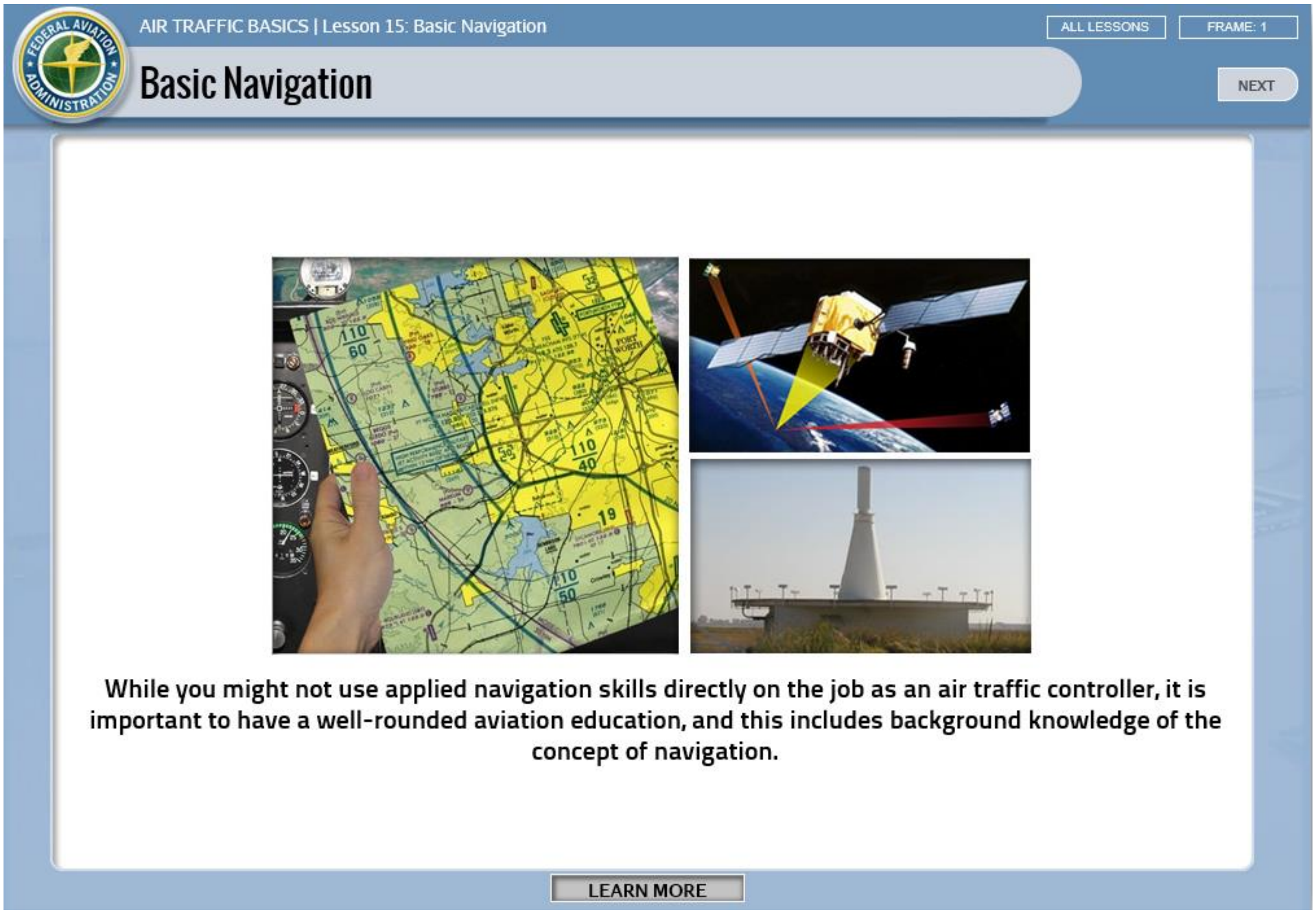
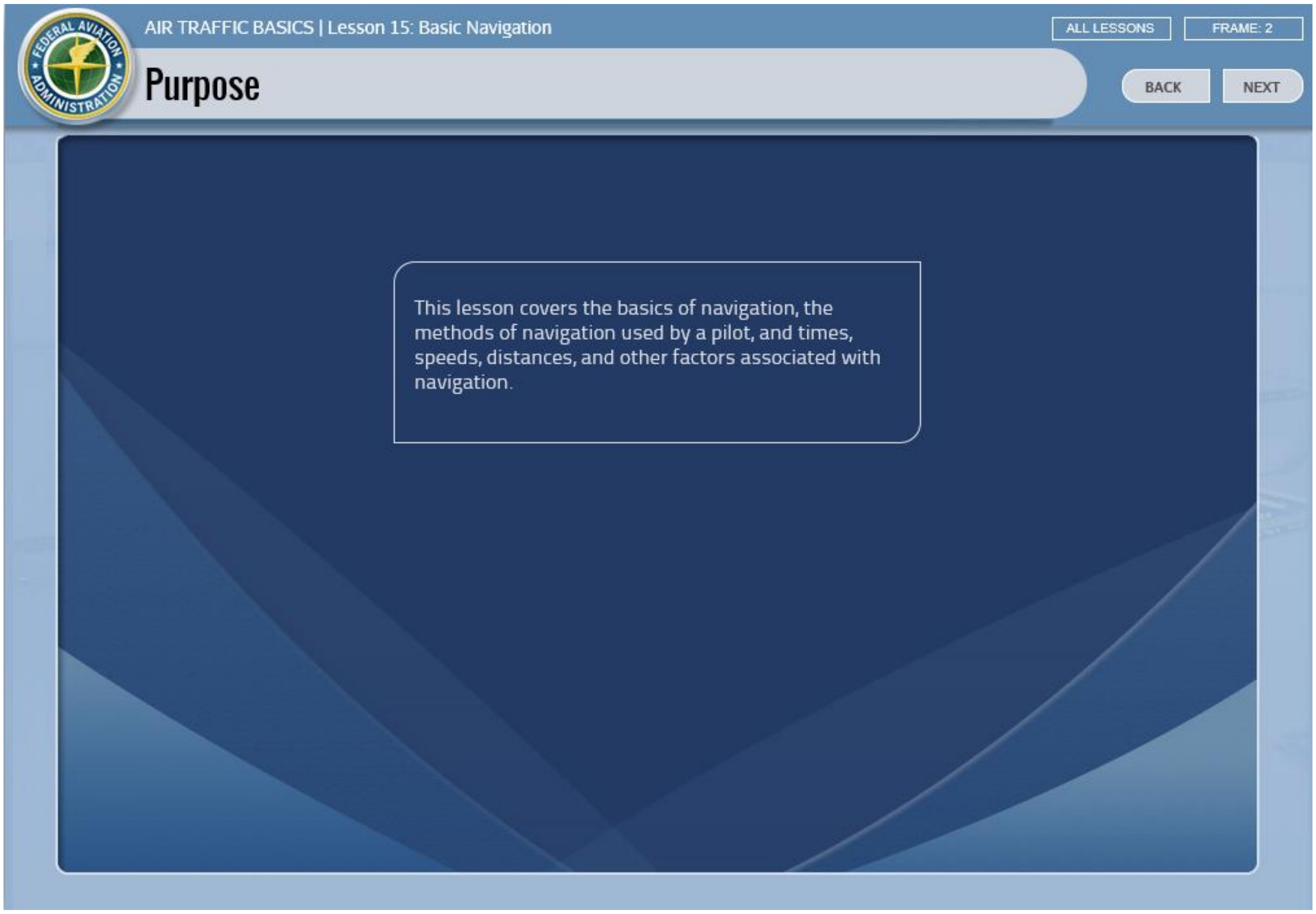



Knowing the vocabulary and principles a pilot uses will serve you well in developing a better understanding of your job and how it fits into the overall aviation picture.

Knowledge of basic navigation and the methods used by pilots will also provide you with guidelines to issue realistic clearance instructions.


AIR TRAFFIC BASICS | Lesson 15: Basic Navigation
ALL LESSONS
FRAME: 2
Purpose
BACK
NEXT
This lesson covers the basics of navigation, the methods of navigation used by a pilot, and times, speeds, distances, and other factors associated with navigation.

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 3

BACK NEXT

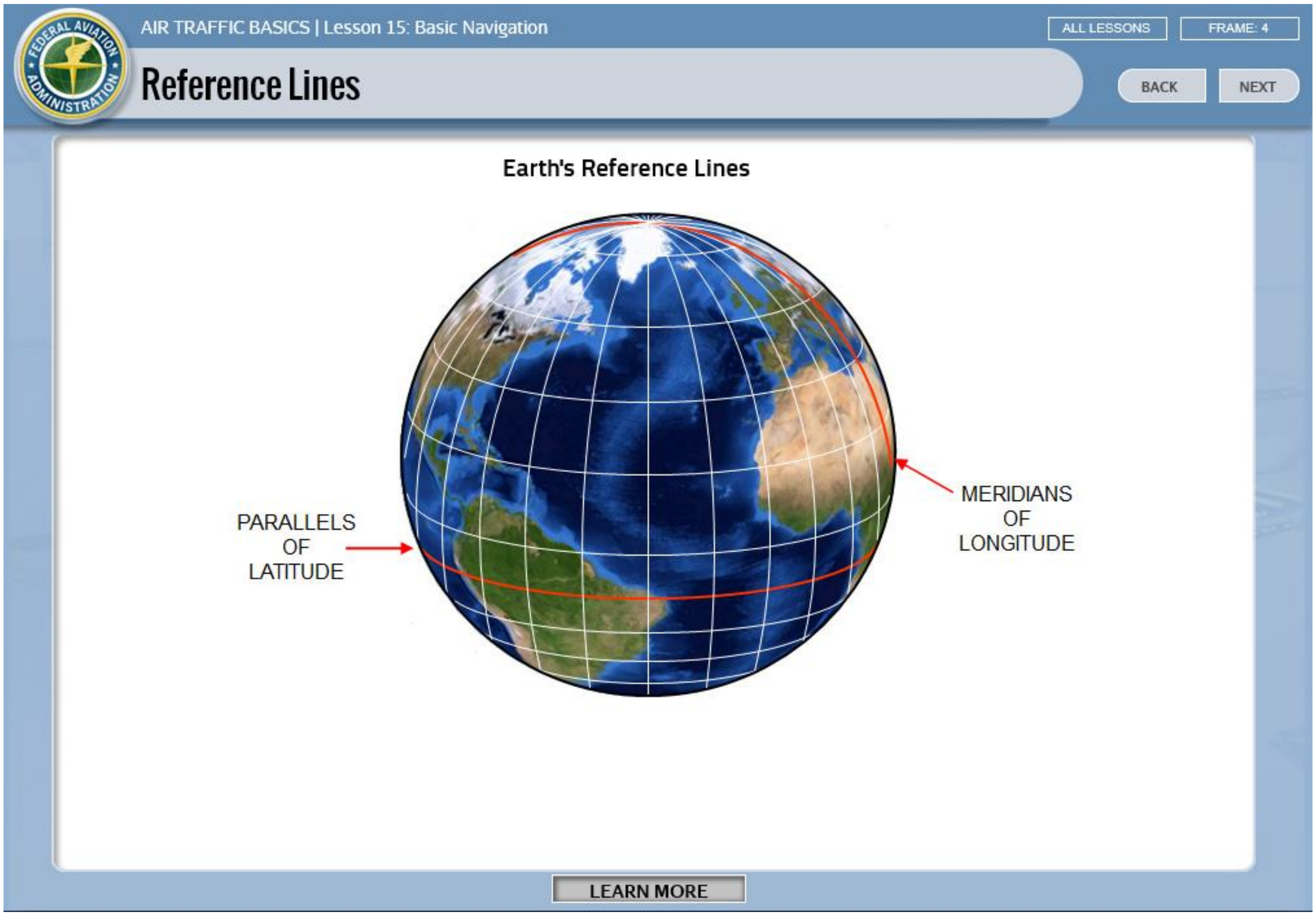
# Objectives

In this lesson, you will identify:

1. Reference lines of the earth and their purpose
2. Great circle route, distance, and direction measurement
3. Methods of time conversion and acronyms used with time
4. Magnetic variations and headings
5. Basic methods of navigation
6. Basic calculations for time, speed, and distance
7. Effects of wind on flight
8. Effects of altitude and temperature on speed

You will meet the objectives in accordance with the following references:

- FAA-H-8083-25, Pilot's Handbook of Aeronautical Knowledge
- Aeronautical Information Manual (AIM)




The earth is considered a true sphere divided by imaginary reference lines called latitude and longitude.

- Parallels of latitude run east and west.
- Meridians of longitude run north and south and connect the earth's poles.

These imaginary reference lines appear on the globe as a series of circles.

Reference: FAA-H-8083-25, Chap. 14

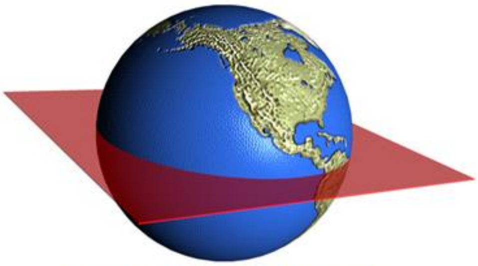
AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 5

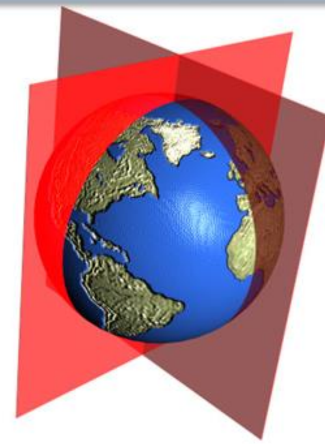
# Reference Lines

BACK NEXT

## Great Circle



The equator is a great circle.



Any meridian is half of a great circle.

**The equator is an imaginary reference line around the earth that is midway between the earth's north and south poles from which north-south distances are measured. The equator is a great circle.**

**A great circle is a circle formed on the surface of a sphere by the intersection of a plane that passes through the center of the sphere; specifically, such a circle on the surface of the Earth an arc of which connecting two terrestrial points constitutes the shortest distance on the earth's surface between them.**

**The circles whose planes run through the center of the earth are known as great circles.**

- **Any two opposing meridians of longitude make a great circle (each meridian is half of a great circle).**
- **Only one parallel of latitude is a great circle, the equator.**

"An Invitation to Fly," Chap. 11 http://www.merriam-webster.com

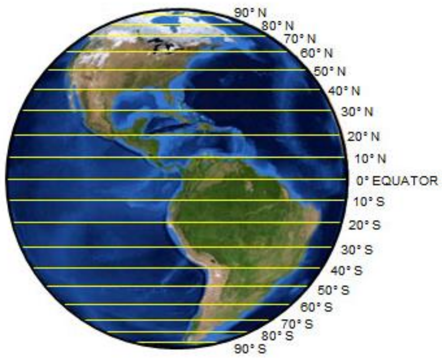
AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 6

