



SNS COLLEGE OF TECHNOLOGY

**An Autonomous Institution
Coimbatore – 35**

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Approved by AICTE , New Delhi and Affiliated to Anna University , Chennai.

DEPARTMENT OF AEROSPACE ENGINEERING

19ASO301 BASICS OF AERONAUTICAL ENGINEERING

UNIT 5 – AIRCRAFT INSTRUMENTS_1



UNIT 5 – AIRCRAFT INSTRUMENTS



- *Atmosphere*
- *Flight Instruments & Navigation Instruments*
- *Gyroscope & Accelerometer*
- *Air Speed Indicators*
- *Altimeter*



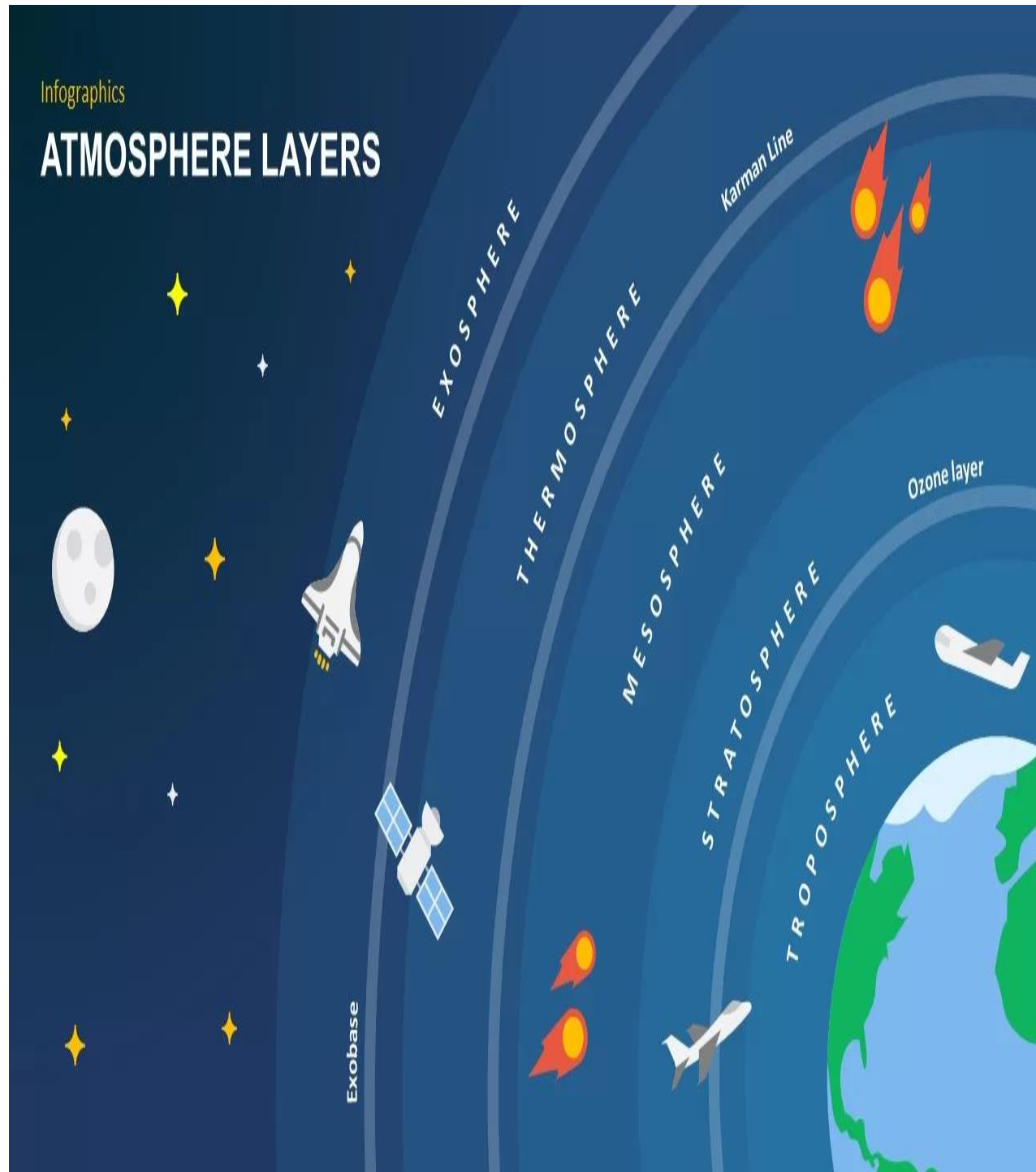
TEXT BOOK



- ***Anderson. J D, “Introduction to Flight”, McGraw-Hill, 1995***
- ***Richard S. Shevel, “fundamentals of Flight”, Prentice Hall, 2010***



Atmosphere



- The layers of atmosphere
- **Troposphere (0 to 12 km):** The closest layer to the earth's surface, where changes in weather phenomena occur.
- **Stratosphere (12 to 50 km) :** Contains the ozone layer, which protects us from harmful solar radiation.
- **Mesosphere (50 to 85 km):** Where temperatures are close to -130 to -150 deg. The Meteors burn up (due to friction with earth's atmosphere at high speeds) before they crash the ground.
- **Thermosphere (85 to 600 km):** The layer where the temperature increases with altitude due to the absorption of solar radiation.
- **Exosphere (600 km onwards):** The outermost layer, where particles can escape into space.



Atmosphere Properties



- **Temperature:** *Affects air density, which in turn has a negative impact on lift generation. Colder air is denser and provides more lift.*
- **Pressure:** *Decreases with altitude. Pilots use pressure readings to determine altitude and maintain safe separation between aircrafts.*
- **Wind:** *Affects flight path, ground speed, and fuel consumption. Pilots consider wind speed and direction when preparing the flight path.*
- **Moisture:** *Contributes to cloud formation, icing, and precipitation. Pilots need to be aware of these hazards to avoid accidents.*



