

"Test Your Knowledge" Answers

Chapter 1

1. Daedalus
2. Chinese
3. Chinese
4. f
5. c
6. e
7. b
8. g
9. a
10. d
11. T
12. F
13. T
14. T
15. T
16. F
17. F
18. T
19. T
20. T

Chapter 2

1. Robert Esnault-Pelterie
2. Alberto Santos-Dumont
3. English Channel
4. Rheims, France
5. Igor Sikorsky
6. heavy
7. e
8. d
9. a
10. b
11. f
12. c
13. F
14. T
15. T
16. F
17. F
18. T
19. F
20. F
21. F
22. F
23. T
24. F
25. T
26. T
27. F
28. T

Chapter 3

1. Pulitzer Trophy Race
2. Pulitzer Trophy Race
3. Bendix Race
4. Ninety-Nines
5. Woodrow Wilson
6. School of Aeronautics at New York
7. Igor Sikorsky
8. Charles Lindbergh
9. many disasters
10. Treaty of Versailles
11. b
12. c
13. d
14. a
15. F
16. F
17. T
18. T
19. T
20. T
21. T
22. F
23. F
24. F
25. T
26. T
27. F
28. F
29. T
30. T
31. F
32. T
33. T
34. T
35. F
36. T
37. T
38. F
39. T
40. T
41. F
42. T

Chapter 4

1. Japanese
2. cripple the American fleet
3. increased
4. civil service employees
5. F

6. T
7. F
8. T
9. T
10. F
11. T
12. F
13. F
14. T
15. T
16. T
17. T
18. F
19. F
20. F
21. T
22. F
23. F
24. T
25. T

Chapter 5

1. T
2. F
3. F
4. F
5. T
6. F
7. T
8. T
9. F
10. F
11. It was the only country possessing the atomic bomb, and it felt secure with that weapon.
12. nuclear deterrence
13. when the Soviet Union prevented any surface transportation in or out of the city
14. North Korean
15. The atomic arsenal was not enough to prevent involvement in war.
16. B-52
17. F-100
18. DeHavilland Comet 1
20. b
21. d
22. e
23. c
24. a
25. French
26. Kennedy

27. Tonkin Gulf Resolution, Johnson
28. Television
29. Tet Offensive
30. Precision guided munitions, smart bombs
31. Rolling Thunder, Linebacker
32. Strategic Air Command (SAC)
33. Civil Reserve Air Fleet (CRAF)
34. KC-135, KC-10
35. command, control
36. The Cold War was defined by the antagonistic and competitive relationship between the former Soviet Union (USSR) and the United States. The USSR's political and economic ideologies were communism and socialism, whereas the US preferred democracy and capitalism. The war was "cold" because the two countries did not directly fight each other with military forces.
37. The Soviets cut off the city of West Berlin from the "free world" in an attempt to make it another Soviet satellite. The U.S. was able to airlift enough supplies to the city so its people could survive. The airlift was so successful that the Soviets ended their siege.
38. Key airpoer role in the Korean War included close air support, interdiction, and air superiority.
39. American pilots did so well in the Korean War because they were well trained.
40. WW II improvements to aviation included: better instrumentation, better navigation equipment, better safety devices, and larger airports (just to name a few).
41. As aircraft approaching the sound barrier experienced severe vibrations and control problems.
42. Swept-wings allowed aircraft to fly faster, but landing at high speeds was very dangerous.
43. New missile technology allowed pilots to strike targets far out, making them less susceptible to enemy defensive fire.
44. B-52 bombers and KC-135 tankers extended the range of US nuclear attack capability, The U-2 was used in a reconnaissance role, B-2 bomber (stealth) was designed to elude nemy radar.
45. Unlike Vietnam's Rolling Thunder, where the US gradually escalated hostilities, the Desert Storm strategy was to hit hard and hit fast. Also, the conduct of Desert Storm was left to the

military leaders and not to the President, as was the case with President Johnson during Vietnam. Finally, centralized control and decentralized execution was practiced as a result of lessons learned in the Korean War and during the North African Air Campaign during World War II.

46. Not only did E-8 JSTARS aircraft spot Iraqi tanks moving towards Saudi Arabia, AC- 130s demolished the tanks. Air power squashed the Iraqi counterattack.

Chapter 6

1. T
2. F
3. T
4. T
5. F
6. T
7. T
8. F
9. T
10. T
11. F
12. T
13. XB-70
14. X-15
15. X-15
16. c
17. a
18. b
19. d

Chapter 7

1. e
2. g
3. a
4. b
5. h
6. d
7. c
8. f
9. leading edge
10. camber (curvature)
11. trailing edge
12. chord (chord line)
13. weight, thrust
14. camber, airfoil
15. stall
16. shock wave
17. maximum gross weight
18. useful load
19. T
20. F

21. T
22. F
23. T
24. F
25. F
26. T
27. T
28. Relative wind or relative motion is the movement of air with enough speed and from a direction that will produce lift as it flows over a wing.²⁹ Airspeed is the rate of speed through the air. Ground speed is the time it takes to fly from A to B over the ground.
30. It will be greater.
31. By streamlining and polishing the airframe.
32. At the speed of sound, a shock wave is encountered which results in lost energy.

Chapter 8

1. wing
2. flap
3. vertical stabilizer
4. aileron
5. cockpit
6. fuselage
7. elevator
8. rudder
9. horizontal stabilizer
10. lateral (pitch), elevator
11. longitudinal (roll), ailerons
12. vertical (yaw), rudder
13. increases
14. takeoffs, landings
15. protrusion, leading
16. induced
17. laminar, induced
18. airfoil's lift
19. c
20. e
21. a
22. g
23. b
24. f
25. d
26. c
27. a
28. b
29. conventional
30. tricycle
31. tandem
32. Anti-skid brakes prevent brake failure due to overheating and reduce the possibility of sliding on a slippery surface.
33. Fixed gear is less costly to build and maintain; plus the drag caused by fixed gear is not a big factor for slow-

moving aircraft, especially compared to the additional weight of retractable gear.

34. The fuel pump maintains a positive flow of fuel from the tank to the engine so the engine does not stall. The vent pipe prevents the tank from bursting when its pressure builds on a hot day. The fuel tank drain allows the removal of water from the tank that may have condensed from the air in the unfilled portion of the tank. The fuel strainer keeps any sediment from entering the fuel line that leads from the tank. The fuel selectors allow the pilot to manage what tank the fuel is coming from — helps keep the weight of the aircraft balanced.
35. T
36. F
37. T
38. F
39. T
40. cork
41. airspeed
42. attitude
43. engine, flight, navigational
44. mechanical, pressure, electrical
45. d
46. a
47. j
48. i
49. b
50. h
51. g
52. f
53. e
54. c
55. T
56. T
57. F
58. F
59. T

Chapter 9

1. coordinates
2. vertical, horizontal, letters
3. intersection (coordinate point)
4. elevation
5. contour lines, color tints, shading
6. air, sectional (map)
7. small black circle
8. picks, sledge hammers
9. magenta
10. radio navigation
11. prohibited, restricted
12. Military Operations Area, military
13. training routes
14. true course, north (variation), deviation, altitude, airspeed, speed, direction

15. visible landmarks
16. true course, 10, checkpoints, course
17. dead reckoning
18. VOR, wind
19. nautical miles
20. thunderstorms
21. radio
22. stationary, rotating
23. b
24. c
25. b
26. a
27. T
28. T
29. F
30. F
31. T
32. T
33. T
34. F
35. F
36. T
37. T
38. T
39. T
40. F
41. Parallels = latitude; Meridian = longitude (only parallel at the equator)
42. The magnetic poles, north and south, are not co-located with the geographic poles.
43. Metals; electrical power; the compass, being mechanical will require adjustment
44. 6, 7, 5, 8, 4, 9, 3, 10, 2, 1
45. The master station and the slave station
46. Accelerometers, gyroscopes, and computers; it is self-contained and provides continuous information on the aircraft's position.
47. The military uses the Precise Positioning System (PPS); the civilian public uses the Standard Positioning System (SPS).
48. Instrument Landing System (ILS); Microwave Landing System (MLS); Differential GPS Landing System

CHAPTER 10

1. a-8, b-4, c-1, d-2, e-6, f-5, g-3, h-7
2. Controlled, uncontrolled
3. Military
4. Blue
5. Approach
6. White
7. True
8. False
9. True

10. 26, 03, XX Left or XX Right or XX Center
11. Automated Terminal Information System; a voice recording telling pilots about local weather conditions, and runway restrictions; it allows the controller to direct their attention to controlling air traffic instead of filling the pilots in on local conditions.
12. Wildlife (usually birds) strikes, community encroachment, noise (abatement)

CHAPTER 11

1. Boeing 747
2. A-300
3. Boeing 727
4. 70
5. a-2, b-3, c-1
6. short distances, speed
7. Boeing, McDonnell-Douglas, Lockheed
8. fares, routes
9. commuter, 20
10. T
11. T
12. F
13. F
14. T
15. They all fly on regular schedules and transport people or cargo as a commercial business.
16. It freed airlines from having to provide service to airports where little or no profit was made; helped the generation of new airlines to serve these smaller airports; increased competition among air carriers; helped to lower ticket prices.
17. They were suddenly faced with competition (their monopolies were eliminated); the newer airlines could charge lower fares, partly because their labor was not unionized and had lower pay, fuel prices tripled due to the energy crisis; high interest rates on newly purchased aircraft while newer airlines were flying used aircraft (lower purchase price and less interest); the recession of the late 1970s/early 1980s; the air traffic controllers strike
18. Airbus
19. Containers are easier to handle and load, and reduced losses from theft.

CHAPTER 12

1. Ultralights
2. Cessna
3. FAA inspections, experimental aircraft
4. General Aviation
5. Fun or transporting family and friends, related to business
6. Small single engine aircraft
7. Cessna and Piper
8. Ultralights, soaring, ballooning, racing, gliding,

aerobatics, homebuilts, antique aviation

9. True
10. True
11. True
12. False
13. False
14. Instructional, personal, sport, business and commercial aviation
15. Small, two-seater with small engines for a low cruising speed. They are very easy to fly (to build confidence in new pilots), inexpensive to buy, operate and maintain.
16. Four-place, single piston engine, fixed wing
17. Flying for fun or some other purpose than transportation or business (relaxation, hobby, competition, or thrill)

CHAPTER 13

1. Air taxi/charter, pilot, aircraft, rental aircraft
2. peace of mind, reliability
3. Piper Malibu, pressurized
4. Air taxi/charter, transportation function
5. Agriculture applications, aerial advertising, aerial photography, fire fighting, fish & wildlife, patrol aircraft, industrial uses, industrial uses
6. True
7. True
8. True
9. True
10. False
11. The use of a private or company owned general aviation aircraft for business purposes
12. Who is flying the plane—business person for business and professional pilot for executive
13. Almost certainly a piston-powered aircraft with a 75% chance of being single engine, 4 seater, similar to a typical personal aircraft except better equipped so it can fly in bad weather
14. Usually twin engine, either turbine or piston powered
15. Fuel efficiency—high cost of fuel and potential shortages; Noise—limitations on it by the Federal Government and airports closed at night to jets due to noise; Cost Effectiveness—it is more effective to buy a plane that will cover the range of most of your travel and use the airlines for the longer, less frequent trips.
16. A segment of general aviation which deals with using general aviation aircraft for hire as a commercial business.