# Latitude and Longitude

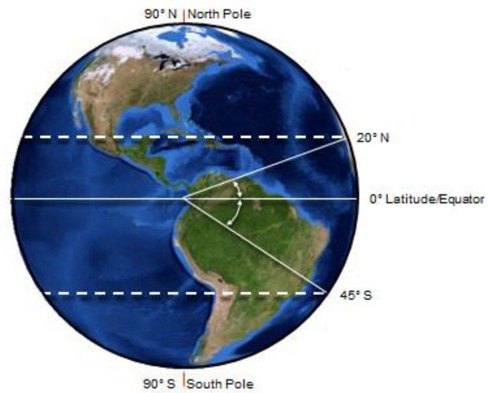
BACK NEXT

## Parallels of Latitude



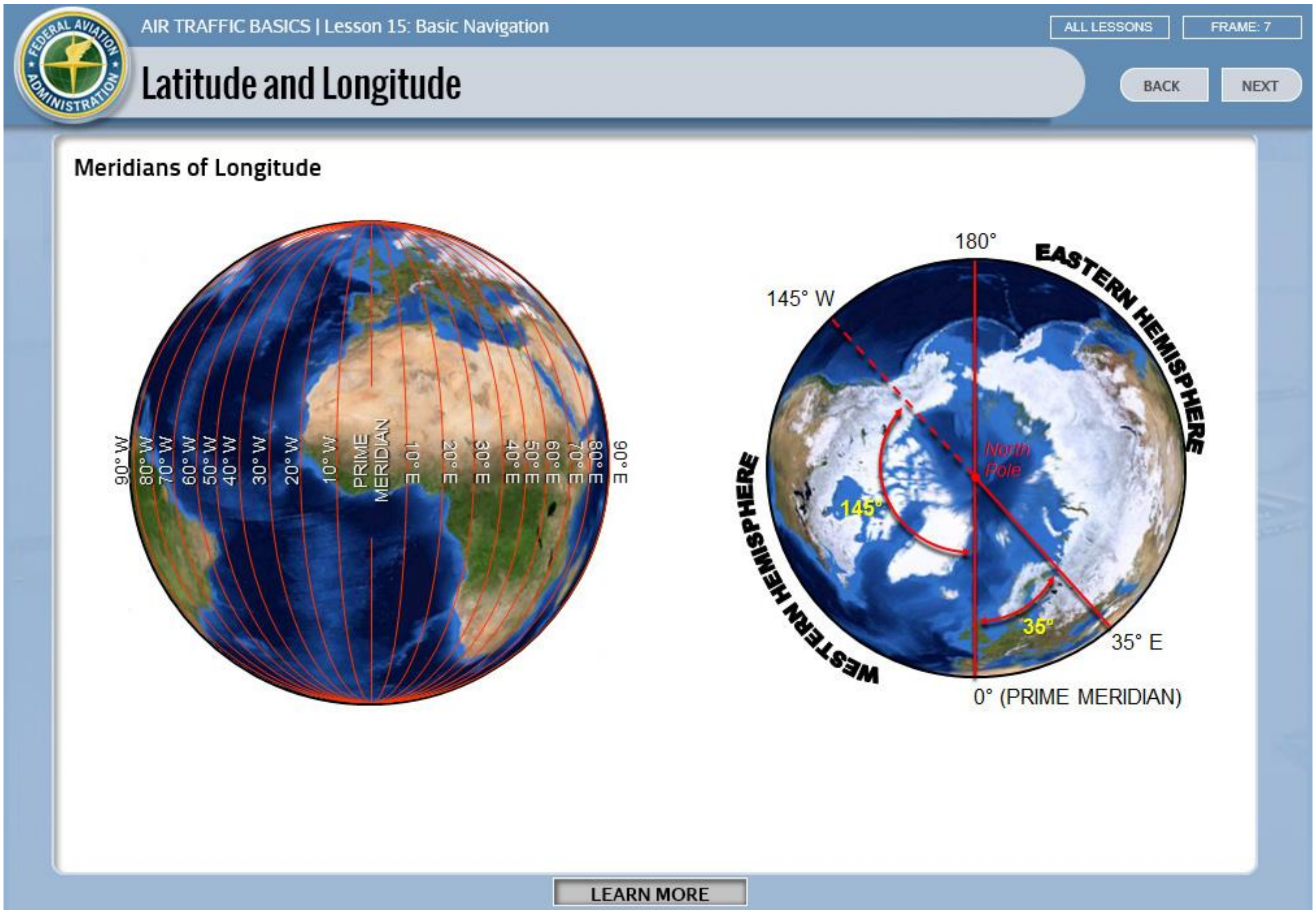

**Parallels of latitude are a series of smaller east-west circles referred to as small circles.**

FAA-H-8083-25, Chap.14




**Parallels of latitude are:**

- **Parallel to equator**
  - **The equator is 0° latitude.**
- **Equal distance apart and used to measure distances north and south of the equator.**
  - **The North Pole is 90° north latitude.**
  - **The South Pole is 90° south latitude.**



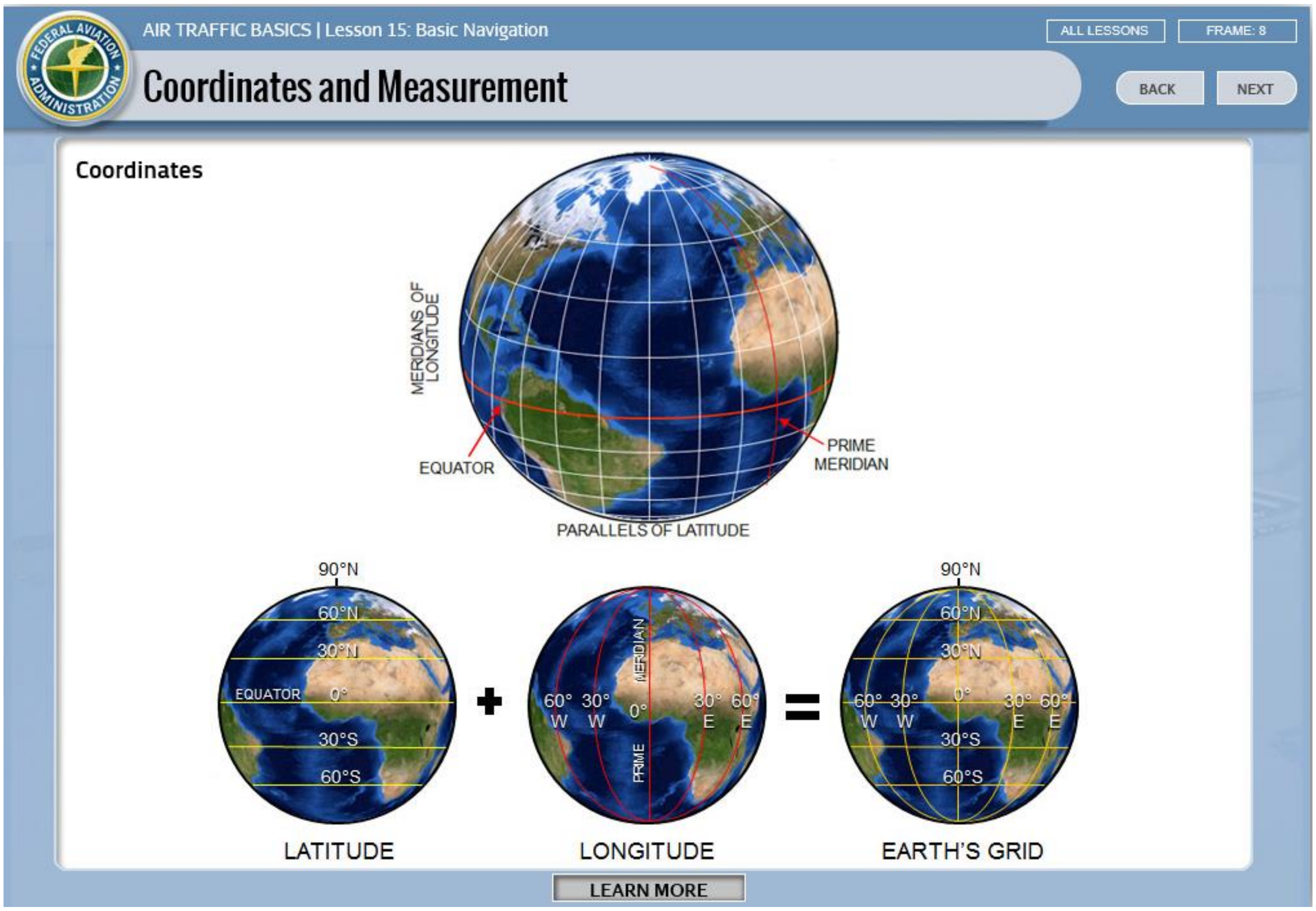

Longitude lines are used to measure angular (circular) distance east and west of the Prime Meridian.

The Prime Meridian (also called the 0° Meridian, or Greenwich Meridian) is the reference line used to measure longitude.

- Longitude is numbered from zero degrees (0°) at the Prime Meridian to 180 degrees east and 180° west.
- 180° east longitude and 180° west longitude are the same meridian.

References:

- FAA-H-8083-25, Chap. 14
- FAA-H-8083-25 "An Invitation to Fly," Chap. 11




The places where meridians and parallels cross are called coordinates.

Coordinates describe the positions of a navigational point on the Earth's surface, consisting of:

- Parallels of latitude
- Meridians of longitude

Coordinates are used:

- In pilot charts and maps
- To describe blocks of airspace
- For airborne navigation systems

Reference: FAA-H-8083-25 "An Invitation to Fly," Chap. 11

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 9

# Coordinates and Measurement

BACK NEXT

## Circular Measurement

A circle = 360 degrees (360°)

1 degree (1°) = 60 minutes (60')

1 minute (1') = 60 seconds (60")

**Example: 129 degrees, 40 minutes, 16 seconds is written as 129°40'16"**

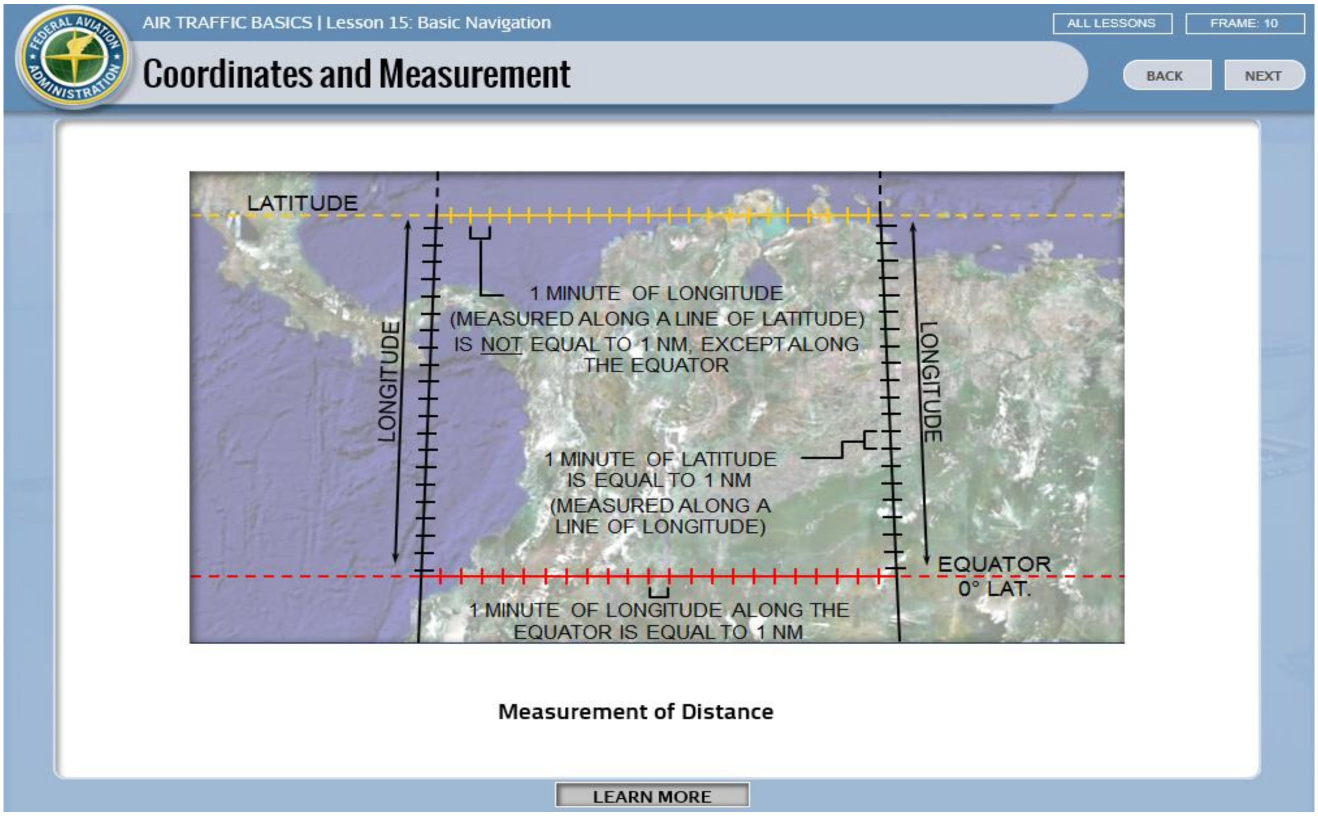
Parallels and meridians are divided into degrees, minutes, and seconds.

Latitude is always stated before longitude.

Parallels of latitude are used for measuring degrees of latitude north and south of the equator.

Meridians of longitude are used for measuring degrees east and west of the Prime Meridian.

FAA-H-8083-25, Chap. 14: "An Invitation to Fly," Chap. 11




Because of the geographic location of the U.S., to determine any location on any U.S. chart, latitude readings increase from bottom to top, and longitude readings increase from right to left.

- Therefore, in the United States, latitude/longitude is read from bottom to top, right to left.

**Example:** 29°40'16"N, 45°30'15"W indicates 29 degrees, 40 minutes, 16 seconds north latitude, 45 degrees, 30 minutes, 15 seconds west longitude.

Longitude **cannot** be used as a scale to measure distance except at the equator.

- One minute of longitude along the equator is equal to 1 nautical mile.
- Meridians converge toward the poles.
  - Distance between lines changes.

Coordinates in ATC:
- Are written without degrees or minute symbols
- Do not include seconds

**Example:** 3427N10536W
***Note****: Some publications list latitude/longitude using the system decimal.*

**Example:** 34-27.73N 105-36.93W

References:
- FAA-H-8083-25, Chap. 14
- FAA-H-8083-25 “An Invitation to Fly,” Chap. 11

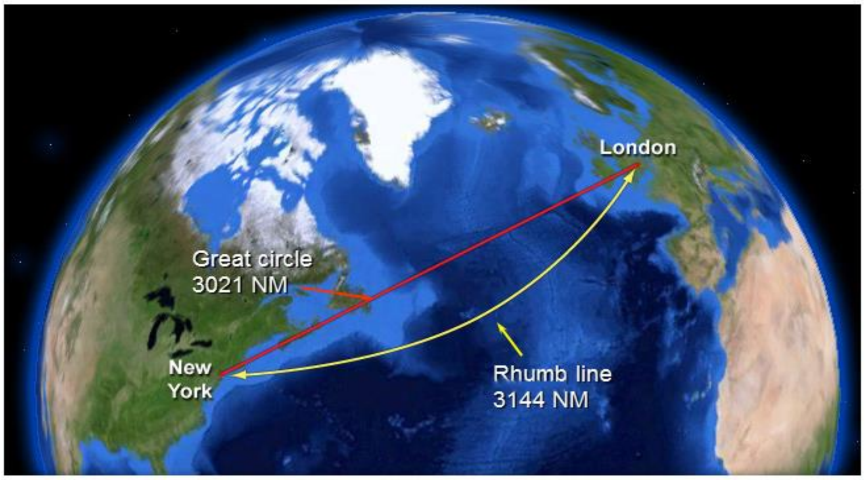
AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 11

# Navigation Routes

BACK NEXT

## Great Circle Route/Rhumb Line




**A great circle route is the shortest distance between two points on a sphere, such as the earth.**

- **Most direct route over the earth's surface**
- **Saves time and fuel**
- **Crosses every meridian at a different angle (constantly changing true direction)**

"An Invitation to Fly," Chap. 11

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 12

# Navigation Routes

BACK NEXT

## Rhumb Line Route

**A rhumb line is a line which makes the same angle with each meridian of longitude and is longer than a great circle route.**

- **An aircraft holding a constant heading would be flying a rhumb line.**
- **Requires more time and fuel because of the greater distance traveled**
- **Is easier to navigate because its direction remains constant**

*NOTE: A great circle route adjusts to the curvature of the earth; the rhumb line does not.*

"An Invitation to Fly," Chap. 11

# Time, Speed, and Distance Measurement

## Measurement of Distance

**Nautical Mile (NM):**

- The NM must be used for all mileages in Instrument Flight Rules (IFR) planning and operations. It is also used in conjunction with federal airways and is used for aircraft separation rules.
- 1 NM is equal to:
  - 6,076.1 feet (Most references show 6,080 feet)
  - 1.15 statute miles
  - 1 minute of latitude

**Statute Mile (SM)**

- The SM is always used in conjunction with visibility.
- 1 SM is equal to:
  - 5,280 feet
  - 0.87NM

FAA-H-8083-25, Chap. 14

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 14

# Time, Speed, and Distance Measurement

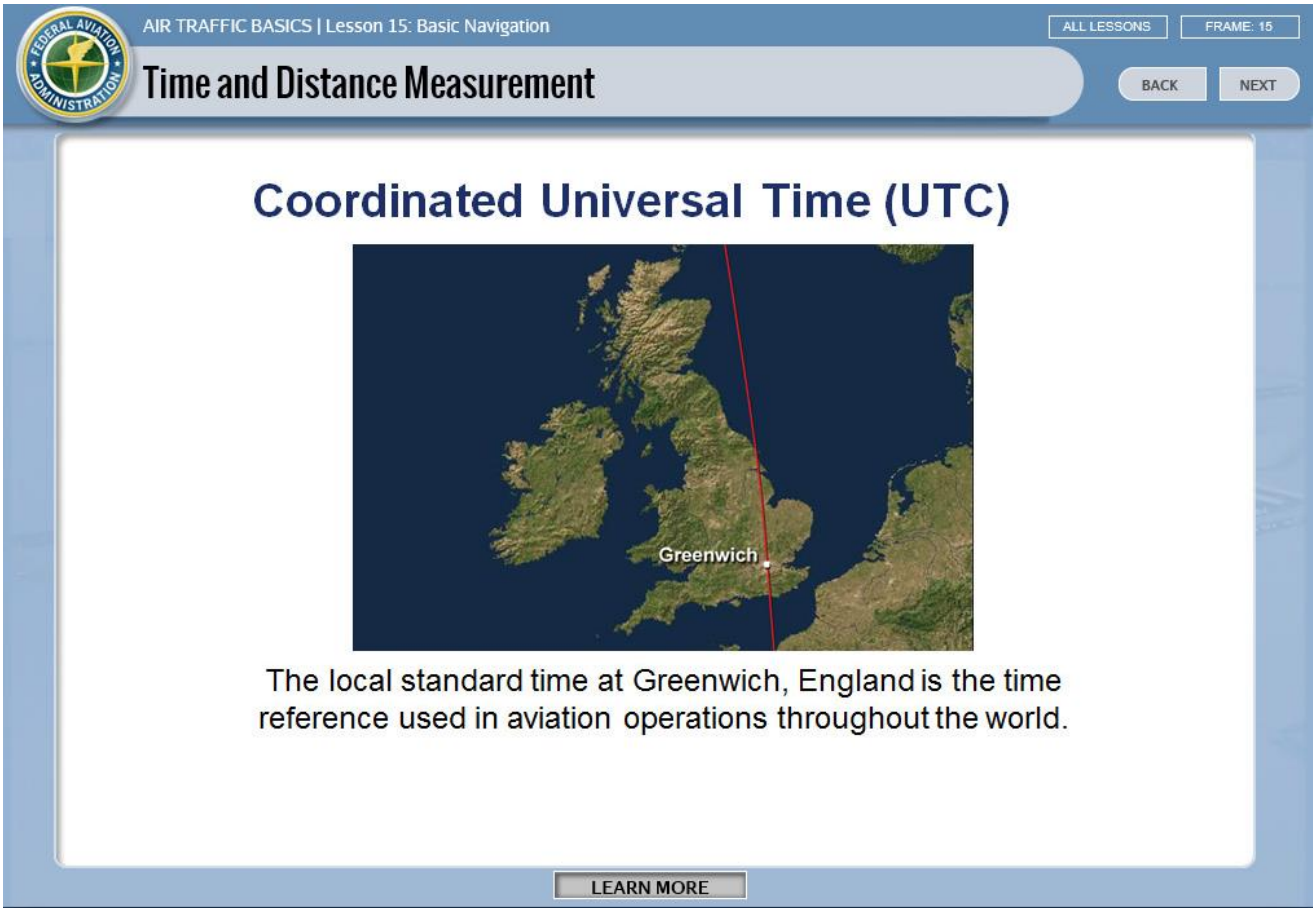
BACK NEXT

## Measurement of Speed

**Knot (KT)**

- 1NM per hour
- NMs and KTs are universal in ATC.

