Assignment 1: Familiarization with Aviation Data Sources and Aircraft Classifications

Date Due: September 1, 2023 Professor: Dr. Trani

Problem 1

Download the latest version of the FAA Advisory Circular 150/5300-13B (https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5300-13B-Airport-Design.pdf). Read carefully Section 1.6 of the advisory circular before answering the following questions. Also become familiar with Appendix 1 in the same Advisory Circular and download the Aircraft Characteristics Database (see sample below). The FAA Aircraft Characteristics Database can be

Date Completed	Manufacturer	Model (Colored cells contain data not yet verified.)	Physical Class (Engine	# Engines	AAC	ADG	TDG	Approach Speed (V_{ref})	Wingtip Configuration	Wingspan, ft	Length, ft	Tail Height, ft (@ OEW)
2018-Apr-11	Aero Boero	AB-180 RVR	Piston	1	A	I	1A	52	no winglets	35.38	23.23	6.73
2018-Apr-11	Aero Boero	AB-95	Piston	1	A	I	1A	34	no winglets	34.19	22.63	7.21
2018-Jul-3	Aero Commander Al	1121 Jet Commander	Jet	2	C	I	2	129	no winglets	44.79	55.58	15.79
2018-Jun-29	Aero Commander Al	500 Commander	Piston	2	A	II	1A	77	no winglets	51.71	36.81	14.50
2018-Jun-29	Aero Commander Al	500-A Commander	Piston	2	A	II	1A	77	no winglets	49.04	36.81	14.50
2018-Jun-29	Aero Commander Al	500-B Commander	Piston	2	A	II	1A	77	no winglets	49.04	36.81	14.50
2018-Jun-29	Aero Commander Al	500U/500S Shrike Commander	Piston	2	A	II	1A	77	no winglets	49.04	36.81	14.50
2018-Jun-29	Aero Commander Al	520 Twin Commander	Piston	2	A	II	1A	64	no winglets	49.04	36.81	14.50
2018-Jun-29	Aero Commander Al	560 and 560-A Twin Commander	Piston	2	A	II	1A	82	no winglets	49.04	36.81	14.50
2018-Jun-29	Aero Commander Al	560-E Commander	Piston	2	A	II	1A	77	no winglets	51.71	36.81	14.50
tbd	Aero Commander Al	560-F Commander	Piston	2	A	er than 26	2	77	no winglets	same as 680F	tbd	tbd
tbd	Aero Commander Al	680 Commander	Piston	2	A	II	2	77	no winglets	49.04	tbd	tbd
tbd	Aero Commander Al	680-E Commander	Piston	2	A	II	2	77	no winglets	51.71	24.20	tbd
tbd	Aero Commander Al	680-F Commander	Piston	2	A	II	2	77	no winglets	49.04	tbd	tbd
tbd	Aero Commander Al	680-FL Grand Commander and 680-FL(P) Pressurize	Piston	2	A	r than 26	2	77	no winglets	same as 680F	stretched 680F	tbd
2018-Jun-29	Aero Commander Al	680-T Turbo Commander	Turboprop	2	B	I	2	98	no winglets	44.06	41.48	14.50
2018-Jun-29	Aero Commander Al	680-V Turbo Commander	Turboprop	2	B	I	2	98	no winglets	44.06	41.48	14.50
2018-Jun-29	Aero Commander Al	680-W Turbo Commander	Turboprop	2	B	I	2	98	no winglets	44.06	42.98	14.50
2018-Jun-29	Aero Commander Al	681 Hawk Commander	Turboprop	2	B	I	2	100	no winglets	46.55	44.35	14.95
2018-Jun-29	Aero Commander Al	685 Commander	Piston	2	B	I	2	98	no winglets	44.08	43.00	15.00
2018-Jun-29	Aero Commander Al	690/690-A Twin Commander	Turboprop	2	B	I	2	100	no winglets	46.55	44.35	14.95

downloaded at: https://www.faa.gov/airports/engineering/aircraft_char_database.

Aircraft Characteristics Database.

a) Name the two aircraft characteristics used to estimate the FAA Aircraft Design Group (ADG).