CHAPTER 14

1. Heavier
2. A-10
3. F-117
4. E-3
5. S-3A
6. C-9A
7. c
8. b
9. d
10. c
11. Combat, noncombat, combat
12. Strategic, tactical
13. C-17
14. Bomber; Electronic attack-second in series; electronic fighter; experimental intended as bomber; cargo or passenger; reconnaissance fighter; tanker/cargo or passenger
15. Better training and better technology
16. False
17. False
18. True
19. True
20. False
21. Long term benefits of technology transfer among allies, a common use aircraft for NATO nations, increases the supply and availability of repair parts for the F-16 in Europe, and improves the F-16's combat readiness
22. The airplane dominates all aspects of warfare, control of the air is a prerequisite to winning on the ground as proven in wars since World War II

CHAPTER 15

1. 4000
2. Hybrid, compound
3. STOL, VTOL
4. Vietnam
5. 50; 1500; 1500; 50
6. c
7. a
8. a
9. V-22 Osprey, hybrid, US Military
10. Newton's 3rd Law of Motion
11. Exhaust vectored downward, the entire propulsion unit turns
12. Lethal, nonlethal
13. True
14. False
15. True
16. False
17. False

CHAPTER 16

1. CAB
2. FSS
3. NAFEC
4. NTSB
5. NASA
6. ICAO
7. Federal Aviation Agency, independent agency, Civil Aeronautics Administration, Commerce, safety regulations, enforcing, Federal Aviation Administration, Transportation
8. Air Traffic Control Tower, Air Route Traffic Control Center, positive control, Air Traffic Control Tower
9. Aircraft, airmen (or pilot, navigator, air traffic controllers, etc.), regulations, procedures
10. English
11. ICAO or International Civil Aviation Organization
12. Aircraft Owners and Pilots Association (AOPA)
13. Experimental Aircraft Association (EAA)
14. False
15. True
16. True
17. False
18. False
19. False
20. National Aviation Facilities Experiment Center; the FAA's research and development center; new types of airway navigational systems, a new instrument landing system, collision avoidance systems
21. Train personnel who operate the ARTCCs, FSSs, and airport control towers; train military and foreign controllers; train engineers and technicians who install and maintain the electronic equipment required for navigation, communication, and air traffic control; conduct initial and refresher training for their maintenance inspectors; develop examinations for airmen, airworthiness standards for aircraft, maintain records of airmen and aircraft.
22. National Transportation Safety Board; determining the cause or probable cause of any transportation accident
23. To explore, use, and enable the development of space for human enterprise; to advance scientific knowledge and understanding of the Earth, the solar system and the universe, and use the environment of space for research; to research, develop, verify, and transfer advanced aeronautics, space, and related technologies
24. Civil Reserve Air Fleet; allows DoD to use long-range jet transport aircraft belonging to the commercial airlines to move military equipment, cargo and personnel in times of national emergency or natural disaster on only 24 hours notice. The aircraft are supported by aircrews and maintenance personnel supplied by the airlines
25. Emergency Services—SAR missions for downed

aircraft, lost outdoorsmen and children, disaster relief, and emergency airlift of sick and injured as well as blood and transplant organs; Aerospace Education—for the membership and general public to develop awareness and appreciation for aerospace world we live in; Cadet Program—for young men and women 12-21 interested in aerospace and community service

Chapter 17

1. is
2. institutes
3. two
4. formal technical education courses
5. voluntary
6. further training sponsored by the employer
7. d
8. a
9. c
10. d
11. b
12. aptitudes
13. occupation, aptitudes, succeed
14. Technical/vocational school
15. Terminal courses
16. Air Force Reserve Officer Training Corps
17. Professional Officers Course, General Military Course
18. Flight Instruction Program
19. True
20. True
21. False
22. False
23. False
24. It brought about change, it made it acceptable and popular to do research leading to the so-called knowledge revolution, the computer was developed to aid aerospace related industries, created a need for more and better trained people
25. It should be interesting, pleasant, provide satisfaction and self-respect, provide financial rewards

Chapter 18

1. aerospace
2. heat, thermometer
3. precipitation, condensation
4. condensation nuclei, water vapor
5. evaporation
6. spread
7. Earth's, solar
8. heat balance
9. lateral
10. Coriolis effect

11. d
12. b
13. c
14. a
15. b
16. c
17. a
18. a
19. b
20. d
21. T
22. T
23. F
24. T
25. F
26. T
27. F
28. Humidity equals the amount of water vapor in the air. Relative humidity equals the amount of water vapor that can still enter the air mass before it becomes saturated.
29. Transformed — heat energy can be absorbed or reflected by clouds or dust in the atmosphere; it can be absorbed by the Earth and converted into heat energy. Transferred — conduction, convection, advection, radiation.
30. 64°F
31.
 - a. A new car door makes an airtight seal. As the door is closed, air is compressed and can not escape. Thus, the door will not close securely because of greater pressure inside.
 - b. The “pop” is caused by a tube behind the eardrum adjusting to the change in atmospheric pressure.
 - c. When you punch one hole in the can, the liquid does not flow out readily because a partial vacuum is produced. When you punch a second hole, the air enters the top hole and the liquid flows out the bottom hole. No partial vacuum

Chapter 19

1. c
2. a
3. b
4. d
5. f
6. e
7. h
8. g
9. weather
10. cumulus, stratus, cirrus
11. height (above the Earth’s surface)
12. rain, snow
13. winds

14. cumulonimbus
15. cirrus, cirrostratus, cirrocumulus
16. fog, stratus (could be answered stratus and stratocumulus)
17. d
18. c
19. a
20. T
21. F
22. F
23. T
24. T
25. F
26. T
27. F
28. F
29. It is safer to fly on the windward side which has little turbulence. The leeward side will most likely have the turbulent downdrafts.
30. None. The rotor clouds will form on the leeward side.

Chapter 20

1. c
2. d
3. b
4. a
5. e
6. e
7. a
8. b
9. d
10. c
11. f
12. whiteout
13. cloud
14. blowing dust
15. hazardous (danger)
16. blowing sand
17. haze, smoke
18. blowing snow
19. towers
20. vortices
21. see
22. thunderstorm, cumulus
23. body, engine(s)
24. force, weather, uninhabitable
25. d
26. c
27. b
28. a
29. F
30. T
31. T
32. F

CHAPTER 21

1. Gravity
 2. Galileo
 3. Galileo
 4. Chinese
 5. Goddard
 6. World War I
 7. 1-D, 2-C, 3-A, 4-B, 5-F, 6-E
 8. 1-B, 2-C, 3-D, 4-A
 9. B
 10. C
 11. C
 12. D
 13. Centrifugal effect
 14. First, rest, motion, acted upon by some outside force
 15. Third, an equal and opposite reaction
 16. Riffling in the barrels
 17. Payload
 18. Liquid or solid
 19. True
 20. True
 21. True
 22. False
 23. False
 24. True
 25. The first law means that, when launching the rocket vertically, the propulsion system must produce enough force (thrust) to overcome the inertia of the launch vehicle (i.e. greater than the weight of the rocket).
The second law means that the amount of force required to accelerate a body is proportional to the mass of the body.
The third law is at the heart of rocketry. Before launch, the rocket is stationary. The "action" is firing of the engines. Upon launch, liftoff is the equal and opposite reaction (movement in the direction opposite to the thrust)
26. Two bodies attract each other with a force directly proportional to their mass and inversely proportional to the square of the distance between them
 27. Increase the mass of the exhaust or accelerate the exhaust particles to a higher velocity
 28. It is the number of pounds of thrust delivered by consuming one pound of propellant (oxidizer/fuel mixture) in one second.

CHAPTER 22

1. Oxidizer, chilled, liquid
2. Regressive
3. Mono-, bi-
4. Bi-propellant
5. Either (motor, solid) or (engine, liquid)

6. Slow
7. Oxidation, oxygen, another substance
8. Grain
9. Cryogenics
10. Nonhypergolic, hypergolic
11. Coupled valve, valves, crosshead, combustion chamber
12. c
13. d
14. 1-d, 2-c, 3-a, 4-b
15. True
16. False
17. True
18. False
19. False
20. It must contain oxidizer and fuel, ignite correctly every time, produce energy in the form of force, and that force must be controllable
21. By controlling the amount of the surface area exposed to the burning process
22. It is an enclosure filled with a combustible powder that is ignited electrically. The flame of the burning squib in turn ignites the grain of a solid propellant rocket.

CHAPTER 23

1. East, 1000
2. sounding rocket
3. goes into higher orbit
4. retrothrust, slow down, gravity, faster
5. polar
6. a-2, b-7, c-5, d-8, e-6, f-1, g-3, h-9, i-4
7. velocity required for the payload to escape from the gravitational attraction of that planet.
8. Total Velocity Requirement
9. burnout, trajectory
10. the arc of a non-orbiting body
11. sounding rocket
12. transfer, coplanar transfer
13. minimum energy transfer
14. True
15. True
16. False
17. True
18. True
19. Due to the weakening of the Earth's gravitational effect with distance, although higher velocities are required to achieve the higher altitude.
20. The vehicle is first placed in a low-elliptical parking orbit. When it swings around to perigee, enough thrust is applied to push the vehicle to apogee at the desired altitude. When it reaches the high point of this transfer ellipse, thrust is again applied and the vehicle moves out on a circle that is tangent to the transfer ellipse.

CHAPTER 24

1. a-1, b-3, c-5, d-2, e-4
2. a-3, b-4, c-5, d-1, e-2
3. interstellar
4. all
5. billion
6. three (actually 3.26)
7. four
8. 100
9. 100
10. cislunar space
11. space, 50, astronaut wings
12. space, 80, it's the point where an orbiting object will stay in orbit
13. Milky Way
14. light year, trillion.
15. 25, 40, 27
16. sunspot, 8, 15, 11
17. solar flare, 9, 15, 3 days
18. magnetosphere, solar winds, orbit of the moon.
19. cosmic rays, electrons, nuclei of atoms, solar winds
20. Van Allen belts, crescent, two, radiation
21. magnetic storms, radiation bursts, magnetic
22. scintillation, ionosphere
23. outgassing, vacuum
24. cold welding
25. differential charging
26. False
27. False
28. False
29. True
30. We get a global view of the earth, we can see the universe more clearly, potential for abundant resources (solar energy, minerals from other planets), a unique environment to make new materials not able to be developed on earth.
31. Powerful ultraviolet radiation of the sun and ultra-high frequency rays from the other stars
32. The sun
33. about 108 times as large as the earth; a giant thermonuclear reactor; gravity and energy emissions affect the whole solar system directly, magnetic field indirectly; average rotation time 27 days (varies between 25-40 depending on location on surface); sunspot cycle runs 8-15 years averaging 11 years; solar flares can hit earth within 9 minutes (low energy) or 15 minutes to 3 days for high energy particles)
34. Contains almost all its mass in a central nucleus (a tight cluster of protons and neutrons) encircled by whirling negatively charged electrons.
35. An atom that carries a positive or negative charge from losing or gaining electrons

Chapter 25

1. a
2. c
3. b
4. e
5. g (d, f, h)
6. d, f, h
7. b
8. b
9. c
10. a
11. b
12. e
13. d
14. f
15. a
16. c
17. g
18. 2.27, orbit
19. gravitational pull
20. 520
21. one, same
22. rilles
23. similar
24. deserts
25. photos
26. d
27. d
28. a
29. c
30. a
31. T
32. F
33. T
34. F
35. T
36. F
37. T
38. T
39. T
40. F
41. T
42. T

CHAPTER 26

1. 1967 Outer Space Treaty
2. GPS
3. 1-c, 2-g, 3-f, 4-d, 5-i, 6-e, 7-h, 8-b, 9-a
4. 1-i, 2-j, 3-e, 4-d, 5-b, 6-k, 7-l, 8-c, 9-f, 10-g, 11-b, 12-a
5. probes, satellites
6. Sputnik; fly over countries without permission
7. passive, active
8. Selective Availability, Precise Positioning Service

9. Weather—A, C, E, G; Multi-Spectral Imaging—D, F; Reconnaissance—B
10. Geostationary Orbits (GEO), equal access for all
11. Bogata Declaration (1976), Geostationary Orbits (GEO)
12. Defense Meteorological Satellite Program, weather, military, optical, visual and infrared cloud
13. Orbital astronomy and environmental analysis
14. Placement of future space colonies.
15. d
16. c
17. d
18. b
19. True
20. False
21. True
22. False
23. Freedom of use—all nations should have access to space; Non-appropriation—no one owns any part of space; Use of space—since space belongs to all mankind, all nations should share its benefits
24. It documented the three principles of space law in written form and it legitimized a military presence in space by allowing military personnel to conduct scientific research
25. The ICBMs of the Superpowers could reach each other with mass destruction and Anti-Ballistic Missiles were under development to protect each nation, thereby increasing the likelihood of a first strike in nuclear war. To prevent this, both countries agreed not to develop ABM systems, including in space. The treaty is important because it specifies monitoring compliance from space, thus sanctioning monitoring other countries from space.
26. It formed NASA and defined civil and military responsibilities and provided a process for coordination between them.
27. It authorizes the military to provide facilities and support for commercial launches. The launch company only has to pay for the service while the military pays to maintain the facilities.
28. Manage the use of the station through consensus; each nation's own copyrights apply to creations of its citizens while aboard; and each nation decides whether the activities aboard their section are for peaceful purposes (allowing military members to serve)
29. Communication, navigation, observation, and scientific
30. Media transmission (radio and television), pure data transmission (Internet), personal communication (cellular phones), and providing links to other spacecraft
31. Satellites, which act as precise reference points; Control System, operated by USAF to adjust the

satellite positions if necessary; Receivers, use the broadcast signal to calculate its position, velocity, time

32. Weather, Multi-Spectrum-Imaging, and Reconnaissance
33. Provide early warning by detecting enemy missile launch; detecting nuclear explosions; monitoring radio and radar transmissions; photo surveillance
34. Extensive materials processing and manufacturing can occur without polluting Earth's atmosphere, more unique and better products can be developed in space, could lead to human existence in other solar systems that do not have habitable planets, it's a new and different frontier

Chapter 27

1. Apollo
2. Mercury
3. Gemini
4. 1-d, 2-c, 3-b, 4-a
5. John Glenn
6. Aleksei Leonov
7. Apollo 11, Neil Armstrong
8. Apollo-Soyuz
9. Space Transportation System
10. Enterprise
11. Columbia, Challenger, Discovery, Atlantis and Endeavour
12. Hubble Space Telescope
13. T
14. T
15. F
16. T
17. T
18. F
19. T
20. T
21. T
22. F

Glossary

A

Absolute charging – occurs when the whole craft is charged.