FAA-H-8083-25, Chap. 14




**Measurements of Time**

In this section, three measurements of time will be presented.

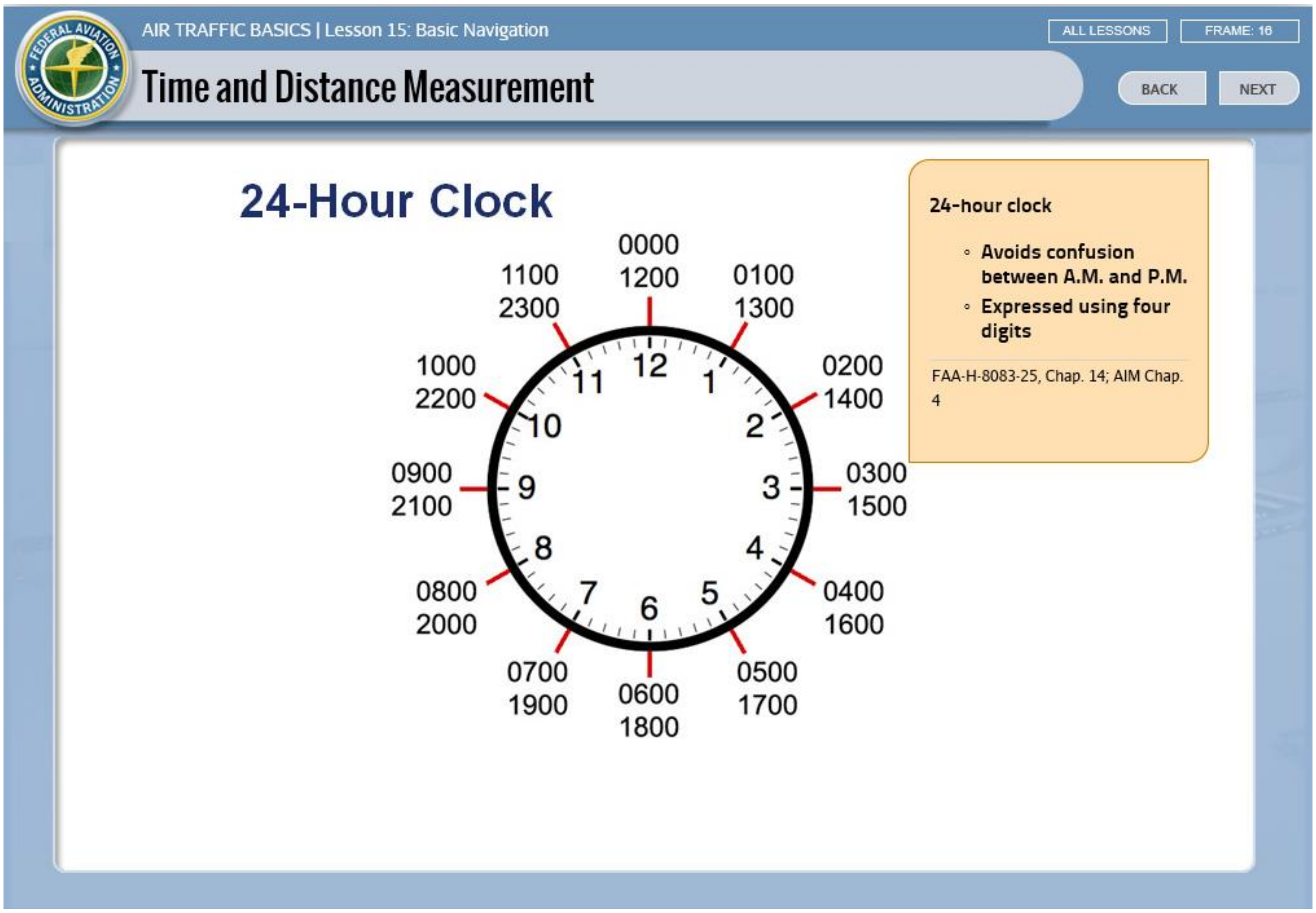
- Coordinated Universal Time (UTC)
- 24-hour clock
- Time Zones

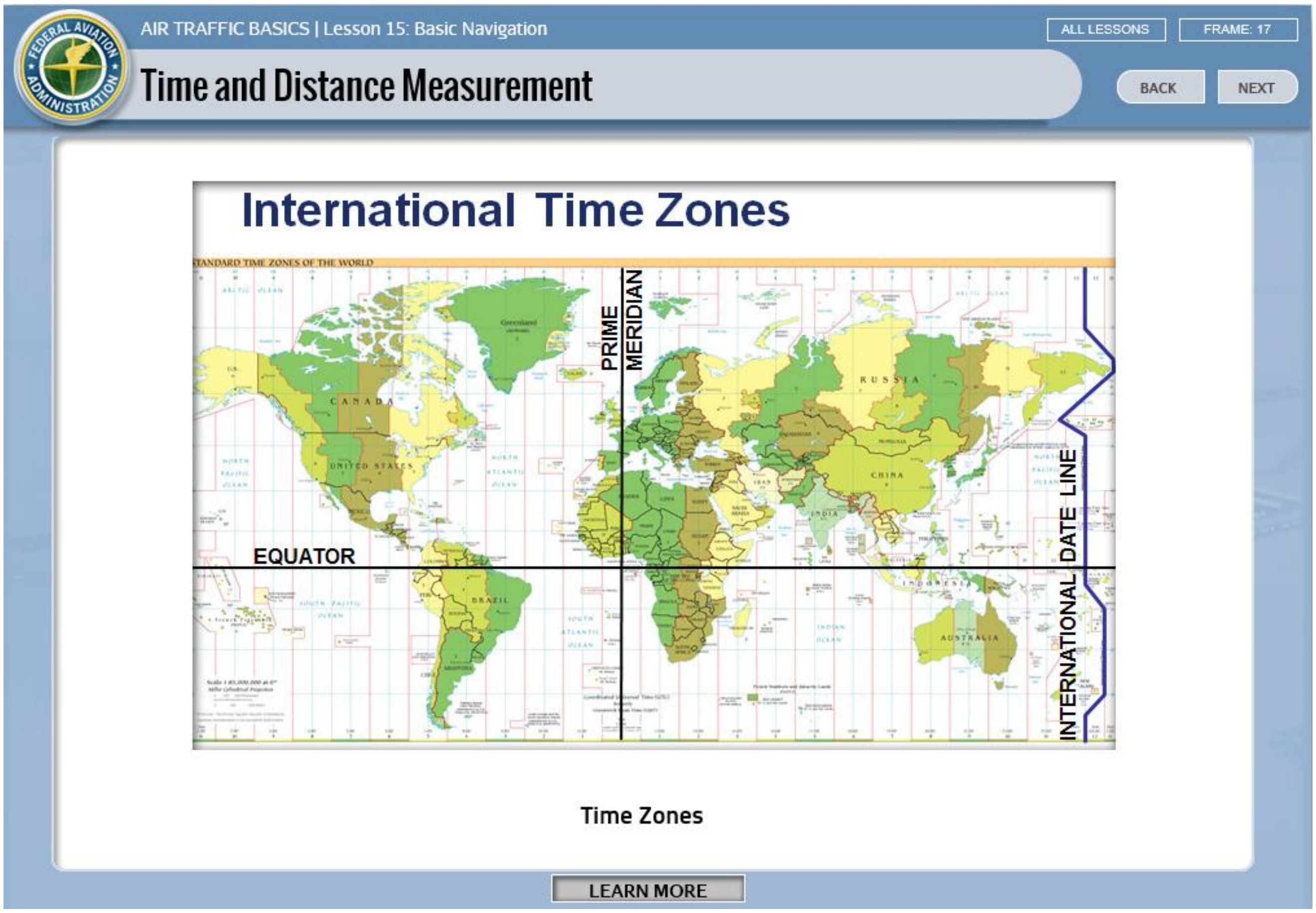
Coordinated Universal Time (UTC)

- Also referred to as “Zulu” time when ATC procedures require a reference to UTC
- Used by the FAA for all operations, however, VFR pilots may use local time
- Eliminates confusion caused by different local times

References:

- AIM, Chap. 4
- FAA-H-8083-25, Chap. 14


AIR TRAFFIC BASICS | Lesson 15: Basic Navigation
ALL LESSONS
FRAME: 16
Time and Distance Measurement
BACK
NEXT
24-Hour Clock
0000
1200
0100
1300
0200
1400
0300
1500
0400
1600
0500
1700
0600
1800
0700
1900
0800
2000
0900
2100
1000
2200
1100
2300
24-hour clock
Avoids confusion between A.M. and P.M.
Expressed using four digits
FAA-H-8083-25, Chap. 14; AIM Chap. 4

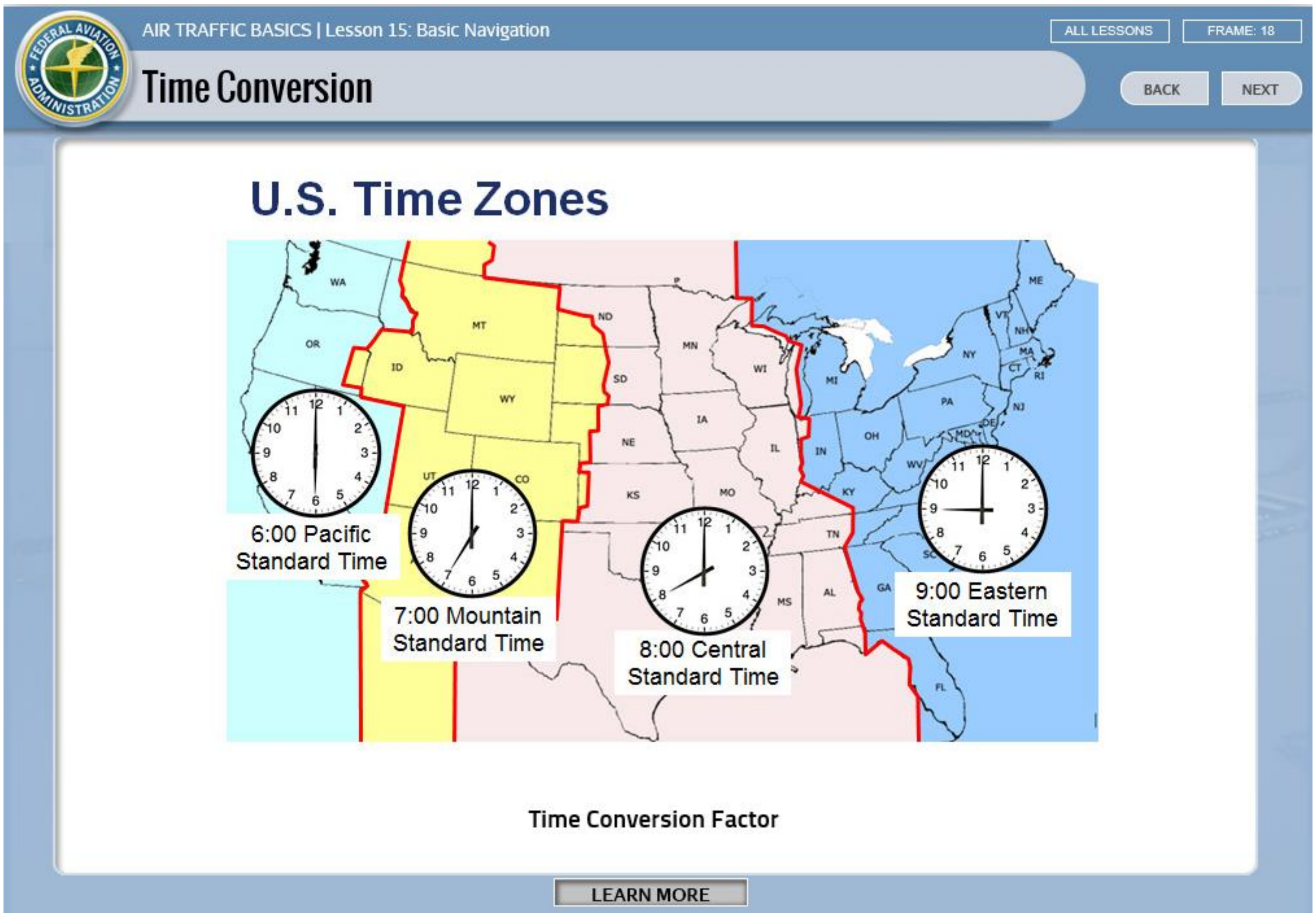



- The earth is divided into 24 standard time zones beginning at 0° longitude.
- Each zone is 15° of longitude wide starting at the Prime Meridian, with some variation due to geographical boundary considerations.
- Time in each zone is called Local Standard Time/Daylight Savings Time (LST/DST).

There are four standard time zones in the contiguous U.S.