The Airplane Design Group (ADG) classifies aircraft based on wingspan and tail height (see Table 1-2). When the aircraft wingspan and tail height fall in different groups, the larger group applies.

b) A commercial airport with a single 7,500-foot runway has RDC code C-III. Can the airport accommodate the Boeing 757-200 (see the picture below)? Briefly Explain.

Boeing 757-200 at Atlanta Hartsfield-Jackson Airport. Source: A. Trani.

The Boeing 752 that is pictured has winglets. ∴ from the FAA Aircraft Characterization Database, its approach speed is 137 kts; it's wingspan is 134.75 ft; and its tail height is 45.08 ft. Based on its approach speed, this Boeing 752 belongs to Aircraft Approach Category "C" (using Table 1-1 of AC 150/5300-13B); and its wingspan and tail height categorize it into Aircraft Design Group "IV" using Table 1-2.

Based on these physical characteristics of the Boeing 752, the runway requires an RDC code of C-IV, or greater. ∴ the runway in this problem cannot accommodate the Boeing 752.

c) Find the airport RDC parameters allowing an airline to conduct operations with Airbus A350-900 aircraft (see the picture below). State the ICAO Aerodrome Reference Code (Element 2) for the Airbus 350-900.

Airbus A350-900 at ATL Airport. Source: A. Trani.

From the FAA Aircraft Characterization Database, the Airbus A350-900 has the following physical and performance characteristics:

Approach speed: 140 kts (AAC C)

Tail height: 57.31 ft (ADG IV)

Wingspan: 212.42 ft (ADG V)

Using the more restrictive of the two (2) ADG groups, the RDC parameter for the Airbus A350-900 is categorized as "C-V".

The Aerodrome Reference Code (ICAO's equivalent for the FAA's RDC Code) for the Airbus A350-900 can be found at the following URL: https://aircraft.airbus.com/sites/g/files/jlcbta126/files/2023-02/NEW-AI~1.PDF

Screenshot is below:

Aircraft		ICAO / EASA Aerodrome Reference Code[1]	FAA Airplane Design Group (ADG)[2]	Aircraft Approach Category[3]
A220-100		3C	III	C
A220-300		3C	III	C
A318-100		3C	III	C
A319-100		3C	III	C
A319neo		3C	III	C
A320-200	Up to 73.5t MTOW	3C	III	C
	At higher MTOW	4C		
A320neo		3C	III	C
A321-200		4C	III	C or D depending on MLW
A321neo		4C	III	C
A300B4-200		4D	IV	C
A300-600R		4D	IV	C
A310-300		4D	IV	C
A330-200		4E	V	C
A330-200F		4E	V	C
A330-300		4E	V	C
A330-800		4E	V	C
A330-900		4E	V	D
A340-200		4E	V	C
A340-300		4E	V	C
A340-500		4E	V	D
A340-600		4E	V	D
A350-900		4E	V	C
A350-1000		4E	V	D
A380-800		4F	VI	C

(*) As stated in ICAO PANS-ADR, Reference field length reflects the model/engine combination that provides the shortest field length in standard conditions (maximum weight, sea level, standard day, Air Conditioning off, runway dry, no slope).

[1] **ICAO / EASA Aerodrome Reference Code** - A code number linked to the reference field length and a code letter linked to the wingspan according to the table hereafter *(source: ICAO Annex 14 Amendment 14, EASA CS-ADR-DSN Issue 4)*.

From the figure, the ICAO Aerodrome Reference Code for the Airbus A350-900 is 4E.

d) A new airport project identifies the Bombardier Challenger 350 (see picture below) as the critical aircraft for the future facility. Find the RDC code and taxiway design group to design the airport.

Bombardier Challenger 350. Model name is Bombardier BD-100-1A10. Source: A. Trani.

Approach speed: 125 kts (AAC C)

Tail height: 20 ft (ADG II)

Wingspan: 69 ft (ADG II)

CMG: 28 ft

MGW: 13ft

Using Tables 1-1 and 1-2 of AC 150/5300-13B, the RDC parameter for the Bombardier Challenger 350 is categorized as "C-II". Using Figure 1-1, its Taxiway Design Group is TDG-1B.

e) A Boeing 757-200 (FAA ID is B752) follows an Airbus A350-900 (FAA ID is A359) that is landing on runway 28C at Chicago O'Hare International Airport (ORD). Find the minimum separation between the Boeing 757-200 trailing the Airbus A350-900 according to the Consolidated Wake Turbulence Reclassification (see course notes on aircraft classifications starting on page 51).