Acceleration – when a body is subjected to the application of a force over a continuing period of time.

Ace – a pilot who shot down five enemy aircraft.

Active communications satellite – a satellite, such as Courier 1B, that received signals from ground stations, amplified them and then rebroadcast the signals to receiving stations on Earth.

Advanced technology jets – jets which used technology such as features which reduce noise levels, fuel use, and exhaust emissions and control by fly-by-wire throughout normal flight.

Advection – lateral heat transfer that is important in the global circulation of air.

Advection fog – fog formed when wind blows moist air over a cold surface and the surface cools the air to its dew-point temperature.

Aerial photography – a highly specialized photography using special films that can be used to spot and map crop damage due to disease or insects.

Aerial refueling – to refuel a plane in midair.

Aerobatics – stunt-flying involving an aircraft that can stand tremendous forces and that can fly upside down, right side up, and everything in between. It also requires a skillful pilot.

Aeronaut – balloonist.

Aeronautics – the science and art of flight through the atmosphere.

Aerospace – a compound term used to describe the atmosphere and space as one medium. **Aerospace**

engineering – prepares a person to work on either aircraft or spacecraft design and production programs. **Agricultural**

applications – aircraft that seed, fertilize, and apply pesticides to almost 200 million acres of farmland annually.

Ailerons – small flaps on the wings that help control the plane.

Airborne – transported or designed to be transported by air.

Aircraft carriers – commercial airlines that are considered common carriers and are in business to serve the public. They are closely regulated and controlled to ensure the safety of the public.

Airfoil – parts of an airplane, such as wings, tail surfaces, and propellers, designed to cause a dynamic reaction from the air through which it moves.

Airframe rocket system – serves to contain the other systems and to provide the streamlined shape.

Air pump – invented by Torricelli, Von Guericke, and Pascal to study vacuums.

Airspeed indicator – informs the pilot of the speed through the air in terms of miles per hour and/or knots.

Air superiority – complete command of the air.

Air taxis – aircraft that provides transportation on a nonscheduled or demand basis. Also used for emergency transportation.

Air traffic control – concerned with keeping aircraft safely separated to prevent accidents.

Airways – three-dimensional highways in the sky and another subdivision of controlled airspace.

Alto – middle altitude clouds where the stratus and cumulus shapes are found and called altostratus and altocumulus.

Altimeter – aneroid barometer that reads in feet of altitude and is calibrated to atmospheric pressure in inches of mercury.

Angle of attack – the angle created by the pilot during takeoff (the angle between the chord line and the oncoming relative wind).

Anorthosite – the most common rock on the moon composed of almost entirely one mineral, feldspar.

Antique aviation – involves either funding or restoring a vintage aircraft or building replicas of old airplanes from original plans.

Apogee – that point in the orbital trajectory or flight path where the orbiting body is most distant from the body being orbited.

Aptitude – the special talents and natural abilities which a person possesses.

Area Navigation System (RNAV) – more of a computer controlled navigation system than a set of stations and receivers. This system uses VOR-type radio stations or GPS as reference points, but allows the pilot or navigator to fly directly from the airport of origin to the destination airport without following the airways.

Asteroids – rocky and metallic objects orbiting the Sun, too small to be considered planets.

Atmosphere – sometimes called “an ocean of air surrounding the earth” or “a gaseous covering.” A gaseous fluid that reacts to any force.

Atomizing – one phase of the combustion process.

Attitude indicator – a gyroscopic instrument that provides an artificial horizon to the pilot.

Aurora australis – colored lights, which appear in the southern latitudes.

Aurora borealis – northern lights. The visible emissions from polar magnetic storms which produce sporadic radiant emissions from the upper atmosphere over middle and high latitudes.

Autogiro – a rotating-wing aircraft that achieves slow flight and vertical takeoff by the use of a freely rotating rotor replacing or supplementing the wings but is driven forward by a conventional propeller.

Automated Terminal Information System (ATIS) – a voice recording of a tower controller that tells the pilot about the wind, clouds, visibility, and any other restrictions that the runways may have.

Automatic Direction Finder (ADF) – another type of radio receiver used to determine direction, but does not provide as much information as the VOR.

B

Ballast – a heavy substance for controlling ascent.

Ballistics – the study of the arc of a nonorbiting body.

Barnstormers – ex-military aviators who flew war-surplus aircraft around the country, circling over a village or small town to attract attention and landing on a nearby farm to offer rides to individuals for a fee and put on flying exhibitions. They also called themselves a “flying circus.”

Barometer – measures the pressure of the atmosphere.

Basalt – a hard, heavy dark gray rock with tiny holes from which gas has escaped.

Beam-ride guidance – missiles that are built to fly along a beam that is aimed at or kept on the target.

Bernoulli's principle – states “as a fluid's speed increases, the pressure within the fluid decreases.” So the pressure on top of an airfoil must be less than the pressure below.

Bipropellant – the oxidizer is stored in one container and the fuel (reducer) in another.

Black hole – probably began as a large star that exhausted its nuclear fuel and collapsed inward on itself resulting in gravity so strong that nothing is allowed to leave it.

Blitzkrieg – lightning war devised by Germans.

Bombers – large, long-range aircraft with a mission to reach into the enemy's homeland and destroy the ability to wage war.

Burnout velocity – the velocity required to place a spacecraft on its intended trajectory that is attained when the rocket engine ceases to produce thrust.

Business aircraft – 78 percent are single-and piston-engine aircraft and 21 percent are twin-and piston-engine aircraft.

Business aviation – the use of a private-or company-owned general aviation aircraft for business purposes.

Buzz bomb – bomb that produced a unique sound caused by a pulsejet engine mounted in a “stovepipe” above the fuselage.

C

Cambered – curved upper surface on a wing to increase lift.

Canards – horizontal surfaces forward of the main wings and are used for trim and control.

Cargo carriers – carriers that carry mainly freight, but now are also allowed to carry passengers.

Catalyst – a substance, which speeds up a chemical reaction but undergoes no permanent chemical, change itself.

Ceiling and visibility unlimited (CAVU) – when the sky is clear of clouds, the winds are calm, the air is cool, and there is no haze.

Centralized control – bringing together of all air assets as one unit.

Centrifugal force – a force moving or directed away from the center of rotation, which is a factor that affects the circulation of air or wind.

Charter services – aircraft and pilot hired by people who cannot afford to own their own aircraft but need to get somewhere in a hurry.

Chemical propulsion system – involves the mixing and burning of a chemical fuel and a chemical oxidizer to produce the hot, expanding gases needed to provide thrust.

Chemosphere – an important region due to a number of important photochemical (radiant energy and chemical) reactions which occur in it.

Chord (airfoil) – an imaginary line that connects the leading edge with the trailing edge of the airfoil.

Chromosphere – above the photosphere. This sphere of color extends to about 15,000 miles.

Circular orbit – an orbit that maintains a virtually constant altitude above the Earth's surface.

Cirrus clouds – clouds that are wispy, thin and lacy. They are high altitude clouds.

Cislunar space – the space between the Earth and the moon.

Civil Air Patrol (CAP) – a federally chartered, private, non-profit corporation that is also the official civilian auxiliary of the U.S. Air Force. Its threefold mission is emergency services, aerospace education, and cadet programs.

Civil airport – airport operated or owned by citizens for private or business purposes.

Civil Reserve Air Fleet (CRAF) – composed of commercial airliners, which have been designated by the Department of Defense for use in time of national emergency.

Clear-air turbulence (CAT) – may exist at different places and altitudes but be completely invisible. The causes may be one or a combination of: convective currents, windshear, and obstructions (such as mountains) to wind flow.

Close ground support – air power used to support army ground operations.

Close support aircraft – aircraft that supports or cooperates with friendly surface forces, consisting of air attacks with guns, bombs, guided airborne missiles or rockets on hostile surface forces.

Cold front – when a cold air mass replaces a warmer air mass, the boundary is called a cold front.

Cold welding – when moving parts fit with only a tiny air space between them. In a vacuum the tiny amount of air which kept them separated escapes and they weld together.

Combat aircraft – aircraft used by the military such as bombers and fighters.

Combined arms operations – the army and air force used in combination with each other.

Combustion chamber – a chamber or cylinder-like assembly in a rocket engine, jet engine, or the like where the propellant is exploded.

Comet – a small, irregularly shaped body whose tiny nucleus is composed of water, ice, rock and frozen gases.

Command guidance – electronic guidance, outside the rocket, wherein signals or pulses sent out by an operator cause the guided object to fly a directed path.

Commercial aviation – a segment of general aviation which deals with using general aviation aircraft for hire as a commercial (money-making) business.

Compass deviation – the deviations caused by electrical power and metal in the airplane that affects the compass. The pilot must use the compass correction card kept in the aircraft if he flies by the magnetic compass.

Composites – super-strong, but lightweight, nonmetallic, epoxy graphite materials used in aircraft construction.

Compound helicopters – a conventional helicopter with extra forward thrust provided by either a jet or propeller unit.

Compounds – molecular bonding of two or more elements.

Compression wave – a type of shock wave that is formed when the air must move aside as a leading edge passes.

Condensation – to change to a denser form as from a gas to a liquid.

Condensation nuclei – small particles that serve as surface for condensation of water vapor.

Conduction – heating by direct contact.

Conic projection – a type of map projection formed by projecting the surface of the earth on the surface of a cone and unrolling this to a plane surface on which the parallels of latitude are then concentric circles and the meridians equally spaced radii.

Continental air mass – a dry air mass.

Controlled airspace – airspace that has several subdivisions and is shown on aeronautical charts. It is subject to control by FAA air traffic controllers.

Control rocket system – the system that carries out whatever the rocket's guidance system dictates should be done.

Convection – heat transfer by vertical motion.

Conventional – landing gear consisting of two wheels forward of the aircraft's center of gravity and a small, third wheel at the tail.

Coplanar transfer – accomplishing transfers and maneuvers within a given plane.

Coriolis effect – rotation of the Earth influences any object moving over its surface such as the atmosphere in motion.

Corona – a division of the Sun's atmosphere known as the crown. An enormous area of faint white light that visibly extends outward from the Sun's surface.

Corporate jet – a turbojet called a bizjet that is expensive to buy and to operate.

Cosmic rays – rays of extremely short wave length and great penetrating power, which bombard the Earth from beyond its atmosphere.

Coupled valve – two propellant valves, opened by a single piston, operating through a crosshead, causing fuel and oxidizer to enter the combustion chamber at the same time.

Cowling – removable metal covering that houses the engine and sometimes also a portion of the fuselage of an aircraft.

Crater – a depression formed by the impact of a meteorite.

Cryogenics – an area of science concerned with the production of low temperatures and the effect of such temperatures on matter.

Crystalline – having the structure of a crystal like salt or sugar.

Cultural features – landscape marked by people such as mines, highways, and railroads.

Cumulus clouds – piled up lower altitude clouds that look "bumpy."

Cyclone – a hurricane that occurs in the Indian Ocean.

D

Dead reckoning – involves the systematic consideration of all factors that will and could affect the flight.

Density – how many molecules of air are squeezed into a given volume.

Density impulse – another measure of a propellant's thrust according to the volume involved.

Dew point – the temperature at or below which water vapor will condense.

Differential charging – occurs when one part of a spacecraft gets charged and has a different charge than another part of the craft.

Differential GPS Landing System – used to fit GPS approaches to the community's needs and still satisfy the aviator.

Dirigibles – rigid airships like large balloons. A lighter-than-air craft that can be propelled and steered.

Distance-Measuring Equipment (DME) – the time it takes a signal to go from the aircraft to the VORTAC and return, converted to nautical miles distance between the airplane and the station.

Dog fight – German and Allied aircraft battled in the air using an aircraft equipped with an interrupting gear which connected a machine gun to the aircraft engine and prevented the gun from firing when a propeller blade was lined up with the gun's muzzle.

Downlink – the communication link from the satellite to the earth station.

Drag – a slowing force acting on a body (as an airfoil or airplane) moving through air, parallel and opposite to the direction of motion.

Drag devices – devices such as speed brakes, air brakes, dive flaps or drag parachutes used to produce a significant amount of drag without affecting the airfoil's lift.

E

Earth's gravitational field – a region associated with any distribution of mass in which gravitational forces due to that mass may be detected.

Electrical system – a generator mechanically attached to an aircraft's engine that provides the electricity required to charge the battery, start the engine, operate the radios, and operate navigation and landing lights.

Electric propulsion system – uses magnetic fields and currents to propel matter in small amounts.

Electrostatic charging – charging related to static electricity. The small electronic parts of a spacecraft, especially computer data bits, can be badly shocked by electrostatic charges.

Elevator – control surface that is responsible for pitch.

Elliptical orbit – any closed orbit that is not circular.

Encroachment – the noise factor or any other considerations at airports that might intrude on the neighboring communities.

Engine instruments – keep the pilot aware of how his thrust-producing device is operating.