- Eastern
- Central
- Mountain
- Pacific

Reference: FAA-H-8083-25, Chap. 14




**U.S. Time Conversion Factors**

- Eastern Standard Time, +5 hours
- Central Standard Time, +6 hours
- Mountain Standard Time, +7 hours
- Pacific Standard Time, +8 hours
- Alaska Standard Time, +9 hours
- Hawaii Standard Time, +10 hours

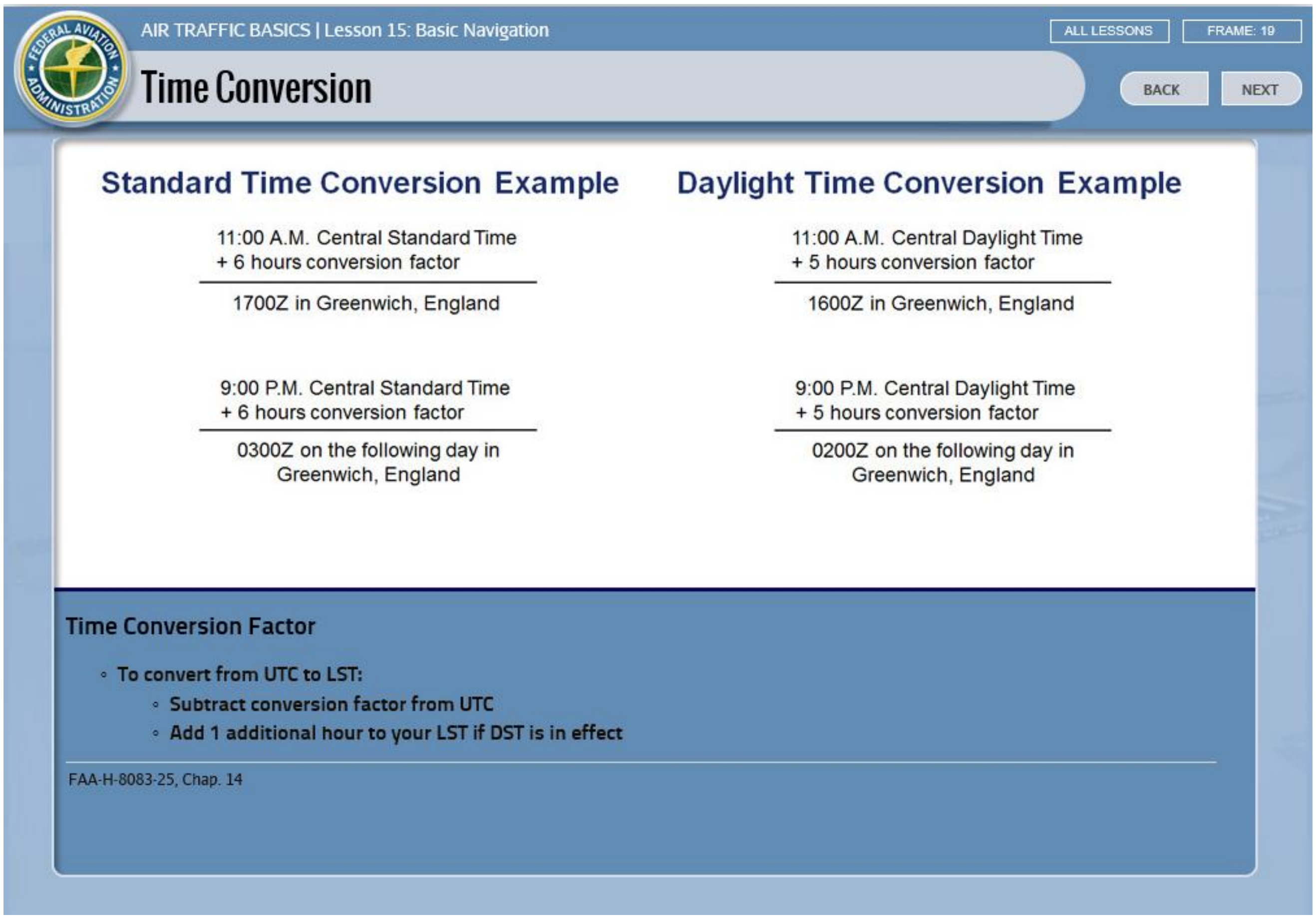
If Daylight Savings Time is in effect, subtract 1 hour from conversion.

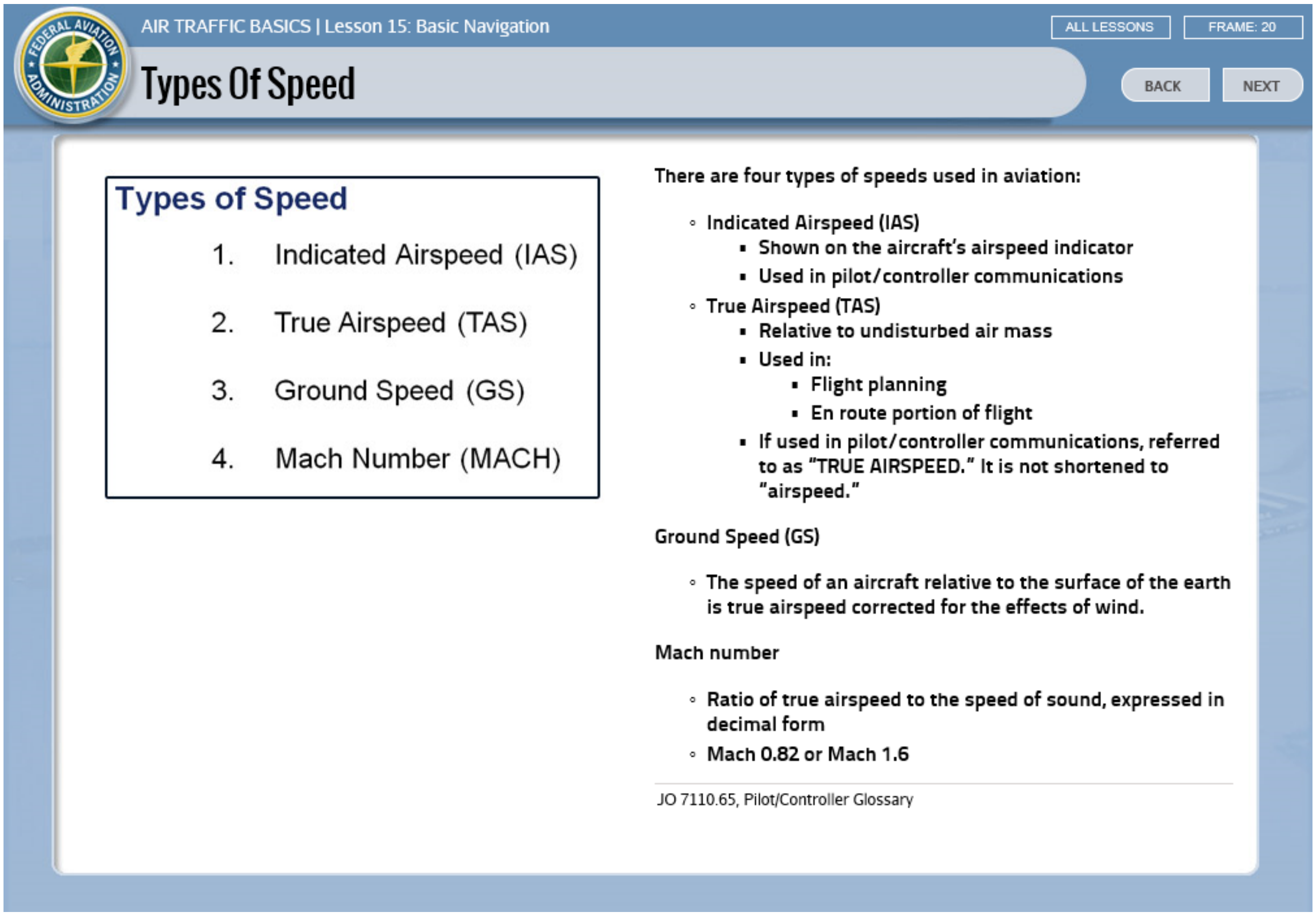
To convert from LST to UTC:

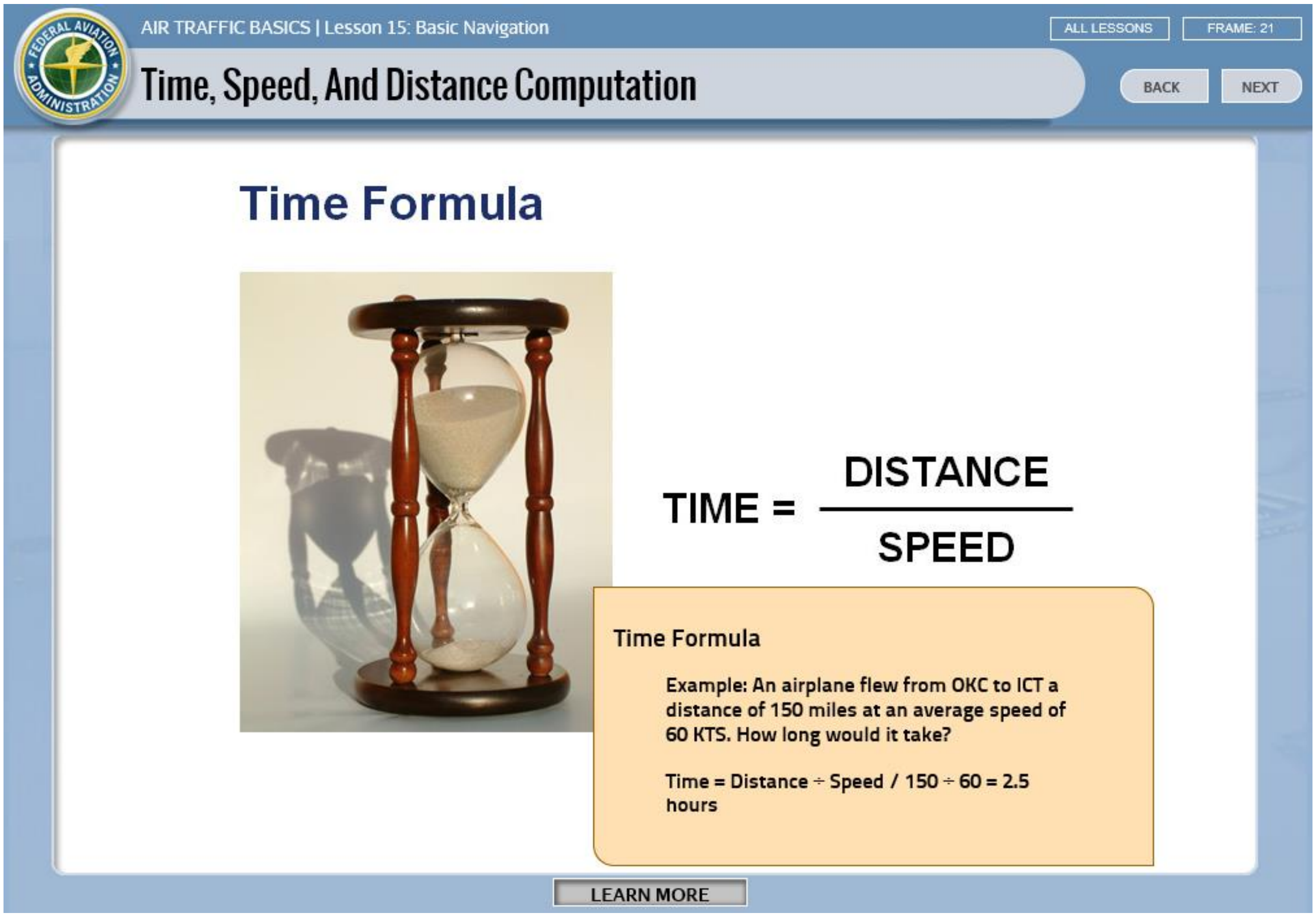
- First convert to 24-hour clock
- Determine appropriate conversion factor and apply

***NOTE:*** *DST starts at 2 A.M. the second Sunday in March, and ends at 2 A.M. on the first Sunday in November. Some locations do not switch to DST.*

Reference: FAA-H-8083-25, Chap. 14


AIR TRAFFIC BASICS | Lesson 15: Basic Navigation
ALL LESSONS
FRAME: 19
Time Conversion
BACK
NEXT
Standard Time Conversion Example
11:00 A.M. Central Standard Time
+ 6 hours conversion factor
1700Z in Greenwich, England
9:00 P.M. Central Standard Time
+ 6 hours conversion factor
0300Z on the following day in Greenwich, England
Daylight Time Conversion Example
11:00 A.M. Central Daylight Time
+ 5 hours conversion factor
1600Z in Greenwich, England
9:00 P.M. Central Daylight Time
+ 5 hours conversion factor
0200Z on the following day in Greenwich, England
Time Conversion Factor
To convert from UTC to LST:
Subtract conversion factor from UTC
Add 1 additional hour to your LST if DST is in effect
FAA-H-8083-25, Chap. 14


AIR TRAFFIC BASICS | Lesson 15: Basic Navigation
ALL LESSONS
FRAME: 20
Types Of Speed
BACK
NEXT
Types of Speed
1. Indicated Airspeed (IAS)
2. True Airspeed (TAS)
3. Ground Speed (GS)
4. Mach Number (MACH)
There are four types of speeds used in aviation:
◦ Indicated Airspeed (IAS)
▪ Shown on the aircraft's airspeed indicator
▪ Used in pilot/controller communications
◦ True Airspeed (TAS)
▪ Relative to undisturbed air mass
▪ Used in:
▪ Flight planning
▪ En route portion of flight
▪ If used in pilot/controller communications, referred to as "TRUE AIRSPEED." It is not shortened to "airspeed."
Ground Speed (GS)
◦ The speed of an aircraft relative to the surface of the earth is true airspeed corrected for the effects of wind.
Mach number
◦ Ratio of true airspeed to the speed of sound, expressed in decimal form
◦ Mach 0.82 or Mach 1.6
JO 7110.65, Pilot/Controller Glossary




**Time** = Distance divided by Ground Speed (T = D ÷ GS)

- Time is measured in hours and minutes and must be converted to decimals in order to apply this formula. Divide minutes by 60 to get the decimal equivalent of hours and minutes.

***NOTE:*** *2.5 hours is expressed as 2+30 in ATC.*

Reference: FAA-H-8083-25, Chap. 14

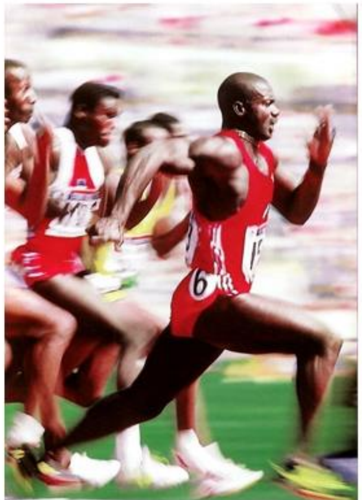
AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 22

# Time, Speed, And Distance Computation

BACK NEXT

## Speed Formula



$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

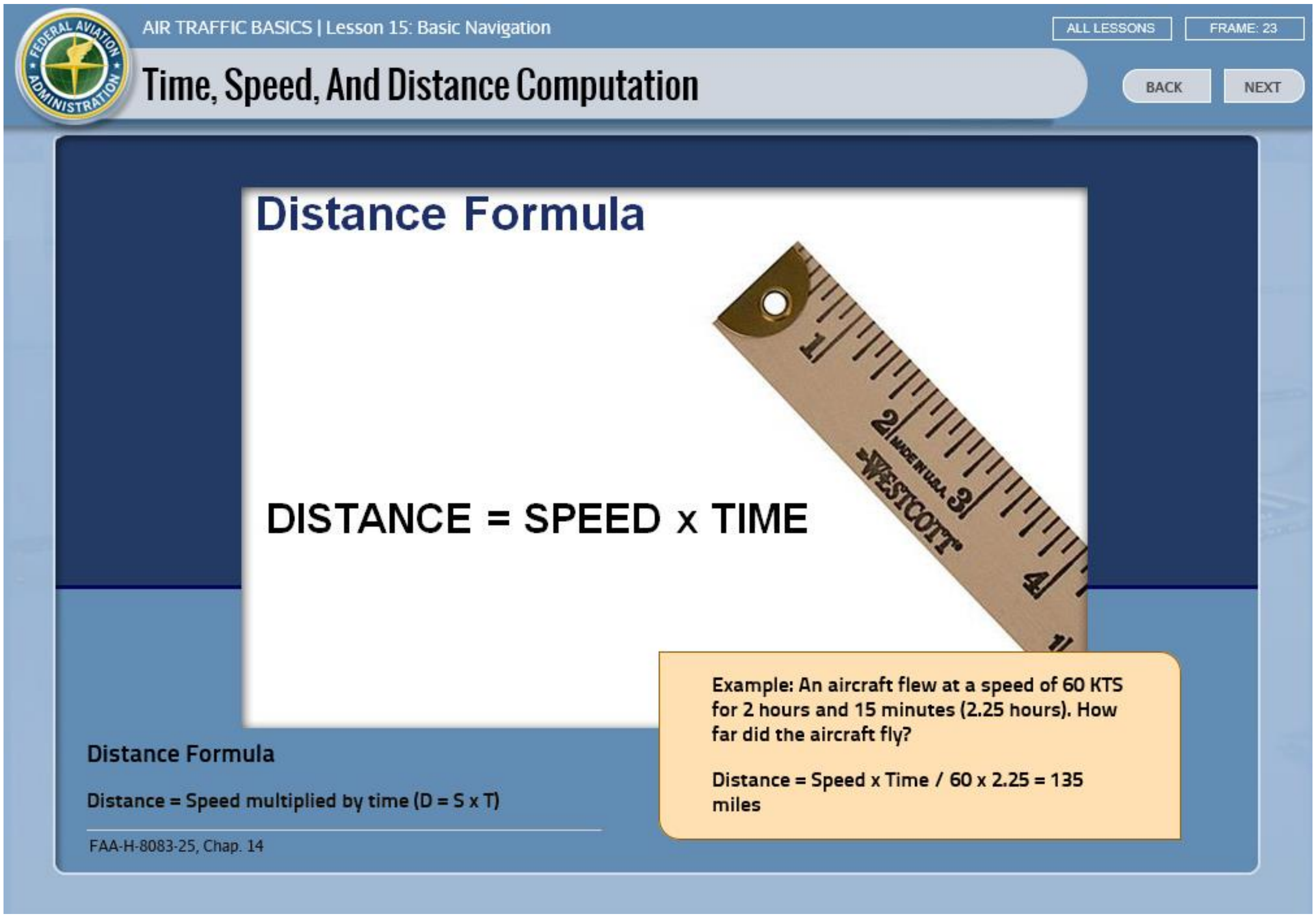
**Example: An aircraft flew a distance of 140 miles in 3 hours and 30 minutes (3.5 hours). What was the aircraft's speed?**