B752: CWT RECAT E

A359: CWT RECAT B

From Slide 54, "E following B" requires a minimum separation of 5 nm.

f) If the Boeing 757-200 in part (e) travels at 140 knots on final approach, find the time between successful arrivals (in seconds) between the A359 arrival and the B752 arrival to the runway threshold (see example in the notes).

$$headway = \frac{5\ nm}{140\ nm/hr}\left(\frac{3600\ s}{hr}\right) + 20\ s = 148.6\ s$$

g) How many landings can be performed on runway 28R if the sequence of part (f) is repeated many times.

$$\frac{\left(\frac{3600\ s}{hr}\right)}{\left(\frac{148.6\ s}{landing}\right)} = \frac{24\ landings}{hr}$$

h) A new generation of supersonic aircraft is expected to operate in 2035. The Boom Overture (https://boomsupersonic.com/) will be able to operate at speeds 1.7 times the speed of sound in cruise (Mach 1.7). The Overture is expected to land at 162 knots. What is the FAA AAC class for the supersonic aircraft?

AAC D (using Table 1-1 of AC 150/5300-13B).

Problem 2

Identify the commercial aircraft presented in the Table 1. State the FAA Aircraft Design Group (ADG), Taxiway Design Group (TDG) and Aircraft Approach Class (AAC). Here is a list of possible choices (more choices than pictures to add a little challenge): Cessna Citation CJ3, Boeing 777-300, Boeing 737-800, Boeing 717-200, Boeing 767-400, Boeing 787-8, Beechcraft King Air B200, Cirrus SR-22, Embraer 145, Airbus A320-200, and Embraer 175. Use the FAA Aircraft Characteristics Database to get information on ADG, TDG, AAC (https://www.faa.gov/airports/engineering/aircraft_char_database).

To help you identify the aircraft use my web site which contains similar pictures with annotations (https://photos.app.goo.gl/8bdSvdwPQU7IHIDi2). Other good sites to help identify aircraft are Airliners.net http://www.airliners.net and Jet Photos http://www.jetphotos.net.

Table 1. Aircraft for Problem 2.

Picture	Aircraft Name	ADG	TDG	AAC
	Airbus A320-200	III	3	C
	Boeing 777-300	V	6	D
	Boeing 787-8	V	5	C
	Embraer 175	III	3	C
	Boeing 717-200	III	2B	C

Picture	Aircraft Name	ADG	TDG	AAC
	Boeing 737-800	III	3	D
	Embraer 145	II	2B	C
	Cessna Citation Jet 3	II	2A	B
	Beech King Air B200	II	2A	B
	Cirrus SR-22 G2	1	1A	A

Problem 3

Airport features using the Airnav.com and BTS web sites.

Go to the Airnav web site (accessible through our page with "Interesting Web Sites") and look at the following airport:

RDU - Raleigh-Durham International Airport.

a) Create a simple table with the following data: list the runway name (numeric or alphanumeric label), runway length and runway width.

Runway:	Length (ft):	Width (ft):
5L/23R	10000	150
5R/23L	7500	150
14/32	3570	100

Note: A runway has two runway ends labeled numerically. For example Runway 18/36 indicates the number of degrees from the magnetic North multiplied by 10. So an aircraft landing on runway end 18 would be flying South (180 degrees from the magnetic North which is heading zero).

b) Find out the elevations of runway thresholds 5L and 23R at RDU. Estimate the difference in elevation and find the average runway slope (in percent) using the two elevation points and the runway length published in Airnav.

Runway 5L elevation (at runway end): 366.8 ft

Runway 23R elevation (at runway end): 408.6 ft

Elevation difference: 41.8 ft

Runway slope = $\frac{rise}{run} = \frac{41.8\ ft}{10{,}000\ ft} = 0.42\%$

c) Does runway 5L at RDU has approach lights? State what kind of lights.

Yes. "MALSR: 1,400 foot medium intensity approach lighting system with runway alignment indicator lights"

d) Name any obstruction for runway 32. State the slope to clear the obstruction.