Equatorial orbit – the orbit a satellite travels from west to east over the Earth's equator.

Eris – some scientists call this the 10th planet in our solar system.

Escape trajectory – a spacecraft must accelerate to its escape velocity which causes the velocity of the spacecraft to be so high and the inertia so great that the spacecraft comes under the influence of another body's gravity before it reaches its apogee.

Escape velocity – the speed at which an object is able to overcome the gravitational pull of the earth.

European Space Agency (ESA) – an international organization composed of 14 European Member States which aims to provide cooperation in space research and technology.

Evaporation – the process by which liquid water molecules change to a gas or vapor state and enter the Earth's atmosphere.

Evaporation fog – steam that occurs when cold air moves over warm water; the water's normal evaporation process saturates the cooler air with water vapor, and the dew point is reached.

Executive aircraft – a typical executive transport is a twin-engine aircraft that is turbine- or piston-powered. The pilot must have special training, a multi-engine rating, and at least a commercial license.

Exosphere – the top of the atmosphere above the heterosphere. Known as the "region of escape."

Expansion wave – a shock wave that is formed when the air must fill back in as the trailing edge passes.

Extreme turbulence – turbulence where the entire aircraft may be tossed about and is practically impossible to control; structural damage to aircraft may result.

F

Federal Aviation Administration (FAA) – the United States Government agency, which is responsible for regulating air commerce.

Fighter escort – small pursuit aircraft used to escort large bombers and given the freedom to chase enemy fighters and shoot them down.

Fighters – aircraft that have the basic mission of destroying other aircraft.

Fixed-Base Operation (FBO) – a service station for airplanes.

Fixed landing gear – usually on less expensive, smaller airplanes because it is much less costly to build and maintain.

Flaps – attached to the trailing edge of the wing. When cruising, the flaps simply continue the streamlined shape of the wing's airfoil.

Flight instruments – inform the pilot of the altitude, the airspeed, and the attitude of the aircraft.

Flight Service Station (FSS) – provides all types of weather information for pilots.

Fog – a large mass of water vapor condensed to fine particles, at or just above the earth's surface.

Force – the cause of motion. Power or energy exerted against an object in a given direction.

Form drag – the shape of the aircraft that creates drag.

Forward-swept wings – wings sweeping which goes back more than 100 years. The design needed to be structurally stronger in high-speed flight.

Four-year colleges/universities – offers a broad education because students can choose from more electives in both humanities and science areas than those in junior college or vocational/technical schools can.

Fracto – a combining term which means broken and/or ragged.

Free fall – the motion of a body in space when the only force acting on it is that of a gravitational field.

Freezing level – may be around 15,000 feet during summer and perhaps as low as 1,000 feet above ground level on warm winter days.

Friction drag – caused by the friction of air particles rubbing against the parts of an airplane.

Frost – a feathery deposit of minute ice crystals or grains upon a surface or object, formed directly from vapor in the air.

Fuel system – includes everything that involves delivery of fuel to the engine including fuel tanks and fuel lines.

Fuselage – the basic structure of the airplane to which all the other parts are attached.

G

Galaxy – a grouping of billions of stars apparently merging into a luminous band that extends across the sky.

Gas-heating system – uses an external heat source to heat and cause the propellant to build the pressure necessary to provide thrust by exiting the exhaust nozzle at high velocity.

Gearbox – the gear including the change gear and the propeller shaft or driving chain by which power is transmitted from the engine to the live axle.

General aviation – all civil aviation other than flying done by scheduled air carriers and government agencies.

Geostationary orbit – an orbit stationed above one point on Earth's surface.

Glaze ice – formed and builds quickly as an airplane flies through supercooled rain droplets.

Global Positioning System (GPS) – consists of about 24 satellites in orbit around the Earth, several ground tracking stations, and a receiver in the aircraft.

Grain – a single piece of powder charge regardless of size of shape used in a rocket.

Gravitation – the term used to describe the force of attraction that exists between all matter within the universe.

Gravity – when gravitation involves Earth and a body or mass on or near the Earth.

Great circle – any circle on the Earth's surface that is made by a plane crossing through the Earth's center.

Grid system (graticule) – a system of coordinates that involves numbers across the top and letters down the left side. The Earth graticule uses 18 primary great circles going north-south and parallel small circles and two poles going east-west.

Ground speed – a measure of how fast the aircraft is going across the surface of the Earth. This is important in determining how long it will take to get from a start point to the destination.

Guerilla warfare – military actions carried out by small forces in the rear of an enemy with the purpose of harassing the enemy, interrupting his lines of communication, and destroying his supplies.

Guidance rocket system – a self-contained electronic unit that employs a computer and an inertial platform and may also have a star-tracking unit for space navigation.

Gyroscopic stability – a spinning flat weight that tends to line up on one of its axes. That axis is the one perpendicular to the face of the weight. Once the weight is aligned on the axis, it will remain there.

H

Hail – pellets or lumps of frozen rain or snow sometimes precipitated during a thunderstorm.

Hangers – a garage for airplanes which protects it from weather damage.

Haze – a concentration of water vapor, lighter than fog or clouds, but thick enough to reduce visibility.

Heading indicator – a type of compass with a gyroscopic device behind the compass card that tells the pilot which way he is flying.

Heat – the sum total energy of all moving molecules within a substance.

Heavy-lift – the largest and heaviest helicopters that were designed for military use.

Helium gas – a Very light inert gas used to inflate airships.

Hemisphere – half-sphere.

Heterosphere – begins at about 55 to 60 miles in altitude where the molecules and atoms of the gases are spaced much farther apart. At this level, gravity influences the gases according to mass with the heaviest found in the lower part and the lighter gases found in the upper part.

High-inversion fog – a low cloud fog formed by condensation of water vapor at or near the top of cool air that is covered by a warmer air layer.

Hohmann transfer – minimum energy transfer that was developed by a German engineer named Walter Hohmann and is a practical method of space maneuver to this day.

Homing guidance – require that the rocket “home in” on the target that is radiating heat or light.

Homosphere – extends from Earth’s surface up to an altitude of about 60 miles. That region in which the gaseous composition and mixing are relatively constant.

Humidity – the amount of water vapor in the air.

Hurricane – a strong tropical cyclone (usually in the West Indies) with winds that often surpass 100 mph and have been clocked at more than 200 mph.

Hybrid helicopters – a variety of advanced helicopter concepts lumped together which, in one way or another, attempt to solve the problem of using the rotor for vertical takeoff and landing without impeding forward flight.

Hybrid propellant – systems that use both liquid propellants and solid propellants in combination within the same engine.

Hybrid rockets – rockets that use hybrid propellant systems.

Hydraulic system – may operate the brakes, lower the landing gear, move the flight controls, and extend and lower the flaps. The mechanical advantage of this system allows the pilot to exert great pressure on the aircraft control systems or structures.

Hydrogen gas – discovered by Henry Cavendish in 1766. A “flammable air” that is lighter than air and was first used to fill balloons.

Hydrographic features – water features.

Hypergolic – a biopropellant that is self-igniting.

I

Icing – the act or process of atmospheric moisture freezing upon the surfaces of an aircraft.

Igniters – any device, chemical, electrical, or mechanical, used to ignite.

Ignition characteristics – starting every time in the same way, choosing between a continuous or restartable propellant, and safety are all properties of a propellant considered for ignition.

Induced drag – caused by lift vector pointing in the same direction as the drag vector.

Induced lift – induced lower pressure on the top of the wing due to the camber.

Inertia – the force produced by the reaction of a body to an accelerating force, equal in magnitude and opposite in direction to the accelerating force.

Inertial guidance – a self-contained unit that automatically adjust the rocket after launching to follow a given flight path, the mechanisms reacting to inertial forces during flight.

Insolation – the rate at which the Earth’s surface is heated by solar radiation.

Institutes – special schools that place more emphasis on subjects that are essential to doing the job that the student is preparing for. Students take several courses in the humanities and earn a bachelor’s degree.

Instructional aviation – aviation that teaches a pilot how to fly, usually in small single-engine airplanes.

Instrument Flight Rules (IFR) – weather conditions at an airport during which a pilot must use instruments to assist takeoff and landing.

Instrument Landing System (ILS) – is used only within a short distance from the airport and only when the purpose is to land the airplane.

Interdiction – air attack directed on a route or area to deny its use to the enemy.

Intergalactic space – within the galaxy.

Internal Navigation – a self-contained unit located within the aircraft that needs only to be programmed for a starting point and destination.

International Civil Aviation Organization (ICAO) – an international organization dedicated to standardizing aviation functions.

International courts – a judicial assembly between or among nations.

International customs – a usual practice carried on by tradition and enforced by social disapproval of any violation, between or among nations. Those practices accepted by nations as the right way to act.

International law – the rules generally observed and regarded as binding in the relations between states or nations.

International treaties – written agreements or contracts between or among nations that are legally binding to those who sign them.

Interplanetary space – measured from the center of the sun to the orbit of its outermost planet.

Interstellar space – between or among the stars.

Ion – an atom that carries a positive or negative electrical charge as a result of losing or gaining one or more electrons.

Ionosphere – reflects certain radio waves, which allows them to be received at stations far away from the broadcasting station. An outer region of the atmosphere that consists of layers of ionized air particles.

Isobars – lines drawn on maps to join points having the same barometric pressure. When isobars are far apart, the wind is weak; when they are close together, the wind is strong.

J

Jet stream – a comparatively narrow current of air which moves around the Northern (and Southern) Hemisphere of the earth in wavelike patterns. Compared to a “river” of wind moving at high speed.

Joined wings – an aircraft with its main wing swept upward and backward connected at the tips to the rearward wing which would be swept forward and downward, resembling the shape of a diamond.

Joint-use airport – airport where civil aviation and military aviation share the runways.

Jumbo jet – wingspan was 65 feet longer than the 707, and its fuselage was nearly 90 feet longer and almost twice the diameter.

Junior college – a school giving training in only the first one or two years of the standard college course.

Jupiter – the fifth planet from the Sun and by far the largest planet in our solar system.

K

Kamikazes – Japanese pilots who gave their lives in suicide attacks against US naval ships. They were to crash their aircraft loaded with bombs into a Navy ship.

KREEP – a rock found on the moon which has not been found on Earth.

Kuiper Belt – a ring of celestial bodies billions of miles beyond Neptune.

L

Laminar air flow – smooth flow pattern of air around an object.

Land-sea breeze phenomena – convection currents along shorelines produce heated air rising upward, which cause advection currents (wind) to flow from the water over the warmer land during the day. During the night, convection currents develop over the warmer-than-land water and cause the wind to blow from the land toward the water.

Lateral axis – an imaginary line that runs from one wingtip through the fuselage and exits the other wingtip. Also called the pitch axis.

Latitude – planes of the Equator that are parallel small circles and two poles.

Leading edge (airfoil) – the edge that meets relative wind first.

Leeward – the part or side of an object (such as a mountain) that is sheltered from the wind or is farthest from the source of the wind and is usually dry.

Lenticular – clouds that have a lens-like shape (double convex) and usually form in the mountains.

Light-lift – helicopters used in the military for observation and transportation of personnel. In the civilian community, they are used as executive transport and for many commercial uses such as crop dusting, construction and hauling personnel and light cargo.

Light turbulence – turbulence usually found in hilly and mountainous areas, below 5,000 feet when the air is colder than the Earth’s surface (soon after the passage of a cold front) and at anytime the wind is blowing about 20 mph.

Light-year – the distance a photon can travel in one of Earth’s calendar years.

Liquid propellants – a propellant in a liquid state which may be bipropellant or monopropellant.

Long-haul jets – commercial jet airliners such as the Douglas DC-8 and the Convair 880 and 990.

Long-range bombing – bombing long-distance targets requiring aircraft with bigger engines and fuel tanks.

Long-range navigation – used by aircraft as a means of navigation using ground-based radio stations, a receiving unit aboard the aircraft and special LORAN navigational charts.

Low explosive – solid propellants that produce force without causing a massive, destructive explosion.

Lift – the upward force that opposes the pull of gravity.

Lighter-than-air – a concept that must be met to achieve flight. Balloonists were first to develop the concept.

Longitude – the 18 primary great circles going north-south.

Longitudinal – front to back of an aircraft. (roll)

M

Mach number – determined by Ernst Mach as being the speed of sound through a medium.

Magnetic course – the course according to the magnetic compass heading or direction. The difference between magnetic north and true north must be subtracted from or added to the true-course direction. Otherwise, the airplane will not follow the true course drawn on the chart.

Magnetic storms – (also called electromagnetic or radiation storms) are characterized by a sudden onset of radiation bursts in which the magnetic field undergoes marked changes in the course of an hour or less.

Magnetosphere – the region of the Earth's atmosphere where ionized gas plays a big part in the dynamics of the atmosphere and where the geomagnetic field plays an important role.

Major carrier – the largest carriers in terms of the number of passengers carried regardless of the length of the routes.

Manned spacecraft – spacecraft carrying one or more human beings.

Maritime air mass – a humid air mass.