**Speed = Distance ÷ time / 140 ÷ 3.5 = 40 KTS.**

### Speed Formula

**Speed = Distance divided by Time (S = D ÷ T)**

FAA-H-8083-25, Chap. 14


AIR TRAFFIC BASICS | Lesson 15: Basic Navigation
ALL LESSONS
FRAME: 23
Time, Speed, And Distance Computation
BACK
NEXT
Distance Formula
DISTANCE = SPEED x TIME
Example: An aircraft flew at a speed of 60 KTS for 2 hours and 15 minutes (2.25 hours). How far did the aircraft fly?
Distance = Speed x Time / 60 x 2.25 = 135 miles
Distance Formula
Distance = Speed multiplied by time (D = S x T)
FAA-H-8083-25, Chap. 14

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 24

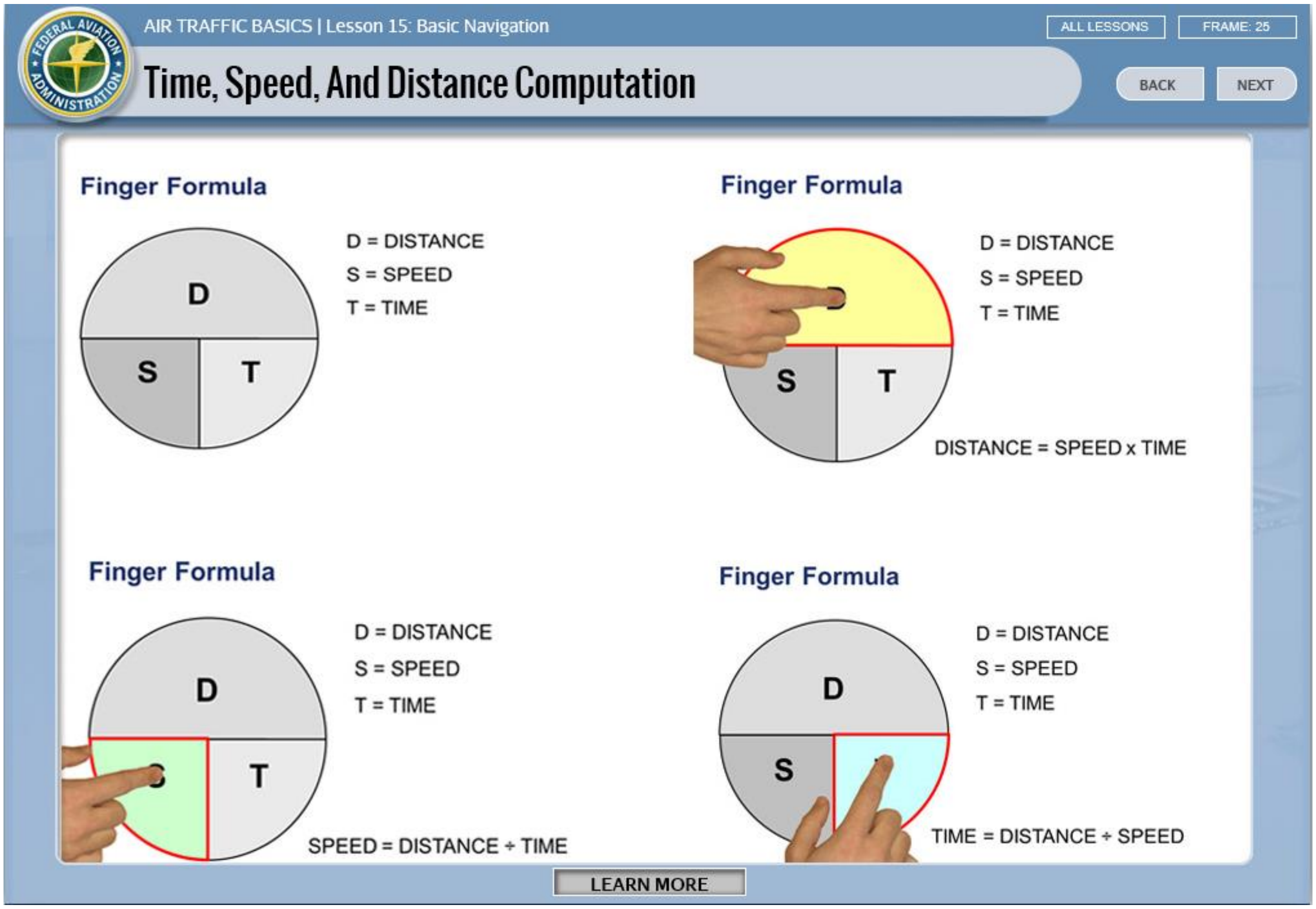
# Time, Speed, And Distance Computation

BACK NEXT

## Additional Information

Remember that only like units can be used together in a formula.

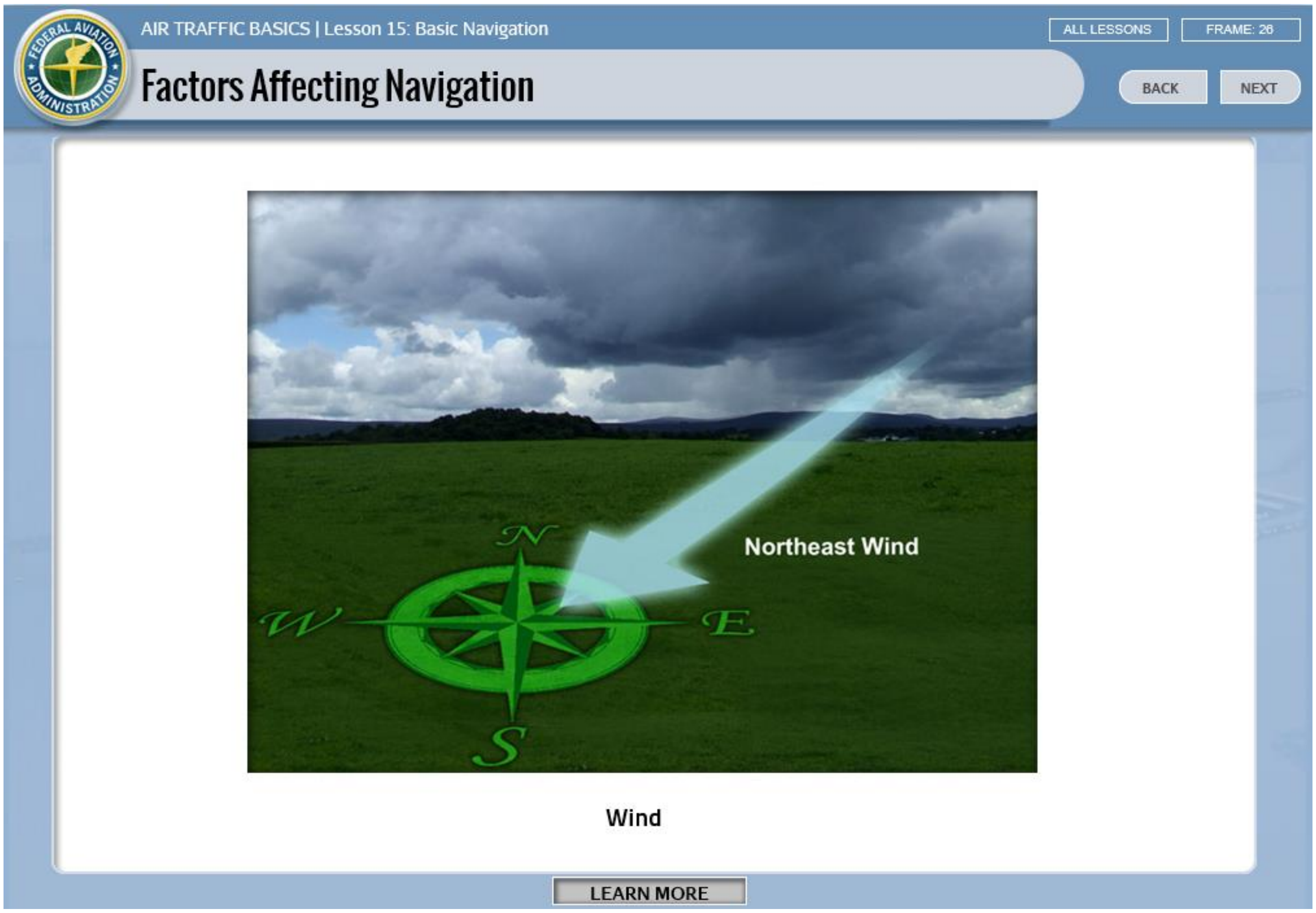
- If you use NMs, you must use KTs.
- If you use SM, you must use MPH.
- If you use hours, you will get units per hour, and if you use minutes you will get units per minute, etc.




**Finger Formula**

The following "finger formula" is helpful in remembering this relationship: Place a finger over the unknown you wish to find and read the correct formula.

- Place finger over T and read D/S or Distance/Speed.
- Place finger over S and read D/T or Distance/Time.
- Place finger over D and read S x T or Speed x Time.

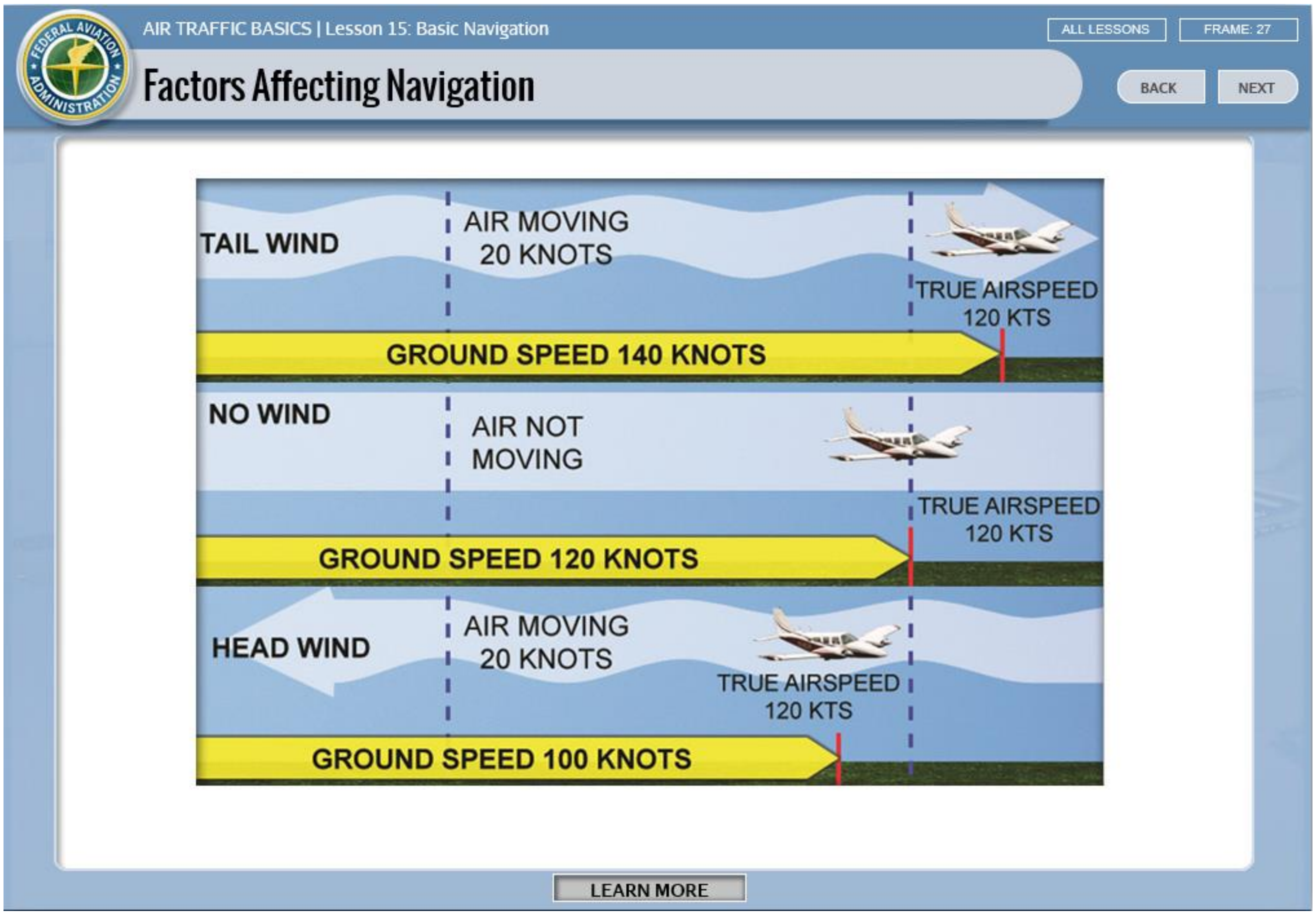



Wind is a mass of air moving over the earth's surface in a definite direction.

- Wind is stated to include the following:
  - Direction from which the wind is blowing
  - Velocity in knots

**Example:** A wind report of 04025 is coming **from** 040 degrees at 25 knots.

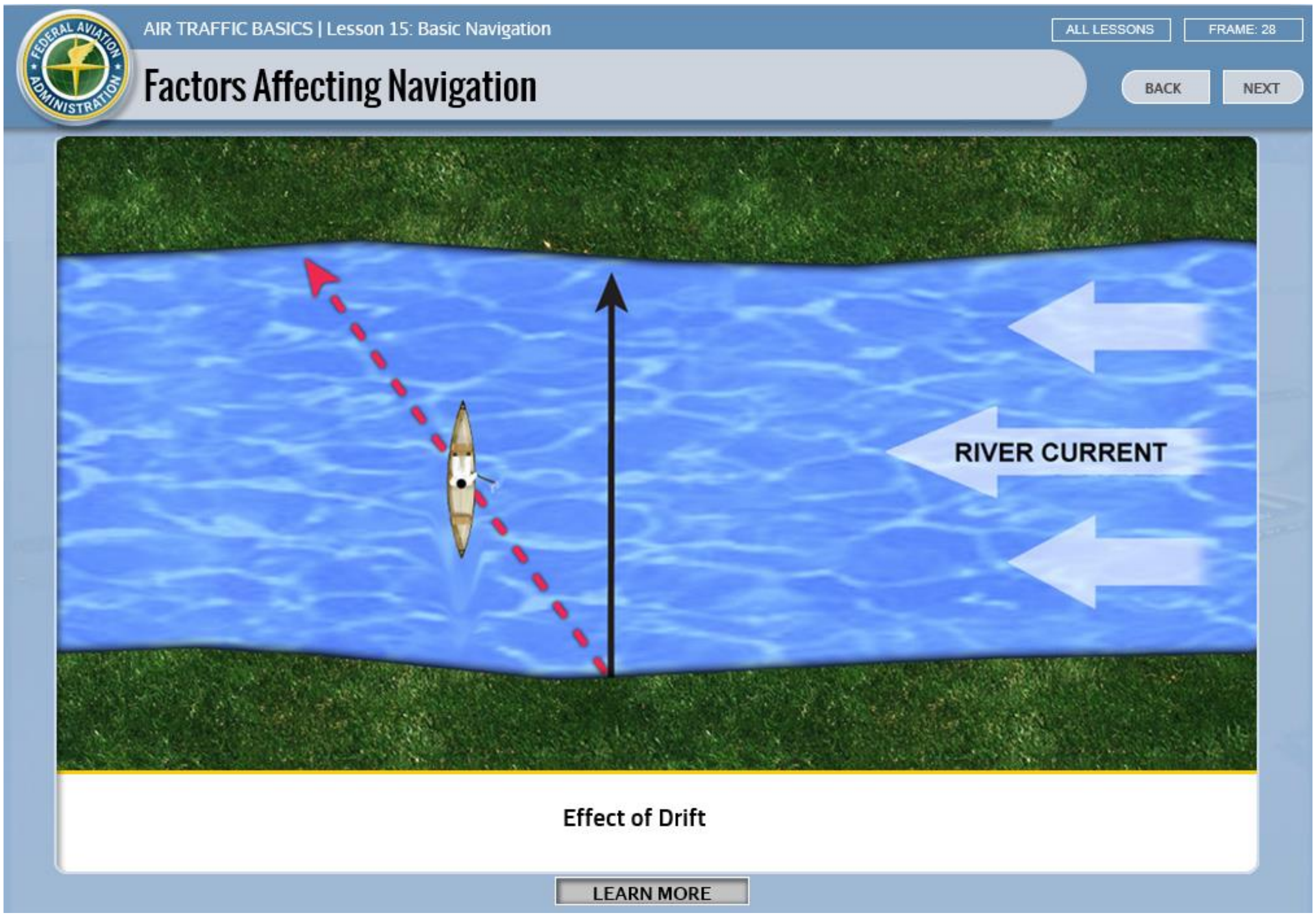
Reference: FAA-H-8083-25, Chap. 14




**Ground Speed vs. True Airspeed**

- Wind does **not** affect true airspeed.
- Wind does affect ground speed.
  - Increased by tailwind
  - Reduced by headwind
- Crosswind affects speed and direction of flight.