"120 ft. trees, 3046 ft. from runway, 1 ft. left of centerline, 24:1 slope to clear"

e) What kind of pavement is used on the longest runway at RDU?

"concrete/wired/combed"

f) Use the Bureau of Transportation Statistics web site to find the number of departures (called scheduled departures) at RDU airport in the year 2019. the link is: https://www.transtats.bts.gov/airports.asp. The link is also accessible through our accessible through our page with "Interesting Web Sites"

71,190 departures (selected from month ending December 2019)

Will also accept 71,441 departures (selected from month ending January 2020)

g) Find the number of annual arriving and departing passengers at RDU in the year 2019 (before Covid-19).

No. arriving pax: 6,690,000

No. departing pax: 6,719,000

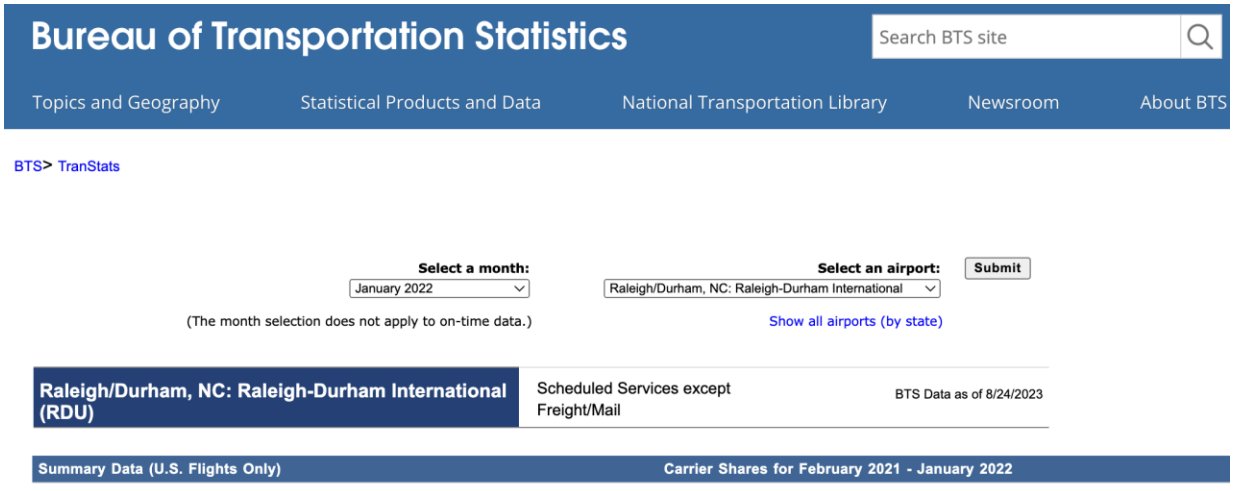
Will also accept January 2020 numbers (6,734k arrival pax and 6,760k departing pax)

h) Find the number of annual passengers (arrivals and departures) at RDU in the year 2022. Comment on the number of passengers served in 2022 compared to 2019.

No. arriving pax: 5,678,000

No. departing pax: 5,696,000

Will also accept January 2023 numbers (5,799k arrival pax and 5,824k departing pax)



BTS Web site with airport data.

Problem 4

True or false section.

Question	True / False
There were more than 2,000 Douglas DC-6Bs built after WW II.	FALSE
The Douglas DC-3 was a successful commercial aircraft introduced in 1936.	TRUE
The Boeing 747-100 carried five times the passengers as the first generation jet-powered aircraft.	FALSE more like 4 times
The first generation, jet-powered aircraft introduced in the 1960's required ~10,200 feet of runway length.	FALSE
Automated people movers were introduced in the late 1940's at US airports	FALSE
Regional jets require the same runway length as the first generation of jet-powered commercial aircraft.	FALSE
The average runway length of NPIAS airports is ~4,650 feet	TRUE
An airport in the US served more than 100 million passengers (arrivals and departures) in 2019.	TRUE
Regional jets account for 1/3 of the commercial flights in the National Airspace System (NAS).	TRUE
ADS-technology is used to track aircraft in real-time today.	TRUE