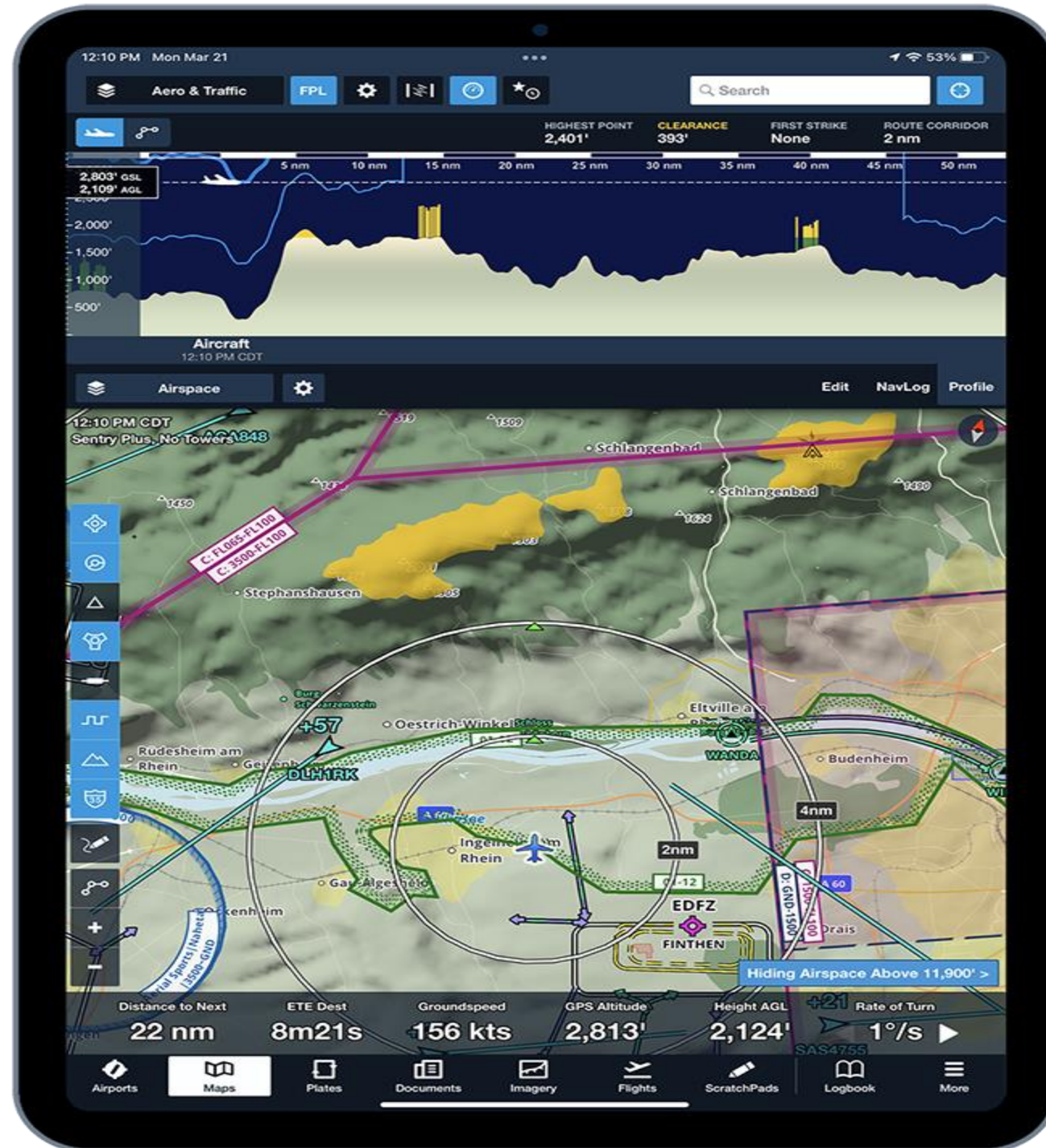
Atmospheric Properties



- *Because of aggressive molecular movement at high temperatures, warm air occupies more space than an equal mass of cold air.*
- *In other words, warm air is less denser than cold air.*
- *Humid air is less dense than dry air. Molar mass of H_2O is 18 grams per mole, while the average Molar mass of nitrogen and oxygen molecules is 29 grams per mole.*



Meteorological Data and Flight Planning



Pilots rely on meteorological data to plan their flight path.

These include:

- *Surface weather observations (METARs)*
- *En-route weather forecasts (TAFs)*
- *Upper air weather charts*
- *Satellite imagery and radar data*



Flight Instruments and Navigation Instruments





Flight Instruments



- **Artificial Horizon (Attitude Indicator):** Shows the aircraft's pitch and roll relative to the horizon.
- **Air Speed indicator:** Measures the aircraft's speed through the air.
- **Altimeter:** Indicates the aircraft's altitude above mean sea level.
- **Vertical Speed Indicator:** Shows the rate at which the aircraft is climbing or descending.
- **Turn Coordinator:** Indicates the rate and direction of a turn.

Six Primary Flight Instruments





Flight Instruments



Heading Indicator: Shows the aircraft's compass heading.

Gyroscope: Maintains the artificial horizon's stability.

Magnetometer: Provides a reference for the heading indicator.

Engine Monitoring System: Displays engine parameters such as temperature, pressure and RPM.

Traffic Collision Avoidance System (TCAS): Alerts pilots of potential midair collisions.





Navigation Instruments



Navigation instruments help pilots to determine their position and navigate along their planned flight path:

- **GPS (Global Positioning System):** Provides real-time position information using satellite signals.
- **VOR (Very High-frequency Omnidirectional Range):** Provides directional guidance to or from a ground station.
- **ILS (Instrument Landing System):** Guides the aircraft during landing in low-visibility conditions.
- **ADF (Automatic Direction Finder):** Uses radio signals from a ground station to determine direction.





Conclusion



- *Flight and navigation instruments work together to ensure safe and efficient flight.*
- *Flight instruments provide real-time data on the aircraft's status, while navigation instruments guide pilots along the flight path.*
- *Pilots rely on these instruments for critical decision.*