Reference: FAA-H-8083-25, Chap. 14

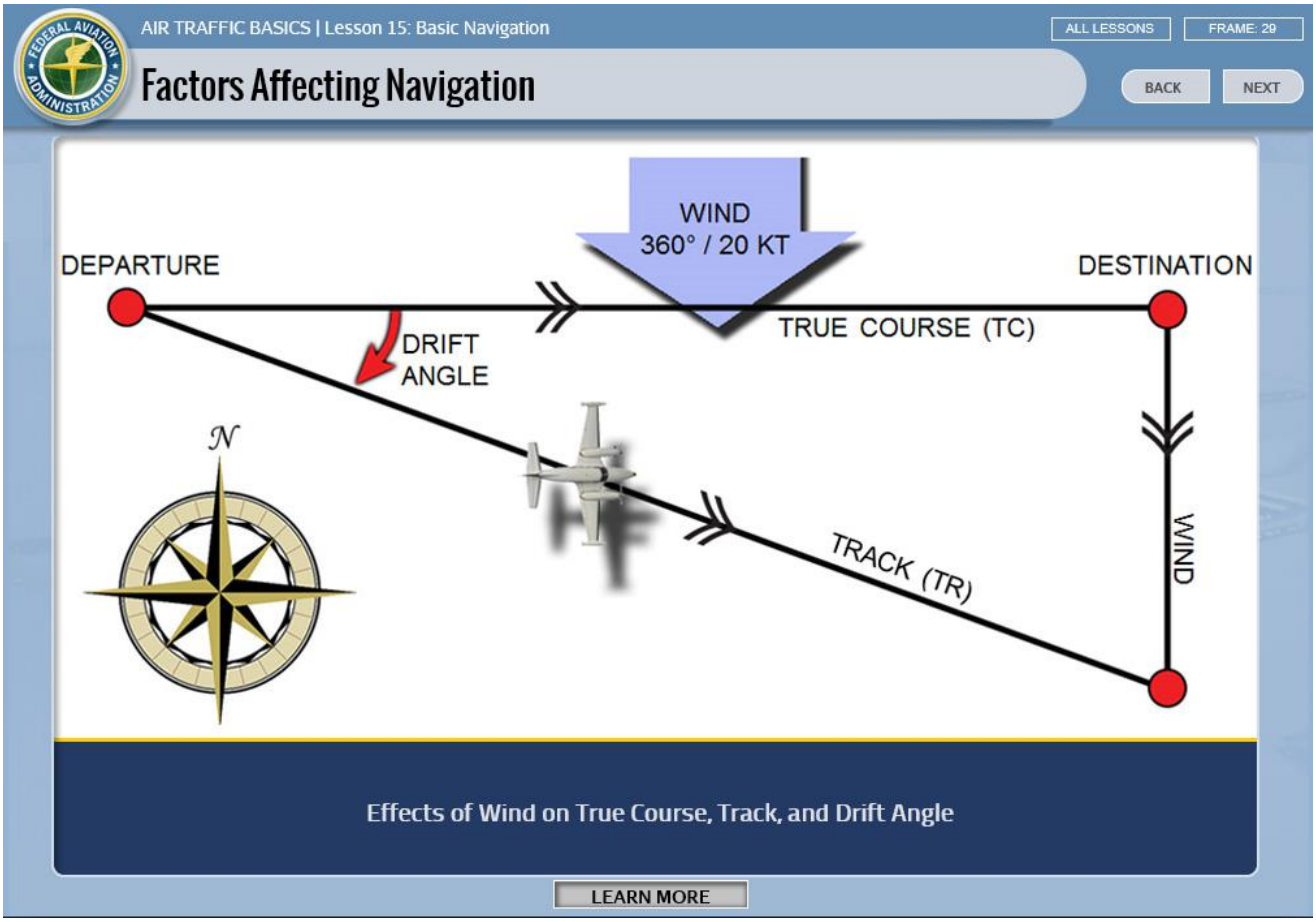



An aircraft's movement over the ground is comparable to a boat crossing a river.

- If there is no current in the river, a boat starting at one shore of the river and rowing perpendicular to the river's edge would end up at a point on the opposite shore directly across from its starting point.
- However, if there is a current, the boat will be carried downstream until the boat eventually reaches the opposite shore.

- The displacement of the boat downstream is dependent upon the:
  - Direction and speed of the river current
  - Direction the boat is headed
  - Speed of the boat through the water

Reference: FAA-H-8083-25, Chap. 14




True course represents the intended path of the aircraft over the earth's surface.

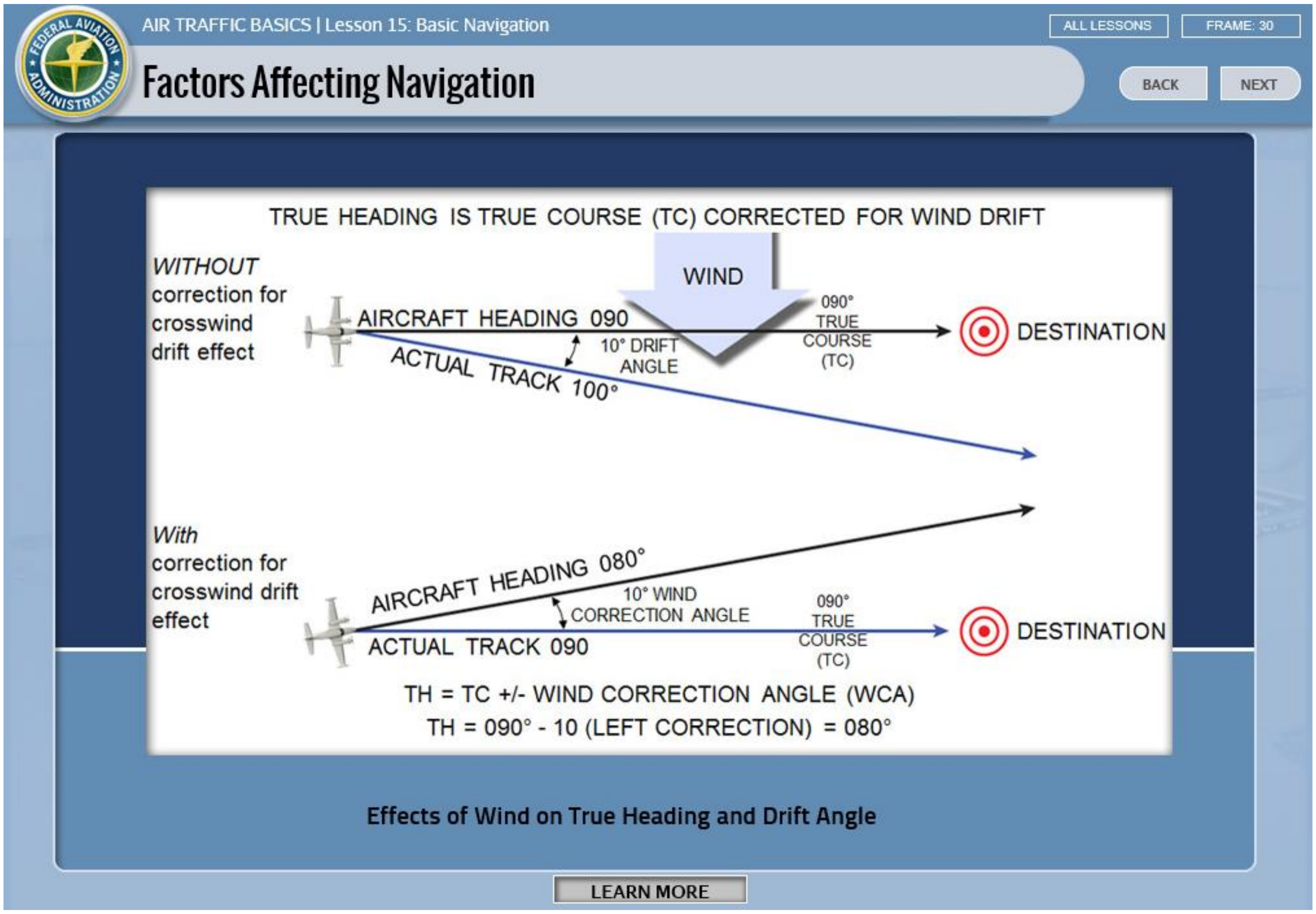
Track is the actual path that the aircraft has flown over the earth's surface.

Drift angle is what any free object will do as the air moves downwind with the speed of the wind.

- This is just as true of an aircraft as it is of a balloon.
- In one hour, an aircraft drifts downwind an amount equal to wind speed.

References:

- FAA-H-8083-25, Chap. 14
- FAA-H-8083-25 "An Invitation to Fly," Chap. 12




True Heading (TH) is True Course (TC) corrected for wind (TC +/- WCA = TH).

- The pilot attempts to fly True Course.
- The wind pushes aircraft off course.
- The track over ground is not a desired one.
- The difference is called drift angle.

To compensate, pilots correct heading toward direction from which wind is coming.

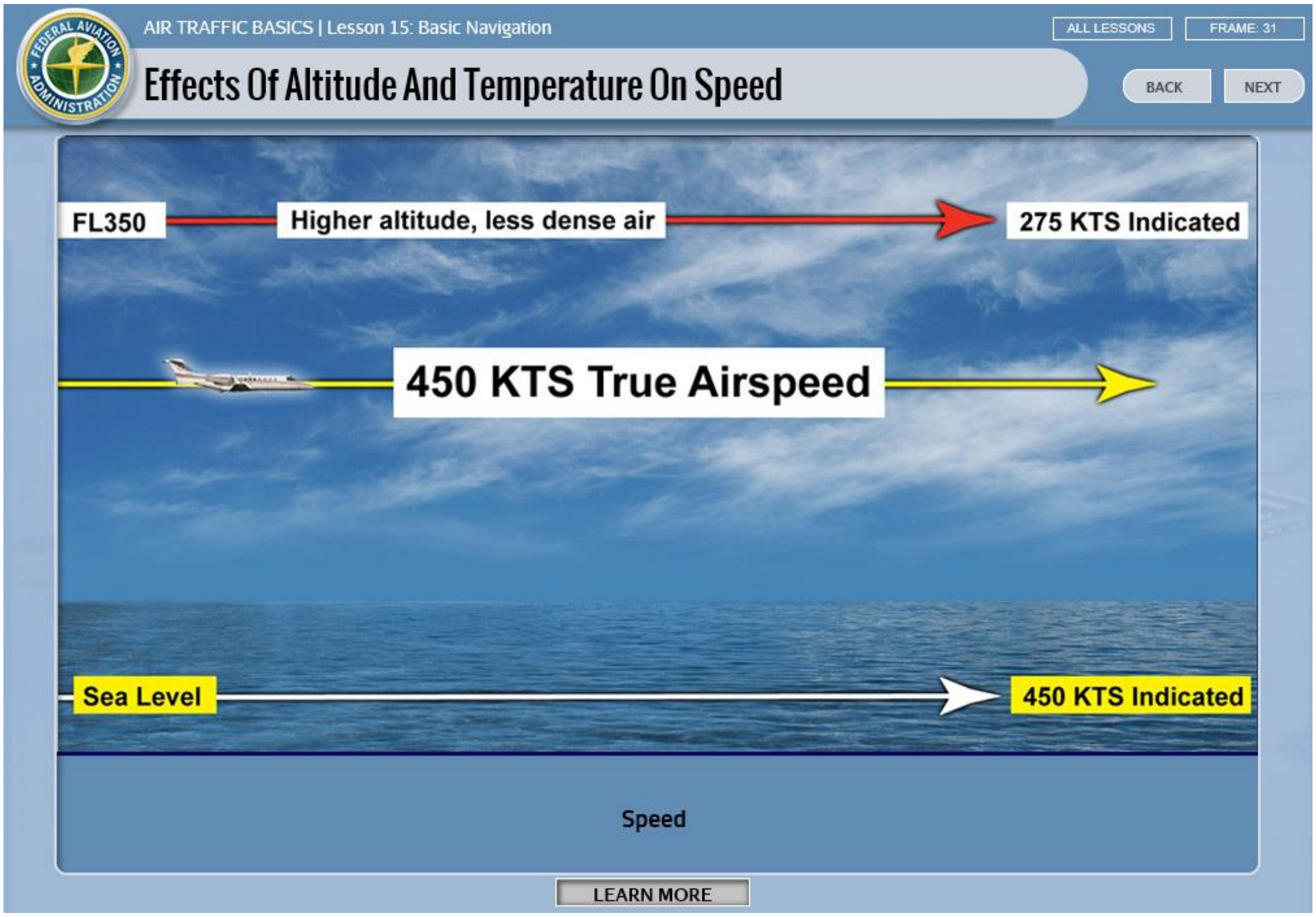
- Right or left of true course
- The resulting angle is Wind Correction Angle (WCA).
- The resulting heading is called the True Heading (TH).

It is the controller's responsibility to compensate for wind speed and direction when:

- Formulating estimates
- Issuing radar vectors

References:

- FAA-H-8083-25, Chap. 14
- FAA-H-8083-25 "An Invitation to Fly," Chap. 12




Pilots use performance tables to calculate their true airspeed from power settings, altitude, and temperature.

- Calculating the wind's effect on true airspeed gives the pilot groundspeed, which is then used to determine:
  - Time en route
  - Estimated Time of Arrival (ETA)

More importantly to a controller, for a constant true airspeed, the indicated airspeed decreases with increases in altitude and temperature.

  - Because speeds assigned by ATC are expressed as knots of indicated airspeed, controllers need to be aware of the possible differences between true airspeed and indicated airspeed.

References:

- FAA-H-8083-25, Chaps. 6, 9
- FAA-H-8083-25 "An Invitation to Fly," Chap. 4

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 32

# Effects Of Altitude And Temperature On Speed

BACK NEXT

## Effects Of Altitude On Speed

- **In the less dense air at higher altitudes, fewer air molecules enter the aircraft's pitot tube, resulting in a lower indicated airspeed reading.**
- **At altitudes near sea level, there is little discernable difference between an aircraft's true airspeed and its indicated airspeed.**
- **At high altitudes, an aircraft's indicated airspeed is significantly lower than its true airspeed.**

AIM, Chap. 4; "An Invitation to Fly," Chap. 4

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 33

# Effects Of Altitude And Temperature On Speed

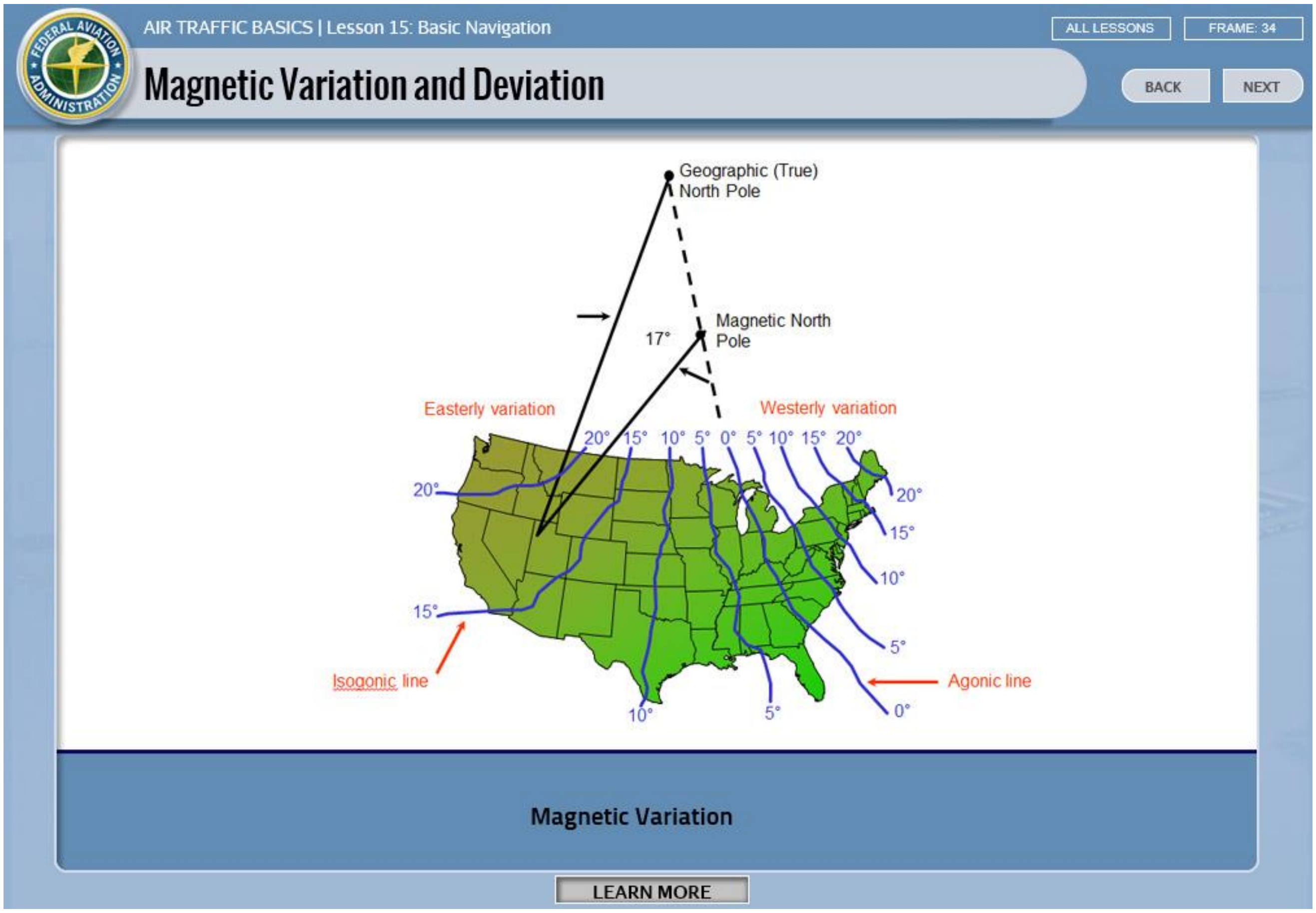
BACK NEXT

## Effects Of Temperature On Speed

**As it does with increasing altitude, air becomes less dense as temperature increases.**

- **As a result, an increase in temperature has the same effect on speed as an increase in altitude.**
- **Unlike the effects of altitude on speed, the difference between indicated airspeed and true airspeed caused by changes in temperature are relatively small and are less significant to a controller.**

"An Invitation to Fly," Chap. 4




Variation is the angular difference between true north and magnetic north.