Mars – the fourth planet in our solar system that is also called the Red Planet because it appears as a small reddish light when viewed with the naked eye.

Mass – the amount of material in an object.

Mechanical instruments – instruments that work by means of direct mechanical linkage (such as a gear attached directly to the engine to give a reading on how fast the engine is operating) or on the principle of the gyroscope.

Mercator projection – maps in which the earth's surface is shown as a rectangle, with the meridians as parallel straight lines spaced at equal intervals and the parallels of latitude as parallel straight lines intersecting the meridians at right angles but spaced further apart as their distance from the equator increases. The areas become increasingly distorted toward the poles.

Mesosphere – a region of the atmosphere starting at 30 miles up to about 50 miles altitude.

Meteoroid – any of the small, solid bodies traveling through outer space.

Microburst – caused when a column of air is quickly cooled (usually by rain) and rapidly falls toward the Earth.

Microwave Landing System (MLS) – broadcasts much wider beams than the ILS – both horizontally and vertically.

Missile – a rocket-propelled vehicle with a weapon or warhead as the payload.

Mission-adaptive wings – the wing changes to create its most efficient shape for a variety of conditions.

Moderate turbulence – turbulence that requires aircraft occupants to wear seat belts and unsecured objects move about.

Modular air vehicle – air vehicles from different aircraft sections that allow the airplane to do different missions. This mixing and matching of sections allows the vehicle to meet the needs of country defense.

Mojave Aerospace Ventures – winners of the x-prize.

Momentum – the product of mass and velocity.

Monocoque – French word meaning single shell. It depends on the covering or skin to provide the required strength to resist the stresses of flight.

Monopropellant – liquid oxidizer and fuel existing together in the same storage tank.

Moon dust – a fine dust that covers the surface of the moon.

Moon rocks – rocks on the moon that have remained exposed on the lunar surface for periods as long as 500 million years without being destroyed.

Multi-spectral imaging – a satellite imaging system that observes radiant energy. This imaging can give useful information about crops, ocean currents and natural resources.

N

Napalm bombs – a firebomb that was made of 110-gallon tanks of jelled gasoline, which when dropped, would explode and burn an area some 250 feet long and 80 feet wide.

NASA's "vomit comet" – an airplane that flies as high as it can and then dives straight down putting its passengers in free fall for almost a minute.

National Aeronautics and Space Administration (NASA) – a government organization with a threefold mission. First, to explore, use, and enable the development of space for human enterprise. Second, to advance scientific knowledge and understanding of the Earth, the solar system and the universe and use the environment of space for research. Third, research, develop, verify and transfer advanced aeronautics, space and related technologies.

Navigation instruments – help the pilot find the way from the point of departure to the destination.

Nebulae – any of several dark or bright misty, cloudlike patches seen in the night sky, consisting of groups of stars too far away to be seen singly.

Neptune – the outermost of the gas planets and the fourth largest planet in the solar system. It is eighth in distance from the Sun.

Neutrosphere – in this region, there is little ionization compared to that which takes place in the ionosphere.

New Horizons – an unmanned space probe launched toward Pluto in 2006.

Newton's First Law of Motion – states that a body in a state of rest and a body in motion tend to remain at rest or in uniform motion unless acted upon by some outside force.

Newton's Law of Universal Gravitation – states that two bodies attract each other with a force directly proportional to the square of the distance between them.

Newton's Second Law of Motion – states that the rate of change in the momentum of a body is proportional to the force acting upon the body and is in the direction of the force.

Newton's Third Law of Motion – for every action there is an equal reaction in the opposite direction.

Nimbo – the combining term to indicate that a cloud is at the moment producing precipitation or is capable of producing precipitation.

Noise abatement procedures – usually involve a very quick climb by the aircraft after takeoff. Also, the aircraft might try not to fly over certain areas on the ground.

Non-coplanar transfer – a transfer that does not occur in the same plane because Earth satellites are at many different altitudes and at various angles to the equator.

Nonhypergolic – a bipropellant that is nonself igniting.

Nova – stars that are not stable; they flare, subside, and flare again.

Nozzle (of a rocket engine) – a “bell-shaped” duct that allows the escaping exhaust to expand thereby lowering its pressure.

O

Oblique-wing aircraft – this aircraft wing changes form during flight for optimum lift under different circumstances and can be rotated to different positions for the best aerodynamic characteristics.

Occluded front – when a warm air mass, lying between two cold air masses, is lifted up by the cold air mass behind it. The rapidly lifted warm air cools and creates a low and severe precipitation can sometimes occur.

Opportunity – a Mars rover.

Orbits – paths described by one body in its revolution about another body.

Ornithopter – flying machines that are kept aloft and propelled by flapping wings, described first by Leonardo da Vinci.

Outgassing – bubbles escaping from a spacecraft which can cause damage to delicate sensors and lenses.

Oxidation – the combination of oxygen with another substance.

Oxidizer – either another chemical compound or maybe oxygen in pure form – liquid oxygen.

Ozonosphere – a special region of the atmosphere that performs the very important function of shielding us from ultraviolet and infrared radiation that could be fatal.

P

Para-frag bombs – bombs with small parachutes attached to fragmentation bombs so that the allied bombers could come in low over the airfield and drop their bombs without exploding the plane that just dropped the bomb.

Particulate matter – dust and very small particles of matter.

Passenger terminal – designed to handle passengers, baggage, and cargo. Most have large waiting rooms for passengers to relax as well as places to eat, purchase tickets, and rent cars.

Passive communications satellites – those satellites, such as Echo I, that does nothing more than to reflect radio and television signals.

Patrol aircraft – aircraft used by utility companies to inspect pipelines or power lines.

Payload – whatever the rocket is carrying.

Performance instruments – tells how the aircraft has responded to commands.

Perigee – the opposite of apogee – that point where the orbiting body is closest to the body being orbited.

Personal aviation – the use of an aircraft for other than business or commercial use.

Photosphere – the portion of the Sun which gives light. It is composed of mostly hydrogen and helium and is very hot.

Pilotage – navigating by reference to visible landmarks.

Pluto – the outermost planet of the solar system, discovered in 1930, ninth in distance from the Sun.

Polar air mass – a cold air mass.

Polar magnetic storms – solar disturbances observable only in the polar areas.

Polar orbit – involves a path that crosses or nearly crosses the North and South Poles during each orbit.

Powered flight – aircraft having, producing, or propelled by means of engines.

Precipitation – when visible water falls in the form of rain, sleet, snow, and hail.

Precise Positioning System (PPS) – the military's encoded signal.

Pressure – air at higher altitudes is under less pressure than air at lower altitudes. Standard day pressure is 14.7 psi, or 29.92 on a mercury barometer. All air molecules pressing down upon all the molecules below them. Pressure is exerted in all directions with a given volume of air.

Pressure gradient – the rate of pressure increase or decrease on any atmospheric plane, usually a horizontal plane, for any given distance.

Pressure instruments – uses the principle that pressure decreases with height to tell the pilot about the performance of the aircraft.

Prime meridian – the great circle line that passes from the North Pole to the South through Greenwich, England.

Probes – satellites or spacecraft that either fly by, orbit or land on a celestial body, other than Earth.

Progressive burn rate – an instantaneous spread of the flame-front along the entire surface of the hole and as more and more surface area is exposed by burning, more and more thrust is produced.

Propellant – the oxidizer and reducer which propel the rocket.

Propfan system – combines the air-moving efficiency of the turbofan engine with the thrusting efficiency of the propeller causing a dramatic reduction in fuel consumption while retaining the turbofan's high power and the speed it makes possible.

Propulsion rocket system – includes the propellant used, the containers for the propellant, all plumbing that may be required to get the propellant from the containers to the engine, and the rocket engine itself.

Pulsar – known as a pulsating star because it flashes electromagnetic emissions (radio or other waves) in a set pattern.

Pure jets – a jet using a type of propulsion where all of the thrust is provided by the jet exhaust.

Q

R

Radar – radio detecting and ranging by means of emitting radio signals and observing and analyzing the minute signals reflected from an object to detect range, bearing, and other characteristics of the object.

Radiation – energy radiated in the form of waves or particles such as the heat energy of the sun that reaches Earth.

Radiation hazards – intense amounts of radiation found with the Van Allen portion of the magnetosphere that can be damaging to astronauts and to satellites.

Radial – each degree line, in a 360-degree circle, extending away from the site.

Radiation fog – fog that forms at night when land surfaces radiate much of the heat absorbed from the sun back into space.

Ramjet engine – the simplest type of all-jet engines because it has no moving parts. The force of inertia “rams” air into a streamlined chamber where it is compressed slowed down, mixed with fuel, ignited, and released.

Ramps – a large paved area for parking airplanes.

Reaction engine – a rocket engine where the action of the rocket's exhaust gases produces a reaction, forcing the rocket in the opposite direction.

Reciprocating engine – certain parts of the engine move back and forth in straight-line motion. This straight-line motion has to be changed to rotary motion for turning the propeller of an airplane.

Reconnaissance aircraft – aircraft used by the military to watch an enemy or potential enemy in order to keep track of what they are doing.

Reducer – the substance to be oxidized.

Regional-commuter aircraft – smaller airlines that carry passengers within a certain limited geographical region. They serve many of the smaller cities that the larger airlines have dropped.

Regressive burn rate – the most thrust is produced shortly after ignition, and it diminishes thereafter.

Relative humidity – the method used to tell you the amount of water vapor that can still enter an air mass before it becomes saturated.

Relative wind – opposite the flight path and impacts the airfoil at any angle to the chord line.

Retractable gear – landing gear that retracts in order to get them out of the airstream and thereby reduce drag.

Retrothrust – negative thrust (moving down from a higher to a lower orbit require negative thrust).

Rille – one of several long, narrow telescopic valleys on the surface of the moon.

Rime ice – form when the airplane is flying through super-cooled cloud condensate. If allowed to accumulate, it will reduce lift and become a danger to flight.

Rocket – operates on the same principle as the firework rocket, consisting of a combustion chamber and an exhaust nozzle, that carries either liquid or solid propellants which provide the fuel and oxygen needed for combustion. A type of power plant that is used to propel something (payload).

Rotary engines – an air-cooled engine with the cylinders arranged in a round fashion. The crankshaft was fastened solidly to the airframe and allowed the engine and the attached propeller to spin around the fixed crankshaft.

Rotary-wing aircraft – a large rotor (propeller) on top of a helicopter, which is made up of a number of blades, each like a wing, and as the rotor whirls, the blades move through the air causing, lift.

Rotor blades – the airfoils in the rotor of a rotary-wing aircraft.

Rotor clouds – clouds that show by their shape and motion that the air coming over the mountain is spinning on an “axis” that parallels the mountain's linear shape.

Rotor system – a complete system of rotating airfoils that supplies all or a major part of the lift supporting an aircraft.

Rudder – a control surface that controls yaw (left and right movement) of an airplane.

Runway designations – runways are identified by a number which corresponds to a compass direction rounded to the nearest 10 degrees.

S

Satellites – a man-made object or vehicle intended to orbit Earth, the moon, or other celestial body for the transmission of space data.

Saturation – when the air is holding the maximum amount of water vapor for the existing temperature and pressure.

Saturn – the second largest planet in the solar system and the sixth from the Sun. Known for its famous rings.

Scintillation – the twinkling of the stars.

Scramjet engine – similar to ramjet engine except the air is not slowed to subsonic speeds within the engine.

Seaplanes – flying boats.

Sedna – a newly discovered celestial body that one day may be classified as either a planet or a dwarf planet.

Self-reacting compound – one molecule contains atoms of both oxidizer and reducer and, upon ignition, reacts with itself, yielding energy as it breaks down or decomposes.

Semimonocoque – a fuselage structure that uses internal braces to help the skin carry the forces generated.

Severe turbulence – turbulence where aircraft may at times be out of control, occupants are thrown against seat belts, and unsecured objects are tossed about.

Shock wave – the sudden displacement of air and the resulting wedge-shaped wave formed by the air.

Short-haul jets – smaller jets such as the Boeing 727 and the DC-9.

Short-Takeoff-and Landing (STOL) – the ability of an aircraft to clear a 50-foot obstacle within 1,500 feet of commencing takeoff and to stop within 1,500 feet after passing over a 50-foot obstacle when landing.

Slats – protrusions from the leading edge of a wing that, when combined with the flaps, result in a significant increase in lift.

Small circle – any circle other than a great circle.

Smart weapons – weapons preferred because pilots could launch them far away from the targets and thus stay away from enemy defensive weapons.

Smoke – the vaporous matter arising from something burning and made visible by minute particles of carbon suspended in it.

Solar flares – a sudden and temporary outburst of energy from a small area of the sun's surface.

Solar powered aircraft – aircraft powered by the sun's rays.

Solar radiation – a process which causes evaporation by heating the oceans and large bodies of water.

Solar radio burst – large amounts of radio energy released by solar flares, which causes radio waves to become jammed.

Solar winds – steady electromagnetic emissions that are an extension of the Sun's corona into interplanetary space.

