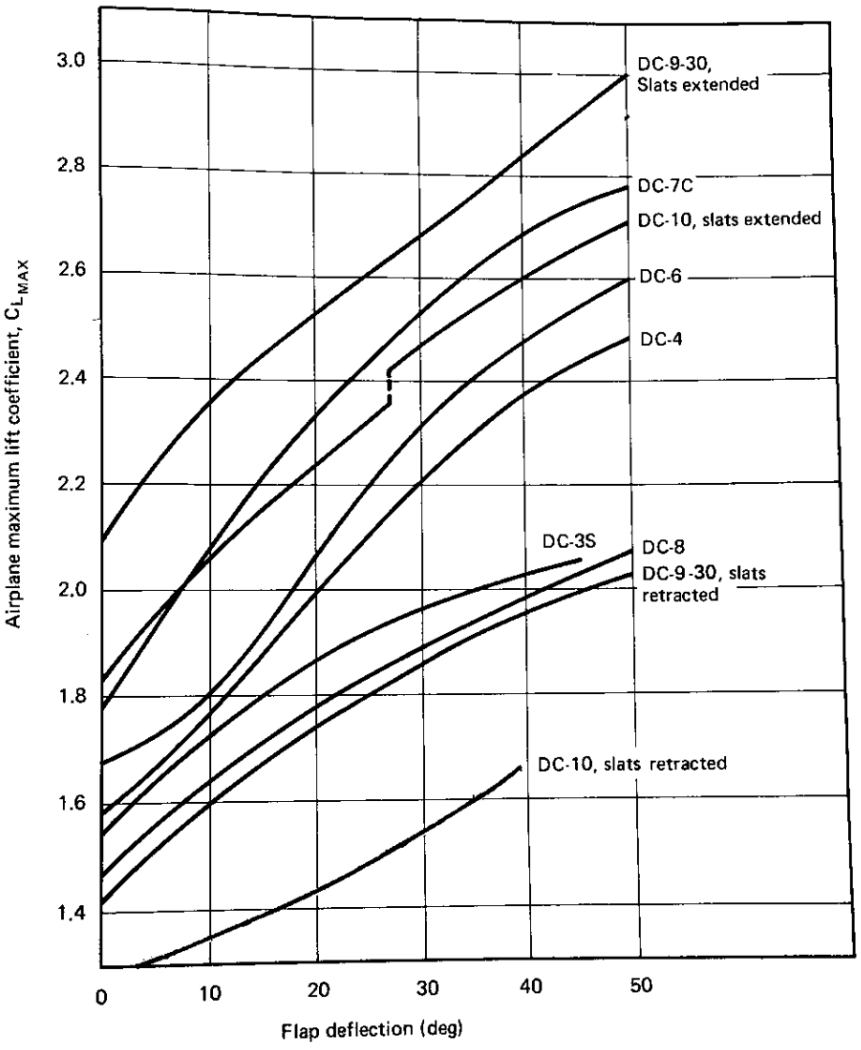


Figure 15.35 FAR landing-field length, dry runways.



	$\frac{S_{W_F}}{S_W}$	Type of flap	Flap chord (% chord)	$\Lambda_{C/4}$
DC-3S	0.575	Split	0.174	~ 10°
DC-4	0.560	Single slotted	0.257	0°
DC-6	0.589	Double slotted	0.266	0°
DC-7C	0.630	Double slotted	0.266	0°
DC-8	0.587	Double slotted	0.288	30.5°
DC-9-30	0.590	Double slotted	0.360	25° } Slats
DC-10-10	0.542	Double slotted	0.320	35° }

Figure 14.15 Airplane maximum lift coefficient based on $V_{S_{min}}$ ($dV/dt = -1$ knot/s).