- Variation is measured in degrees from true north.
- The magnetic north pole is located 1,300 miles from the true north pole, and is always moving.
- Isogonic lines connect points of equal difference between true and magnetic north.
  - Agonic line connects points of zero variation.
  - There is only one agonic line.

Reference: FAA-H-8083-25, Chap. 14

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 35

# Magnetic Variation and Deviation

BACK NEXT


**Example:** "FLY HEADING TWO FOUR ZERO."

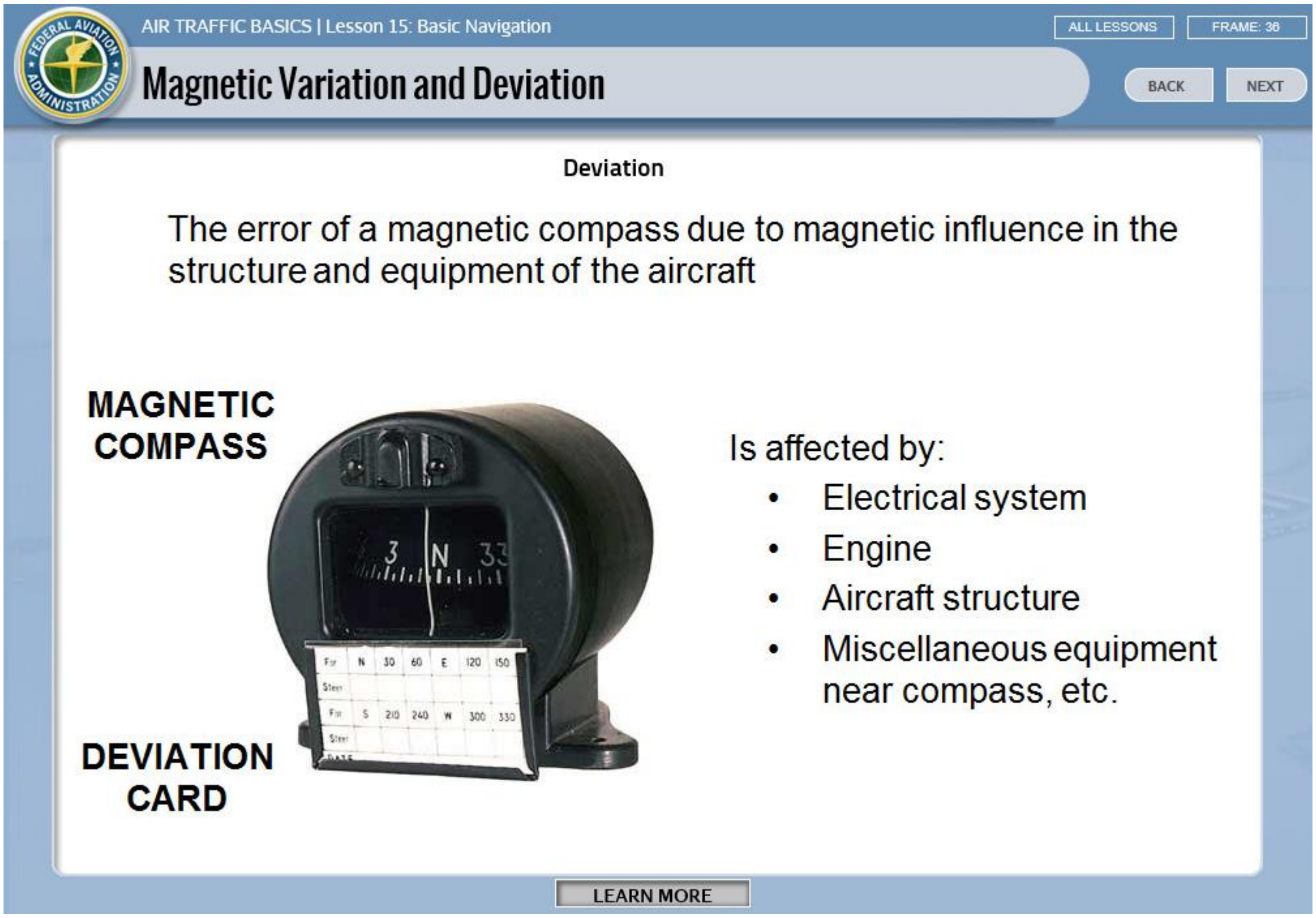
"TURN RIGHT HEADING ONE TWO FIVE."

## Magnetic Variation

### Application

- The agonic line, zero variation, no correction is necessary.
- The isogonic lines, east/west variation, correction is necessary.
  - For east variation, subtract degrees of variation.
  - For west variation, add degrees of variation.
- Magnetic Heading (MH) is True Heading (TH) corrected for variation (TH ± VAR = MH).
- Magnetic directions are usually used in pilot and controller communications.
  - Exception:
    - Wind in weather reports and forecasts are given in reference to true north.

JO 7110.65, Chap. 5 FAA-H-8083-25, Chap. 14




Magnetic Deviation

- Magnetic compass error may change as the aircraft heading changes.

- Results from magnetic influences within aircraft:
  - Electrical circuits
  - Engine
  - Other magnetized parts

- Deviation card is mounted near the compass.
  - Lists corrections
- Compass Heading (CH) is the Magnetic Heading (MH) corrected for deviation (MH ± DEV = CH).

Reference: FAA-H-8083-25, Chap. 14

# Basic Navigation Methods



## Dead Reckoning

Dead reckoning is navigation of an airplane solely by means of computations based on airspeed, course, heading, wind direction, and speed, groundspeed, and elapsed time.

Dead reckoning is the basic method of navigation used for flying a predetermined course taking into account the effects of wind on:

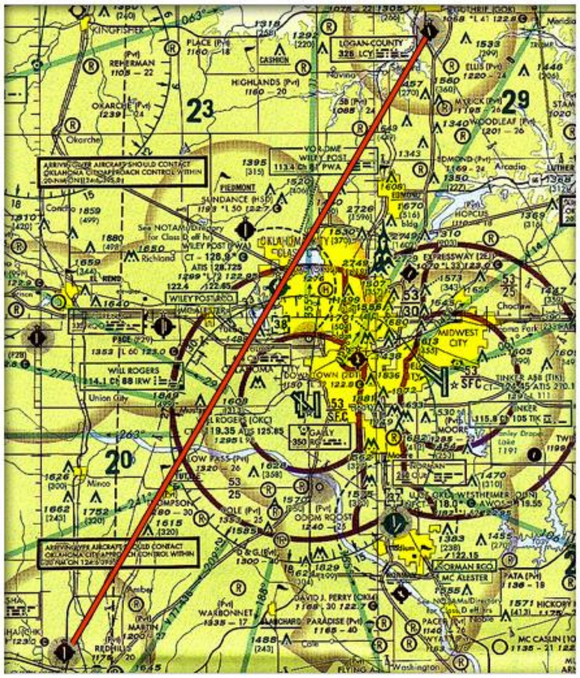
- Track
- Ground speed

Apply wind correction to true course to determine:

- True heading
- Ground speed

Using the appropriate corrections, pilots can estimate how long to fly on certain headings to arrive over their destination.

- This can be done with or without reference to the ground.



FAA-H-8083-25, Chap. 14 AIM, Pilot/Controller Glossary

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS | FRAME: 38

# Basic Navigation Methods

BACK | NEXT

**Pilot's Planning Sheet**

**In flight planning, aviation charts are used to plot and determine the following:**

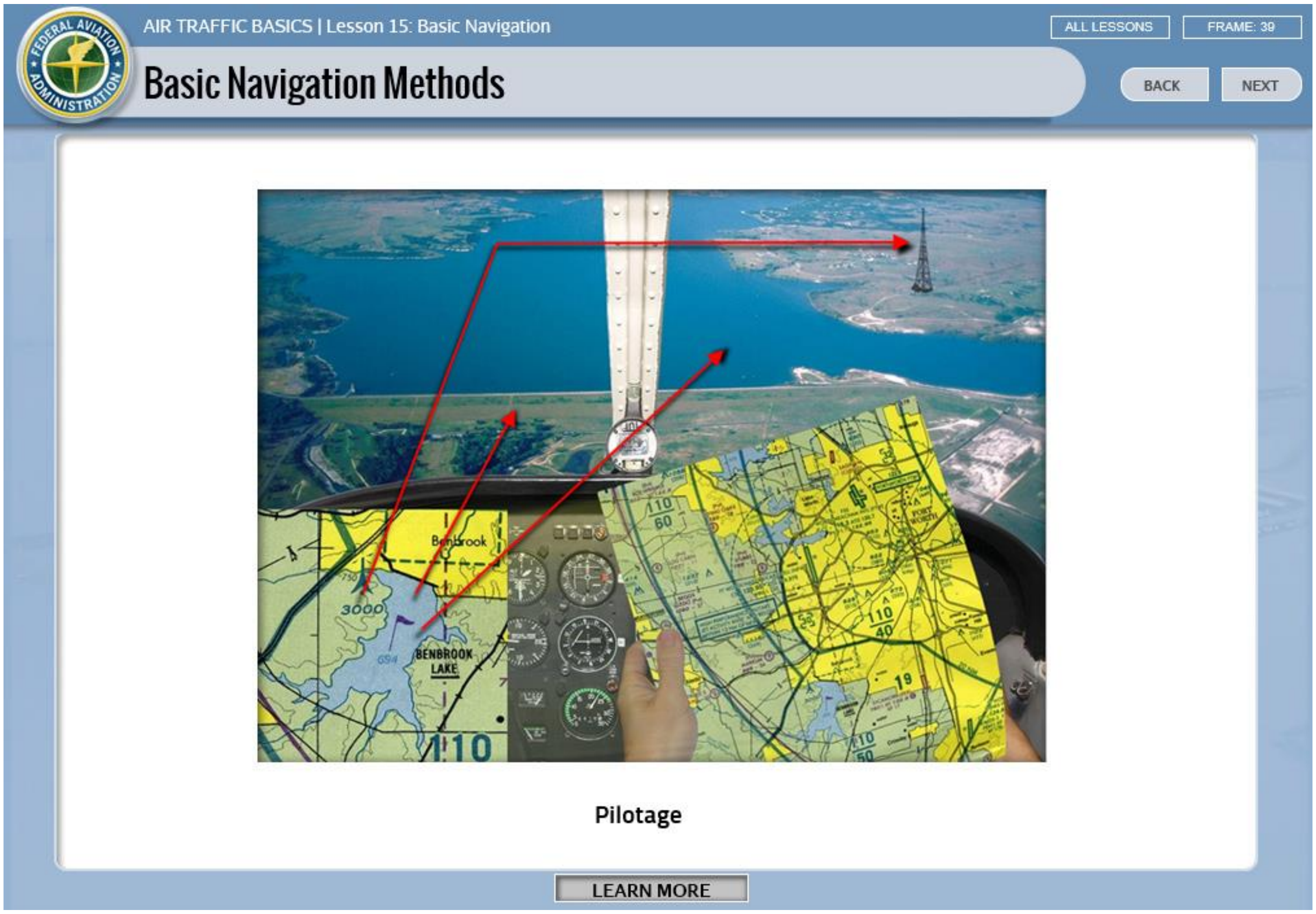
- **True course**
- **Distance**
- **Variation**

FAA-H-8083-25, Chap. 14

PILOT'S PLANNING SHEET

PLANE IDENTIFICATION *N123DB* DATE *11-22-96*

| COURSE | TC | WIND KNOTS | WIND FROM | WCA R+ L- | TH | VAR W+ E- | MH | DEV | CH | TOTAL MILES | GS | TOTAL TIME | FUEL RATE | TOTAL FUEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| From: *Chickasha* To: *Guthrie* | 031° | 10 | 360° | 3' L | 28 | 6°E | 22 | +2 | 24 | 53 | 106 kts | 35 mins | 8 GPH | 38 gal |
| From: To: | | | | | | | | | | | | | | |

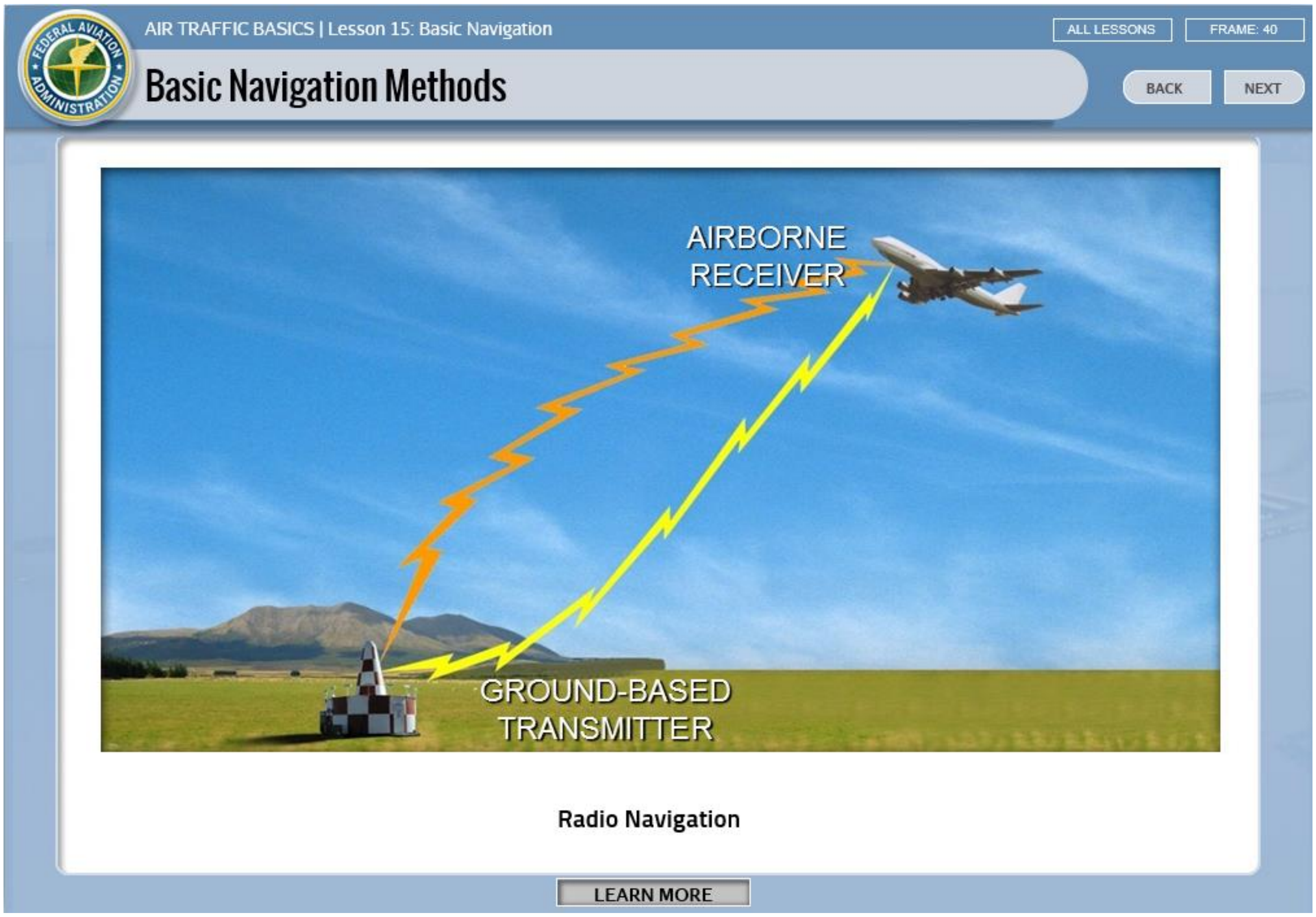



The determination of position by identification of landmarks from their representation on a chart.