Solid propellants – a propellant in a solid state which is less costly and more reliable than the liquid type.

Sound barrier – the speed sound travels through air. Before 1947, it was believed that the speed of sound created a physical barrier for aircraft and pilots.

Sounding rocket flight – a rocket sent into, or even beyond the atmosphere, on a one-way trip to gather information.

Space – a place which extends infinitely in all directions and contains all the stars, planets, and galaxies in the universe.

Special use airspace – some special but relatively small areas of the airspace that most pilots have to avoid. Prohibited airspace and restricted airspace are clearly marked on aeronautical charts.

Specific impulse – the number of pounds of thrust delivered by consuming one pound of propellant (oxidizer/fuel mixture) in one second.

Speed of sound – how fast sound travels through a medium such as air. The speed of sound in air is about 761 mph when the air temperature is 59 degrees F.

Spin stabilization – the ability of a projectile to be steadied in flight by a rotating motion about its longitudinal axis.

Spirit – a Mars rover.

Spoilers – device used to destroy lift. Found on top of the wing and in varying sizes.

Sports aviation – called "flying for fun." It is flying for some purpose other than transportation or business purposes.

Stabilizer (horizontal and vertical) – located on the tail with the horizontal stabilizer having the elevators attached and the vertical stabilizer having the rudder attached.

Stall – separation between the streamlines and the airfoil causing loss of lift producing low-pressure on the top of the wing.

Standard Positioning System (SPS) – the civilian public's signal.

Stealth bomber – an aircraft that is hard to see by radar.

Strafe – to rake (as ground troops or an airfield) with fire at close range and especially with machine-gun fire from low-flying airplanes or formerly with artillery fire.

Strategic airlift – transportation of personnel or cargo between the theaters of operation.

Strategic bombing – bombing enemy territory.

Stationary front – when air masses lose their “punch” and are not replacing one another.

Stratosphere – a region where temperature goes up with increase in altitude, beginning at 10 miles above the Earth and going to about 30 miles up.

Stratus clouds – clouds that stretch out/or cover as a layer.

Sublimation – happens when water molecules leave the frozen (solid) state and directly enter the atmosphere without first changing into a liquid.

Sudden ionospheric disturbance – produced by sunspots, solar flares, and other disturbances on the surface of the sun causing fluctuations in the output of the sun’s rays. SIDs produces excess electrons in the atmosphere, and these will absorb radio waves.

Sunspots – any of the dark spots sometimes seen on the surface of the sun.

Sunsynchronous orbit – a polar orbit that keeps a satellite exposed to constant sunlight.

Supercritical wings – wing designed to delay the point at which an aircraft reaches supersonic speeds, thus delaying the increased drag.

Supernova – occurs when a star gives up great mass in one giant explosion of light and energy.

Supersonic – relating to speeds from one to five times the speed of sound in air.

Supersonic transports – a delta-wing aircraft, which could carry about 100 passengers and fly at about Mach 2.2 (such as the Concorde).

Swept-back wings – aircraft wings that are designed to be more efficient at high speeds for supersonic flight.

Swirl-jet type – a type, in which each propellant is introduced into the chamber in an inverted-cone-shaped spray, finely atomized and sufficiently diffused for adequate mixing with the adjacent spray.

T

Tachometer – an instrument that shows how fast the engine’s crankshaft is turning (expressed in rpm).

Tactical airlift – transportation within a theater of operation.

Tail (empennage) – consists of the horizontal stabilizer and the vertical stabilizer.

Tandem – landing gear in an arrangement where the main gear consists of two sets of wheels, which are, located one behind the other on the fuselage.

Tankers – most of the time used for aerial refueling of bombers, fighters and attack aircraft. They can also transport passengers and cargo.

Taxiways – the roads that aircraft use to get to the runway.

Technical/vocational school – provide the majority of the formal technical education courses. In this type of school, many people learn the special trades and skills that are applicable to the industry they plan to join.

Temperature – the measure of the energy within a gas.

The Milky Way – the galaxy in which we reside, along with about 100 billion other solar systems and stars.

Thermosphere – a region of the atmosphere that begins at 50 miles up and extends outward to about 300 miles.

Throat (of a rocket engine) – the most constricted area or section of a duct or passage of a rocket nozzle that constricts the exhaust and thereby increases its velocity.

Thrust – the force exerted through the propeller shaft of an airplane due to reaction of the air on the revolving blades of the propeller and that moves the craft ahead.

Thrust vectoring – allows the thrust force to be pointed in any direction to assist lift, reduce the chance to stall, or allow the aircraft to fly at extremely high angles of attack and very slowly.

Thunderstorm – any storm accompanied by thunder and lightning.

Tilt-Rotor Research Aircraft (TRRA) – an aircraft where the entire propulsion unit turns.

Total velocity requirement – represents adding together of all the velocity requirements for all stages of the mission.

Trailing edge (airfoil) – the thin junction where the upper and lower surfaces come together at the rear of the wing.

Trainers – an aircraft used to train pilots.

Trajectories – the curved paths of objects hurtling through space.

Transport – its mission is to airlift personnel and material to wherever they are needed.

Tricycle – consists of three wheels, which make an airplane very easy to control on the ground.

Tropical air mass – a hot air mass.

Tropical weather – weather conditions in the tropics which can be continental (extremely varied) or oceanic (low pressure and light winds.)

Troposphere – that region in which people live, work, play, and fly, extending from the Earth’s surface to about 10 miles above the Earth at the equator.

True airspeed – a measure of how fast the airplane is flying through the air.

True course – what the navigator indicates as the course the airplane will follow. This might include consideration of radio navigation stations, landforms such as mountains, or prohibited airspace.

Truss - a type of fuselage that is made of tubing welded in place to form a well-braced framework.

Turbine engines – use the force of hot flowing gases striking a turbine.

Turbofan engine – similar to turbojets except more air is pulled into the turbofan engine, they are much quieter, and more fuel-efficient. The limitations are speed and poor low-altitude performance.

Turboprop jets – a type of jet propulsion in which the gas turbine is fastened to a propeller that is used to propel the aircraft.

Turbulence – air that flows over the wing's surface and scrapes against the rough metal and is slowed down and churned up.

Turn-and-slip indicator – the turn indicator indicates the direction and rate of turn and the ball in the glass tube (inclinometer) indicates the quality of the turn.

Typhoon – a hurricane that occurs in the western Pacific.

U

Ultralights – small, lightweight aircraft, which began as, powered hang gliders.

Uncontrolled airports – airports with no control tower where the pilots must use common procedures to reduce the chances of collisions on the ground and in the air.

United Nations resolutions – formal statements of opinion or determination adopted by the United Nations such as those relating to the use of space and how all mankind should share its benefits.

Unmanned Air Vehicles (UAV) – small, pilot-less aircraft that perform missions, which do not require a pilot on board or which, are considered too dangerous or politically unwise for manned flight.

Unmanned spacecraft – research devices designed to add to our knowledge of the atmosphere and space.

Uplink – the communication link from the transmitting earth station to the satellite.

Upslope fog – fog that results when wind carries moist air up a mountain slope or sloping land until the air is cooled.

Uranus – the third largest planet in the solar system, seventh in distance from the Sun.

Useful load – subtract the empty weight from the maximum allowable weight from the maximum allowable weight to find how many pounds may be loaded into the airplane.

Utility aircraft – aircraft used by the U.S. Air Force to airlift important people or for operational support airlift.

V

Vacuum – completely empty space.

Vectors – a graphic mathematical illustration showing both direction and magnitude.

Velocity – the rate at which a body moves when a force is applied to it.

Vengeance weapons – two World War II German weapons called the V-1 and V-2. V-1 was nicknamed “buzz bomb” and V-2 was a rocket-propelled ballistic missile.

Vertical axis – an imaginary line that passes vertically through the meeting point of the longitudinal and lateral axes and is also called the yaw axis.

Vertical-Takeoff-and Landing (VTOL) – a method by which an aircraft can achieve forward flight, like a conventional aircraft, but can also takeoff and land without any horizontal movement at all.

Vertical velocity indicator- tells the pilot at what rate (in feet per minute) the airplane is climbing or descending.

Viscosity – a fluid's resistance to flow.

Viscous drag – when an object is placed in the path of moving air and the mutual attraction of molecules slows the rate of flow. This is transmitted to other air molecules that are actually touching the surface over which they are flowing.

Visual Flight Rules (VFR) – the general weather conditions the FAA considers a pilot can expect at the surface.

VOR receiver – a receiver that gives a pilot a way to tell where he is from a given ground point without actually seeing the point.

Vortices – form around the wingtips of an airplane and described as horizontal tornadoes. Strong swirling air currents.

V/STOL – vertical/short takeoff and landing aircraft could get into and out of small airports that were located close to the customer's destination.

W

Wake turbulence – a man-made turbulence caused by large aircraft in flight.

Warm front – when a warm air mass replaces a cold air mass, the boundary is called a warm front.

Wave drag – result of lost energy when air flows across a shock wave and undergoes a change in temperature, pressure, and velocity.

Waverider – a hypersonic or supersonic vehicle that has an attached shock wave along its leading fuselage edge. The vehicle appears to be riding its own shock wave.

Weather – the day-to-day changes in atmospheric conditions.

Weather radar – shows areas of precipitation, but its most important function is to show storm cells (thunderstorms) ahead.

Weight – force that directly opposes lift.

Windshear – an atmospheric condition in which changes in speed and direction of the wind occur.

Wind triangle – a tool used by the pilot to figure out where wind drift will cause the aircraft to fly over the ground. It can also be used to counter the effect of drift.

Wind tunnel – a device used in the design and development of virtually all aircraft flying today.

Windward – slopes of mountains that face the wind and are usually moistened with rain or snow.

Wing – primary source of lift with ailerons attached.

Winglets – small wings placed in a vertical position at the end of the wings to eliminate the vortices and improve the efficiency of the wing.

Whiteout – an atmospheric and surface condition in the Arctic in which no object casts a shadow, the horizon being indiscernible, and only very dark objects being seen. Snowfall which reduces visibility.

X-Prize – the prize awarded for a non-government organization spacecraft flying into space and returning within two weeks.

Y

Z

INDEX

- A
- AAA (anti-aircraft-artillery), 138
- ace, 37
- aces in Europe, 100
- aces in the Pacific, 108
- aces in Vietnam, 142
- ADF, 254-255
- Ader, Clement, 12
- advection, 398
- advection fog, 421
- aerial advertising aircraft, 315
- aerial photography, 316
- aerobatics, 300
- aeronautical center, 357-358
- agricultural aircraft, 314-315
- AIA, 364
- air
 - density, 180
 - laminar flow, 181
 - pressure, 180
 - properties and composition, 173
 - speed of sound, 179
 - temperature, 181-182
 - viscosity, 180
- Air Commerce Act, 57
- Air Commerce Act of 1926, 353-354
- Air Corps Tactical School, 95
- Aircraft
 - A-6, 138
 - A-10, 322
 - A-10 Thunderbolts, 148
 - A-10 Warthog, 151
 - AD Skyraiders, 120
 - AD-1 Scissors, 162
 - Aero Commander, 170
 - Aerodrome, 15
 - Aerostar 602P, 307
 - AGM-45 Shrike missile, 138
 - Airbus A-300B, 281
 - Airbus A-320, 167
 - Albatross, 34
 - Ariel, 14
 - Arrow, 295
 - AT-6 Harvard, 299
 - ATF, 287
 - Avro 504, 34
 - B-1, 320-321
 - B-2, 321
 - B-17, 67, 68, 80, 92
 - B-17 Flying Fortresses, 96
 - B-1B, 163, 165, 431
 - B-2, 165
 - B-2 Bomber, 146
 - B-24 Liberators, 96
 - B-25 Mitchell, 100
 - B-26, 135
 - B-26 Marauder, 102
 - B-29, 114
 - B-29 Superfortress, 106
 - B-36, 114
 - B-47 Stratojet, 133
 - B-50, 114
 - B-52, 133, 138, 144, 320
 - B-58, 133
 - BAE Jetstream 31, 287
 - BE-2, 34
 - Beauforts, 105
 - Beech 18, 127
 - Beech Baron 307-308
 - Beech Staggerwing, 56, 62
 - Beechcraft 99, 287
 - Beechcraft Skipper, 292
 - Beechcraft Starship I, 170, 309-310
 - Beechcraft Twin Bonanza, 170
 - Beechcraft BE-400, 309
 - Bell 206 Jet Rangers, 313
 - Bell X-5, 131
 - Bell XP-59 Airacomet, 115
 - Benoist XIV, 32
 - Bleriot XI, 28, 29
 - Boeing 247, 64
 - Boeing 247-D, 126
 - Boeing 299, 68
 - Boeing 707, 126, 166
 - Boeing 727, 166, 283
 - Boeing 737, 166, 283
 - Boeing 747, 166, 279-280
 - Boeing 747F, 285
 - Boeing 757, 167, 283-284
 - Boeing 767, 167, 282
 - Boeing 777, 282
 - Boeing P-12E, 62
 - Boeing Stratocruiser, 125
 - Boeing XB-47, 133
 - Bonanza F-33, 293
 - Boston (Douglas), 52
 - Boston II (Douglas), 52
 - C-5, 148, 328
 - C-9, 331
 - C-12A, 333
 - C-17, 152, 331-332
 - C-20, 333
 - C-21A, 333
 - C-22B, 333
 - C-47 118, 124