- Pilot draws course line on chart from selected checkpoints and prominent landmarks.
- Pilot flies from landmark to landmark by visual references.
- Useful only in VFR weather
- Pilotage is the basic form of navigation for a beginning pilot.
- It is suitable for slow aircraft flying close to the ground.

References:

FAA-H-8083-25, Chap. 14
FAA-H-8083-25 "An Invitation to Fly," Chap. 12




**Radio navigation** is a method of determining and maintaining a desired course or determining an aircraft's position by use of radio navigation aids on the ground.

When a pilot flies from one point to another with the use of radio aids, radio navigation allows navigation over areas with too few landmarks for pilotage.

- Radio navigation can also be used as an aid in verifying an aircraft's position when navigating primarily by pilotage or dead reckoning.
- Requirements for radio navigation include:
  - Ground-based transmitters
  - Appropriate navigation receivers in the aircraft
  - Receivers and instrument displays in aircraft
  - Charts and publications
  - Additional pilot training

Reference: FAA-H-8083-25, Chap. 14

AIR TRAFFIC BASICS | Lesson 15: Basic Navigation

ALL LESSONS FRAME: 41

# Basic Navigation Methods

BACK NEXT

## Radio Navigation

**Advantages**

- All weather navigation capability
- Allows instrument approaches and landings:
  - At night
  - During bad weather

**Disadvantages**

- Relies on aircraft and ground equipment that is subject to:
  - Malfunction
  - Interference

FAA-H-8083-25, Chap. 14

# Area Navigation (RNAV)

**Area Navigation (RNAV) - A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids or within the limits of the capability of self contained aids, or a combination of these.**

**RNAV uses random area navigation routes to allow a pilot to fly a direct course to his or her destination without needing to overfly a ground-based navigation aid.**

**IFR flight using random RNAV routes can only be approved in a radar environment, and ATC must provide radar monitoring (except Alaska).**

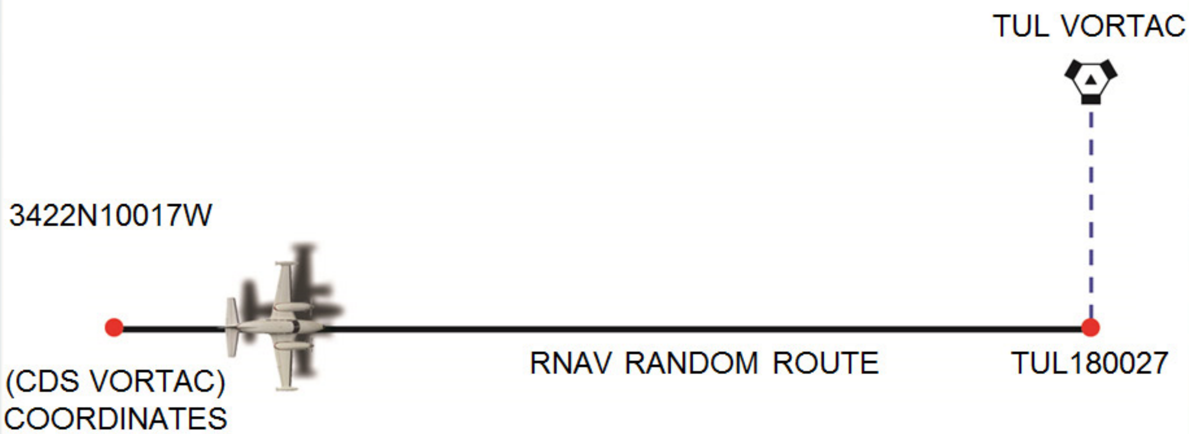
**Fixed RNAV published (T and Q) routes can be flight planned for aircraft with RNAV capability as well as departures, arrivals, and approach procedures.**

**RNAV equipment provides pilots with computed "waypoints" on the direct route the pilot has entered into the system. The pilot flies to these waypoints as if each were a ground-based NAVAID.**

AIM, Chap. 5, 7110.65 Chap.4, Pilot/Controller Glossary; JO 7400.2, Chap. 20

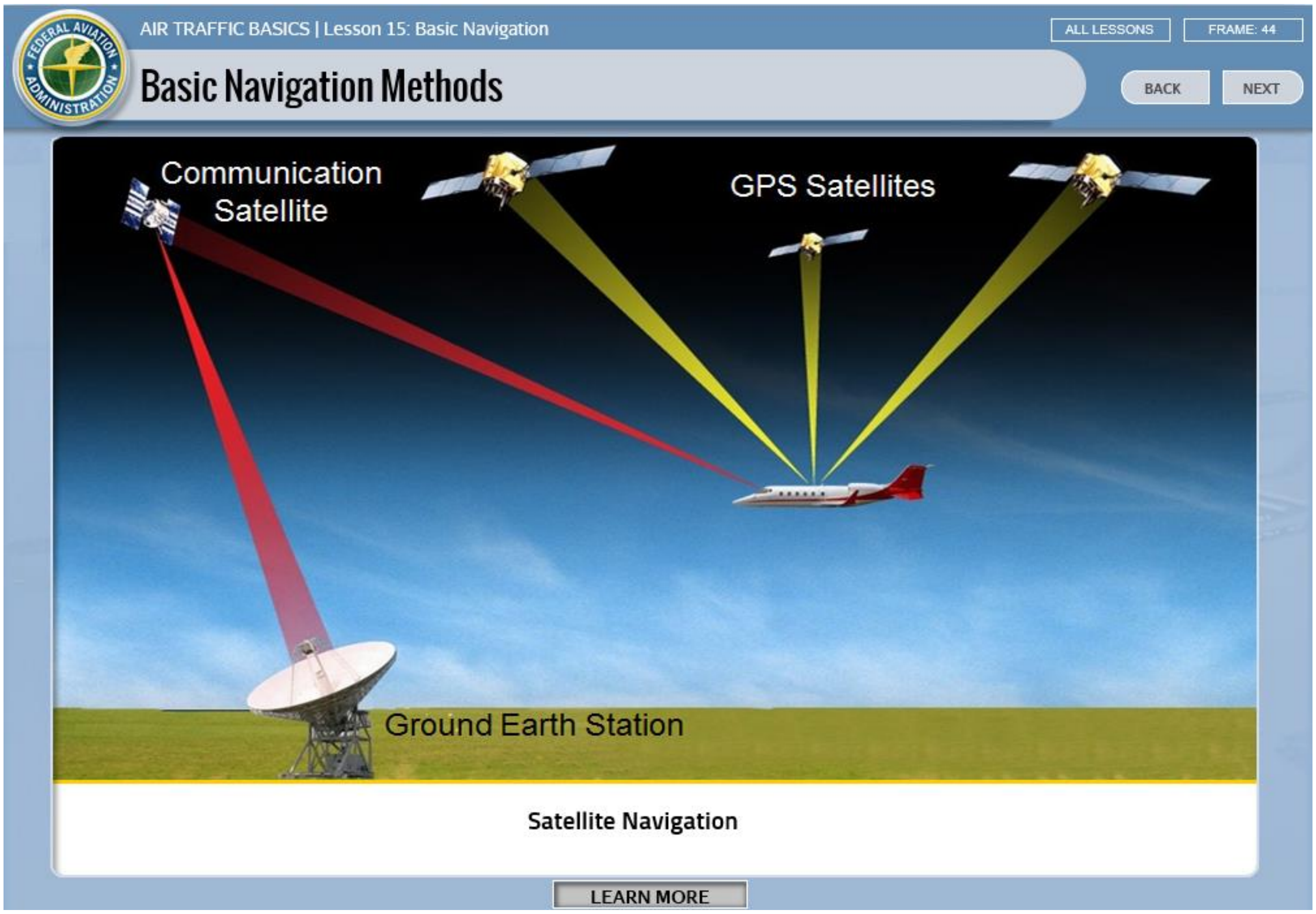
# Basic Navigation Methods

## Waypoint




**These waypoints are provided to ATC in the flight plan as coordinates of latitude and longitude or as a degree and distance fixes from established fixes.**

AIM, Chap. 5




The Global Positioning System (GPS) allows anyone with a proper receiver to determine his or her position instantaneously, with near pinpoint accuracy.

- Anywhere on the earth

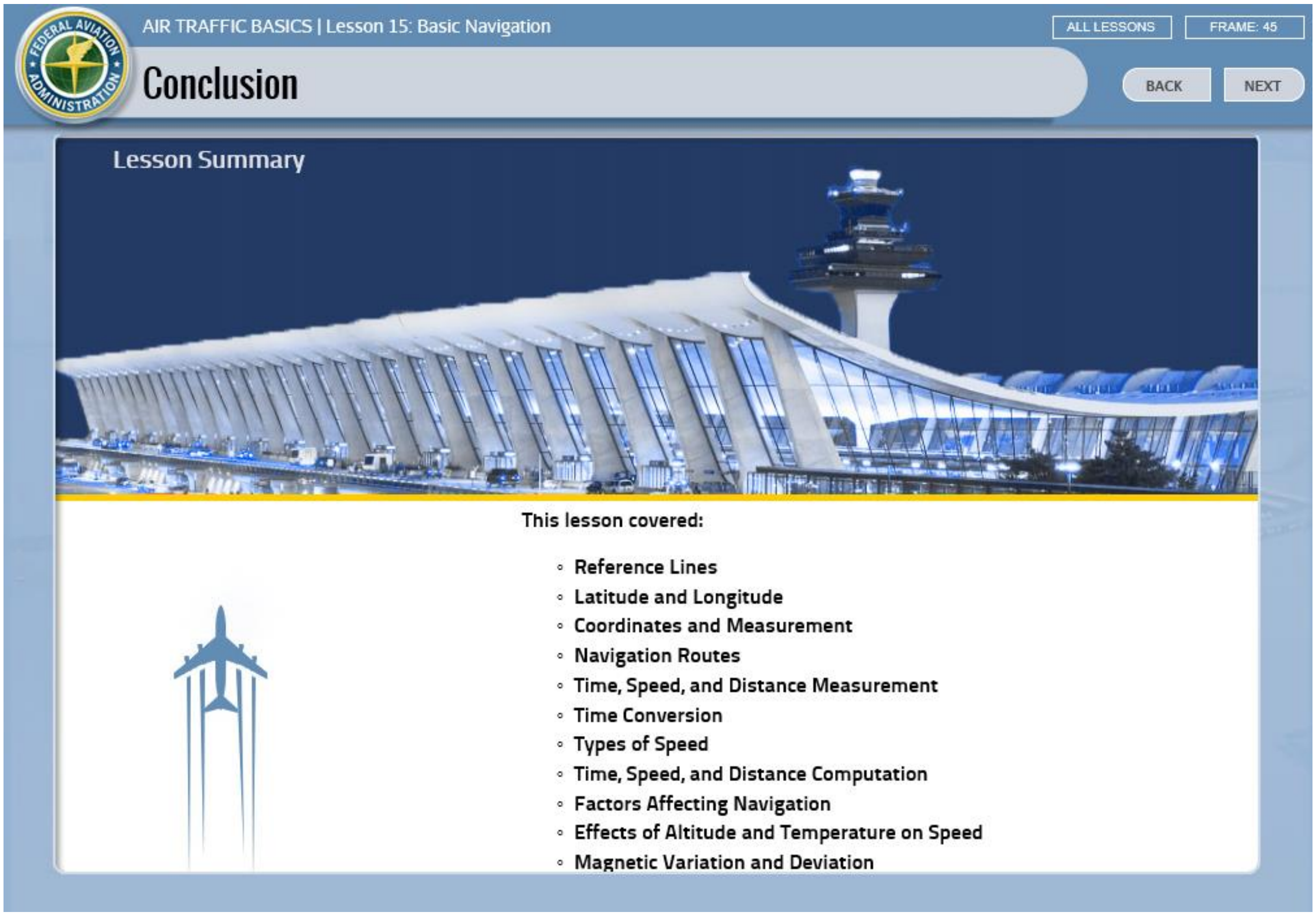
GPS is based on:

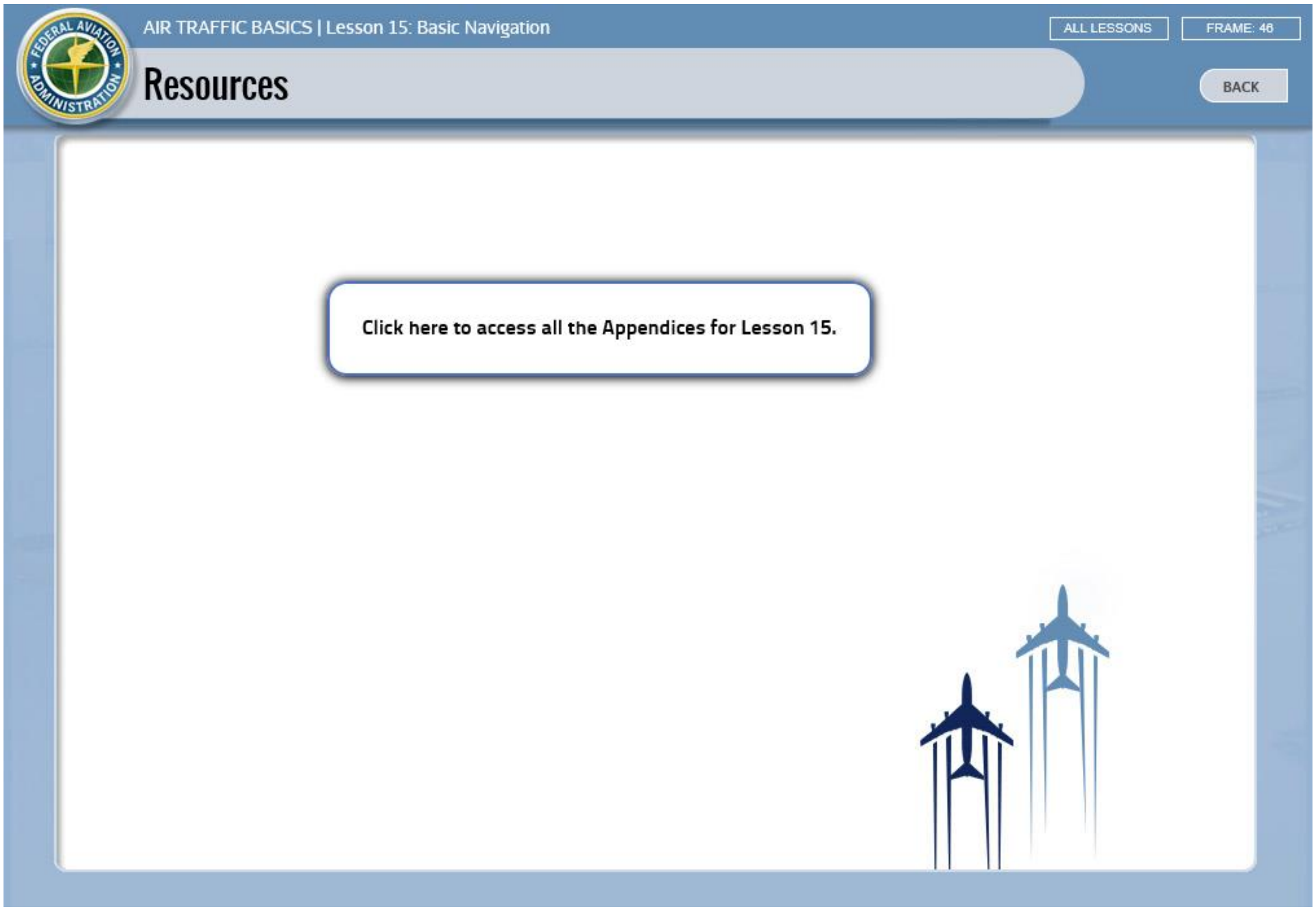
- A constellation of 24 operational satellites, and several spares
- A series of earth-monitoring stations
- Receivers on the ground which use the satellites as precise reference points to triangulate their position

The advantages of GPS are:

- Provides accurate information 24 hours a day
- Is unaffected by the weather

Reference: FAA-H-8083-25, Chap. 14


AIR TRAFFIC BASICS | Lesson 15: Basic Navigation
ALL LESSONS
FRAME: 45
Conclusion
BACK
NEXT
Lesson Summary
This lesson covered:
Reference Lines
Latitude and Longitude
Coordinates and Measurement
Navigation Routes
Time, Speed, and Distance Measurement
Time Conversion
Types of Speed
Time, Speed, and Distance Computation
Factors Affecting Navigation
Effects of Altitude and Temperature on Speed
Magnetic Variation and Deviation


AIR TRAFFIC BASICS | Lesson 15: Basic Navigation
ALL LESSONS
FRAME: 46
Resources
BACK
Click here to access all the Appendices for Lesson 15.