C-54, 118, 124
 C-69, 124
 C-130 Hercules, 149, 323
 C-130 Transports, 148
 C-135, 166
 C-140, 127
 C-141 Starlifters, 148, 329
 Canadair Challenger, 312
 Caravelle 1, 166
 Cessna Citation, 311-312
 Cessna 140, 127
 Cessna 150 Aerobat, 127, 300
 Cessna 152, 127, 291
 Cessna 172 Skyhawk, 293
 Cessna 182 Skylane, 293
 Cessna 185 Skywagon, 294
 Cessna 210 Centurion, 294
 Cessna 310, 170
 Cessna 414, 340, A, 307
 Cessna 421C Golden Eagle III, 307
 Chance-Voight Corsair, 107
 Cherokee, 127
 Chicago (Douglas), 52
 Comet 1, 125
 Concorde, 168
 Convair 240, 124
 Convair 440, 125
 Convair 880 and 990, 166
 Convair XB-46, 133
 Convair XFY-1 Tailsitter, 129
 Curtiss Army R3C-2, 55
 Curtiss JN-4 Jenny, 48
 Curtiss P-36, 68
 Curtiss P-40C, 115
 Curtiss P-6E Hawk, 68
 Curtiss PW-8, 53
 Curtiss R3C-1, 55
 Cutlass RG, 294
 D-558 II Skyrocket, 130
 DC-2, 64
 DC-3, 65,124
 DC-6, 124
 DC-6B, 124
 DC-7, 124
 DC-7B, 124
 DC-7C, 124
 DC-8, 391
 DC-9, 166
 Dehavilland DHC-7 (Canada), 287
 DeHavilland Vampire, 115
 DH-4, 33
 Domier 17, 80, 82
 Douglas Comercial One (DC-1), 64
 Douglas DC-10, 167
 Douglas DC-8, 166
 Douglas DC-9, 166
 Douglas DWC-DOS, 52
 Duke B-60, 307
 E-3A, 326
 E-3B Airborne Warning and Control, 148
 E-4B, 327
 E-8 JSTARS, 151, 327
 EC-121, 138
 EC-66, 138
 EMB 110 Bandeirante, 287
 EMB 120 Brasilia, 287
 Enola Gay, 108
 ER-2, 390
 F/A-18, 325
 FB111A, 150
 F-4, 138, 139, 141
 F-4U Corsair, 120
 F-9F Pantherjet, 120
 F-14, 324
 F-15 Eagle, 147, 148, 322
 F-16 Fighting Falcon, 148, 323, 430
 F-18, 187
 F-22, 325
 F-80, 121
 F-84F, 120
 F-86 Sabrejets 121
 F-100Fs Wild Weasels, 138
 F-105, 138
 F-117 Nighthawk, 148
 F-117 Stealth Fighters, 148
 F-117A, 165
 F-117, Blackjet, 324
 Farman, 34
 Flyer, 19
 Flying Bedstead, 129
 Focke-Achgelis (FA-61), 63
 Fokker D-7, 34
 Fokker Dr-1, 36
 Fokker D-VII, 36
 Fokker T-2, 51
 Fokker Tri-motor, 57
 FW-190, 80, 96
 GAM 63 Rascal, 134
 Gates Learjet, 310
 Gee Bee Racer, 55
 Gloster Meteor I, 115
 Gnome, 30
 Golden Flyer, 25
 Gotha IV, 35
 Grumman Gulfstream II, 170
 Grumman Wildcat, 100
 Gulfstream IV, 170
 Gulfstream III and IV, 310
 Hawker Hurricane, 299
 Hawker-Siddeley Harrier, 170, 349

HE-111, 116
 Heinkel III, 80, 82
 Heinkel HE-178, 115
 Hurricane, 82
 J-3 Cub, 127
 June Bug, 25
 Junkers 52, 86
 Junkers 87, 80, 82
 Junkers 88, 82
 Junkers D-1, 36
 KC-10 Tankers, 148
 KC-10A Extender, 331
 KC-135, 144, 148, 331
 Languedoc, 129
 Le Rhone, 31
 Learjet, 170
 Learjet 55, 170
 Learjet Longhorn, 311
 Leduc 0.10, 129
 LeGrand, 30
 Lockheed 5-80 Shooting Star, 119
 Lockheed F-40, 115
 Lockheed L-1011, 167, 281
 Lockheed XV-4 Hummingbird, 348
 Luscombe Silvaire, 292
 Macchi MC-72, 55
 Malibu, 295, 312
 Martin 2-0-2, 124
 McDonnell F-101B Voodoo, 122
 McDonnell-Douglas DC-9, 284
 McDonnell-Douglas DC-10-30CF, 285
 McDonnell-Douglas DC-10/MD-11, 280
 McDonnell-Douglas 500D, 313
 ME-109, 80, 96
 ME-110, 96
 ME-210, 96
 ME-262, 80
 ME-262a, 116
 Messerschmitt Bf 109, 299
 Messerschmitt ME-262A, 116
 Messerschmitt 109, 80, 82
 Messerschmitt P-1101, 131
 MIG 17, 135
 MIG-15, 120
 MIG-21, 138
 Mitsubishi A6M Zero, 299
 Model 2000 Starship I, 161
 Model 35 Bonanza, 127-128
 Mooney 210, 294
 Morane, 34
 NC-1, 45
 NC-3, 45
 NC-4, 45
 New Orleans (Douglas), 52
 Nieuport 28, 52
 North American Sabreliner, 170
 North American XB-45, 133
 P-38 Lightning, 105
 P-40, 101, 299
 P-47 Thunderbolt, 98, 299
 P-51 Mustang, 97, 98, 115, 299
 P-51D, 115
 PA-18 Super Cub, 295
 Piper Apache, 170
 Piper Archer III, 295
 Piper Cherokee 140, 128, 292
 Piper Commuter, 308
 Piper J-3 Cub, 62, 299
 Pitts Special, 300
 R-4, 63
 RC-135 Reconnaissance Aircraft, 148
 SE-5A, 36
 Seattle (Douglas), 52
 Seversky P-35, 56, 68
 Shorts SD-3-30 (England), 286
 Sierra, 293
 Skysedan, 127
 SM62 Snark, 133
 Sopwith Camel, 31
 Sopwith Pup, 31
 Spad VII, 36
 Spitfire, 82
 SR-71, 163, 326
 Starliner, 124
 Stearman PT-17, 62
 Sterling, 80
 Stuka, 80
 Submarine Spitfire, 299
 Sundowner, 293
 Super Constellation, 124
 Super 80, 167
 Supermarine S.6B, 55
 Swearingen SA-266 Metro II, 286
 T-28, 135
 T-38A, 430
 T337G Skymaster, 307
 Taube, 34
 Taylorcraft BC-12D, 127
 TR-1/U-2, 326
 Travel Air J-5, 56
 Triple Twin, 30
 TU-144, 168
 Turbo Seminole, 308
 U-2, 163
 V-1, 116
 V-2, 116
 Vin Fiz Flyer, 25
 Viscount, 125
 VS 300, 63
 X-1, 129, 182

X-15, 159-160
 X-1A, 131
 X-1B, 131
 X-2, 131
 X-29A, 163
 X-3, 131
 XB-47, 133
 XB-70, 159-160
 XF-91, 129
 Zero, 89
 aircraft in industry, 310
 aircraft instruments, 219-227
 aircraft systems, 216-219
 airfoil
 angle of attack, 184
 camber, 183
 chord, 184
 leading edge, 183
 relative wind, 184
 trailing edge, 184
 Air Force Reserve Officer Training Corps, 377-378
 Air Force Schools, 376-377
 Airline Deregulation Act of 1978, 278
 airmail, 56, 57
 Air Mail Act of 1925, 57, 64
 Air Mail Act of 1934, 12
 air mass, 410-411
 Airport
 Control Tower, 272
 Other Facilities, 273
 Passenger Terminal, 273
 Ramp and Hangers, 271
 Runway, 270
 Taxiways, 270-271
 Air Traffic Control, 355
 airways, 244
 Alcock, Captain John, 47
 Aldrin, Edwin, 617
 all cargo airlines (Flying Tiger), 125
 altimeter, 247
 altostratus, 417
 American Troops in Vietnam, 138
 American War Costs, 143
 Ames Research Center, 128
 Anderson, Charles Alfred "Chief", 71
 angle of incidence, 399
 anorthosite, 547
 Anti-Ballistic Missile Treaty, 587
 AOPA, 363
 apogee, 497
 Apollo-Soyuz Test Project, 619
 Aptitudes and Aerospace Careers, 370
 Apt, Mel, 130-131
 Arctic weather, 443
 ARDC (Air Research and Development Command), 129
 armalcolite, 547
 Armstrong, Neil 617
 Arnold, General "Hap", 69
 ARTCC, 356
 asteroid, 566
 atmosphere, 386-387
 atmospheric elements, 387-388
 atmospheric regions, 388
 ATO (Air Tasking Order), 150
 Attlee, Prime Minister, 108
 autogiro, 63
 axes of an aircraft, 197-199

B

 Baldwin, Thomas, 24
 ballistic trajectories, 501
 ballooning, 297-298
 barnstormers, 48-49
 basalt, 546
 Battle of Britain, 78, 84
 Battle of Midway, 101-102
 Battle of the Coral Sea, 101
 Battleships
 Arizona, 91
 California, 91
 Nevada, 91
 Oklahoma, 91
 West Virginia, 91
 Beech Aircraft, 127, 293
 Beech, Walter, 61, 62
 Bell Aircraft Company, 129
 Bell, Alexander Graham, 24
 Bellinger, Lieutenant Commander R., 45
 Bellis, US Army Lieutenant Cy, 55
 Bendix Trophy Race, 55
 Berlin Airlift, 118
 Berliner, Emile and Henry, 32
 Bernoulli, Daniel, 185
 Bernoulli's Principle, 185
 bipropellant, 469
 black hole, 575
 Black, Joseph, 7
 Blanchard, Jean Pierre, 8
 Blanchard, Madeleine, 8
 Bleckley, Lieutenant Erwin, 39
 Bleriot, Louis, 28
 blitzkrieg, 79
 blowing dust, 432
 blowing sand, 432
 blowing snow, 432
 bombing of Japan, 105-108
 Boulton, Matthew P.W., 28
 Breguet, Louis, 32
 Bridgeman, Bill, 130

Brown, Arthur Whitter, 47
Brown, Lieutenant Russell J., 121
Brown, Walter F., 64
Brown, Willa Beatrice, 71
burnout velocity, 499
Bush, President George, 148, 152
buzz bombs, 116

C

CAA War Training Service, 91
CAI, 358
carburetor ice, 434
Carl, Marion, 130
Carnards, 163
Cassini 556, 607
Cavendish, Henry, 7
Cayley, George, 12
Ceres, 566
Cessna Aircraft, 127, 293
Cessna, Clyde, 61, 62
Chaffee, Roger, 617
Chanute, Octave, 14, 185
Charles, J.A.C., 8
chemosphere, 390
Cheney, Dick, 148
chromosphere, 522
circular orbit, 479, 504
cirrostratus, 417
cirrus clouds, 416
cislunar space, 517
Civil Aeronautics Act of 1938, 58, 3548
Civil Aeronautics Board, 278
Civil Air Patrol, 361-362
Civil Airports, 242
Civil Reserve Fleet, 360-361
Civil War, 9
Civilian Pilot Training Act of 1939, 70
clear-air turbulence, 425
clouds, 415-420
Cochran, Jacqueline, 56, 92
Coffey School of Aeronautics, 71
cold front, 411-412
Cold War, 113, 146
Coleman, Bessie, 49
Collins, Michael, 617
combined arms warfare, 79
combustion, 467
comet, 567
Commercial Airlines, 123-126
Commercial Aviation, 313
Commercial Space Launch Act, 588
Community College of the Air Force, 380-381
community colleges, 371-372
compass deviation, 247

condensation, 396
conduction, 398
Congreve, William, 451
controlled airspace, 244
convection, 398
Cooper, Gordon, 615
Coriolis Effect, 401
Cornu, Paul, 32
corona, 522
Crossfield, Scott, 130
cosmic rays, 527
cryogenics, 467-468
cumulonimbus, 418-420
cumulus clouds, 415-416
Curtiss, Glenn, 24

D

Da Vinci, Leonardo, 5-6, 185
d'Arlandes, Marquis, 7
Davis, Benjamin O., Jr., 72
dead reckoning, 249-252
de Gusmao, Laurence, 7
de la Cierva, Juan, 63
de Lana, Francesco, 6
DME, 255-2560
density, 392
density impulse, 462
Department of Transportation Act 1966, 354-355
de Rozier, Pilatre, 7
dirigible, 9
Dirigibles
 Akron, 67
 LZ-127 Graf Zeppelin, 66
 LZ-129 Hindenburg, 66
 LZ-130 Graf Zeppelin II, 66
 Macon, 67
 ZR-1 Shenandoah, 66
dog fight, 36
Doolittle, Jimmy, 55, 63, 106
Douhet, Air Marshall Giulio, 94
drag
 form, 189
 friction, 189
drag devices, 210-211
dwarf planet, 562

E

EAA, 364-365
Earhart, Amelia, 56, 60, 61
Earth, 544
Earth's Moon, 544-547
Eichstadt, Konrad 451
Eighth Air Force, 96

Electra, 61
electrostatic charging, 532-533
elliptical orbit, 497
Ellison, Major James, 72
El Nino, 426
Ely, Eugene, 25
equatorial orbit, 497
Eris, 564
escape trajectory, 497
Esnault-Pelterie, Robert, 28
evaporation, 393
evaporation fog, 421
Everest, Pete, 130
executive aircraft, 306
exosphere, 525
Explorer 1, 583
Extra-vehicular activity (EVA), 623-624

F

FAA, 353
FBO, 272
F-100 Series of Supersonic Fighters, 132
Federal Airport Act 1946, 354
Federal Aviation Act 1958, 354
Feldspar, 547
Fighter Advancements, 115
Fighter Squadron, 71st, 147
Filaments, 521-523
Finletter, Thomas K., 122-123
Fire fighting aircraft, 316
fixed-wing aircraft, 31
flaps, 208
Flares, 521-522
Fletcher, Henri, 71
Flight controls, 207-208
Focke, Dr. Heinrich, 63
fog, 421
Fokker, Anthony, 36
Fokker (Netherlands), 287
Fonck, Rene, 37
Forces of Flight, 185-189
forward-swept wings, 161-162
four-year colleges 374-376
Franco, General Francisco, 77
front, 411
frost, 435
Fujita, 438
fuselage structure, 211-213

G

GAMA, 364
Gagarin, Yuri 625
Galileo spacecraft, 606-607

Garnerin, Andre-Jacques, 8
Garnerin, Madam Jeanne-Genevieve, 8
Garros, Roland, 36
Geissler, Christopher 451
geostationary orbit 507-508
German Air Force, 77
Gibbs, Edward, 71
Giffard, Henri, 10
Giotto, 606
glaze ice, 434-435
Glenn, John, 615
gliding, 298-299
global coordinate system, 237-239
Goddard, 452-453
Goettler, Lieutenant Harold, 39
GPS, 258-259
grain designs, 473
gravity 453
ground radar, 256
ground speed, 247
Grissom, Gus, 617
Guggenheim, Daniel, 62

H

Hadley's Rille, 545
Haenlein, Paul, 10
hail, 441
Hale, William, 451
Halley's Comet, 568
Hawker, Harry, 46
haze, 431
Hearst, William Randolph, 25
heat, 397-398
Helicopters
 Aerospatiale, 343
 Agusta, 343
 AH-64, 332
 Bell 206 Jet Ranger, 338
 Bell 222, 342
 Bell AH-1 HueyCobra, 338
 Bell UH-1, 340
 Bell UH-60A, 341
 Boeing Vertol CH-46, 339
 Boeing Vertol CH-47, 339
 Brantly-Hynes, 342
 Enstrom, 342
 Lockheed AH-51 Cheyenne, 343
 MBB, 343
 McDonnell-Douglas 500D, 342
 Sikorsky CH-53 (HH-55), 340
 Sikorsky CH-54 Skycrane, 340
 Sikorsky HH-3, 340
 Sikorsky S-76, 342
 Schweizer, 342

Henry, Joseph, 9
Henson, W.S., 14
heterosphere, 385
high-inversion fog, 421
Henry, Joseph, 9
Henson, W.S., 14
Herring, A.M., 14
Hiroshima, 108
Hitler, Adolf, 77, 80-82, 84, 88
Hohmann Transfer, 505
homebuilts, 297
homosphere, 391
Hubble Space Telescope, 601-602
humidity, 395
Humphreys, Lieutenant Frederic E., 24
Hussein, Saddam, 150-152
hurricanes, 439-440
hybrid helicopters, 344-45
hybrid propellants, 478
hypersonic, 479-480

I

ICAO, 360
IFR, 355
icing, 434-435
igniters, 474
induced drag, 191-192
inertial navigation, 260
insolation 399
institutes, 373-374
Iraq, 147
instrument flight rules, 430
international space station, 630-635
International Telecommunications Union, 589
interplanetary space, 519
interstellar space, 519
ion, 524
ionization, 524
ionosphere, 390, 523-525
isobar, 403

J

Jannus, Tony, 32
Japanese Army, 77
Jeffries, Dr. John, 8
Jet Propulsion, 115
jet stream 405
Johnson, General Harold K., 137
Johnson, President Lyndon, 136-140
joined wings, 161
Joint Strike Fighter, 229
Junkers, Hugo, 36
Jupiter 554-556

K

kamikazes, 102, 103
Kelly, Lieutenant Oakley, 51
Kennedy, President John, 135, 136
Kenney Cocktail, 104
Kenney, Major General George, 104, 105
Kinchloe, Ivan, 130
Kleopatra 566
Korean War American Aces, 121
Krebs, A.C., 10
Kuiper Belt, 563, 565

KREEP 528

L

Lafayette Escadrille, 38
Lahm, Lieutenant Frank P., 24
landing gear, 213-215
Landing navigation systems, 261-263
Land Remote Sensing Commercialization Act 588
Langley, Samuel Pierpont, 15
La Nina 426
land-sea breeze 404
launch vehicles 509-511
Legends about Flight, 4-5
LeMay, General Curtis E., 106
Leonov, Aleksei 634
Lewis Research Center, 128
lightning 436
Lilenthal, Otto, 13, 185
Lindbergh, Charles, 59
liquid propellants 474-475
Livvyak, Lilya, 87
long-duration exposure facility 629-630
Looking Glass, 145
LORAN, 257-258
Love, Nancy, 92
Lowe, Thaddeus S.C., 9
Lufberry, Raoul, 38
Luke, Frank, 39

M

MAAG (US Military Assistance Advisor Group), 134
MacArthur, General, 103, 119
Mach, Ernst, 176
Macready, Lieutenant John, 51
Magellan Probe, 542
Maginot Line, 81
magnetic courses, 246
magnetic storms 529
magnetosphere 525

Maloney, Daniel, 13
 Manly, Charles M., 15
 manned maneuvering unit (MMU) 624
 Manning, Captain Harry, 9
 Mannock, Edward, 37
 Mantz, Paul, 9
 Map projections, 237-239
 Mariner 2, 543
 Mariner 4, 548
 Mariner 5, 543
 Mariner 6, 548-549
 Mariner 7, 548-549
 Mariner 9, 549
 Mariner 10, 543
 Mars, 548-554
 Mars Global Surveyor, 550
 Mars Pathfinder, 549-550
 mass, 392
 Maughan, Army Lieutenant Russell, 53
 McKenzie-Grieve, Lieutenant Commander
 Kenneth, 46
 McNary-Watres Act, 64
 Mercury 541
 mesosphere 388
 Messenger, 541
 meteor 569
 meteoroid 569
 Meusnier, Jean Baptiste, 10
 microburst 424
 micrometeorites 569
 military aircraft letter and number designations, 330
 military and joint-use airports, 243-244
 Milky Way 570
 Mir 627
 Mitchell, General "Billy", 39-41, 48, 50, 94, 95
 monopropellant 469
 Montgolfier, Joseph and Etienne, 7
 Montgomery, John J., 12
 Mooney Aircraft Company, 294
 Multi-spectrum-imaging satellites 597-598
 Landsats, 567-598
 Murray, Kit, 130
 Mussolini, 77

N

NACA (National Advisory Committee on Aeronautics), 128
 NAFEC, 357
 NASA, National Aeronautics and Space Administration, 359-360, 554
 Nagasaki, 108
 Napalm bombs, 121
 National Aeronautics and Space Act, 584, 588
 National Championship Air Races, 294

National Security Act, 114
 Navigation satellites, 594-596
 NAVSTAR Global Positioning System
 Timing, 594-596
 Transit, 594
 Nebulae, 574
 Neptune, 560
 neutrosphere, 390
 New Horizons, 562-563
 Newton's Laws of Motion, 455-457
 Newton's Law of Universal Gravitation, 454
 Newton, Sir Isaac, 185, 453-457
 Nickles, Sergeant Edwin, 53
 Nimitz, Admiral Chester A., 102
 Ninety-Nines, 56
 Nixon, President Richard M., 140-143
 Noncombatant Army aircraft, 327-328
 Noncombatant Navy aircraft, 327
 Noonan, Fred, 9
 Normandy Invasion, 99
 North Korea, 119
 nova, 571-572
 Noyes, Blanche, 56
 NTSB, 358

O

oblique-wing, 161-162
 oblique-winged aircraft, 162
 Observations satellites, 596
 occluded fronts, 414-415
 O'Donnell, Gladys, 56
 Omlie, Phoebe Fairgrave, 49
 Oort Cloud, 568
 Operation Desert Shield, 148-149
 Operation Desert Storm, 149-150
 Operation Linebacker, 141
 Operation Linebacker II, 142
 Operation Rolling Thunder, 137
 Opportunity, 550-553
 orbit, 495
 Orteig, Raymond, 59
 Ostfriesland (battleship), 51
 outer Space Treaty, 586
 oxidation, 467
 oxidizers, 467
 ozonosphere, 390

P

Pacific Campaign, 103
 para-frag bombs, 82
 particulate matter, 397
 Pascal, 6

patrol aircraft, 316
Pearl Harbor, 89, 90, 91
Penaud, Alphonse, 12
perigee, 497
Phillips, W.H., 32
photosphere, 503
pilotage, 242
pilot certification, 284-285
Pioneer 1&2, 524
Pioneer 10&11, 531
Piper Aircraft, 127, 289
Piper, William, 62
Plinton, James O., 126
Pluto, 561-563
polar orbit, 490
Popson, Major Raymond Y., 132
Powell, General Colin, 150
PPS, 253
precipitation, 390
pressure gradient, 396, 397
probes, 574
Project Apollo 586
Project Gemini, 585
Project Mercury, 583-585
Project Skylab, 587
prominences, 502
propellant, 462
propfan systems, 200
propulsion efficiency, 482
Pulitzer Trophy Race, 54
Pulitzer, Ralph, 54
pulsar, 544
pure jet, 125
pyroferroite, 528

Q

Quimby, Harriet, 27
quasar, 543

R

radar, 85,145
radiation, 392
radiation fog, 415
radio (aircraft), 246-248
ramjet engines, 200-201, 483
Raskova, Major Marina, 87
Read, Lieutenant Commander Albert, 45
Reagan, President Ronald, 147
Reciprocating engines, 194-196
Reconnaissance satellites, 570
reducer, 462
relative humidity, 389
Reitsch, Hanna, 63

Renard, Charles, 10
Resolution 660, 147
Resolution 678, 148,154
Rickenbacker, Edward V., 37-39
Ride, Sally, 589
ridge, 397
rime ice, 428-429
RNAV, 254
rockets, 551-554
 Aerobee, 552
 Atlas, 553
 Redstone, 553
 Vanguard, 553
 Viking, 552
 V-2, 553-554
rocket systems, 451-455
 airframe system, 452
 control system, 455
 guidance system, 454
 propulsion system, 453
Rodgers, Calbraith Perry, 25
Rohrbach, Adolph, 63
Rommel, Field Marshall, 93
Roosevelt, Eleanor, 71
Roosevelt, Theodore, 23,25
rotary engines, 31
rotary-wing aircraft, 31
Royal Air Force, 35,78

S

SAC (Strategic Air Command), 114,144
Salyut, 595-596
SAMs (surface-to-air-missiles), 138
Santos-Dumont, Alberto, 11,28
satellite, 562-574
 communications satellite 563
 INTELSAT, 563,
 Galaxy, 564
 Tracking and Data Relay Satellite System, 564
Saturn, 532-534
Schneider Trophy Races, 55
Schneider, Jacques, 55
Scientific satellites, 570
Scramjet, 483-484, 487-488, 491
SCUD missiles (surface-to-surface missiles), 150
Seaplanes
 Boeing, 314, 65
 Clippers, 65
section aeronautical charts, 234-236
Sedna, 564-565
Seguin, Laurent and Gustav, 30
Selfridge, Army Lieutenant Thomas, 23
Short brothers, 30
Sikorsky, Igor, 30, 63, 64, 65

single-engine monoplanes, 169
 Shepard, Alan 584
 Skylab 596-596
 slats, 203
 Smallwood, Charles, 71
 smart weapons, 139
 Smith, Elinor, 53
 smoke, 425
 soaring, 292-293
 sojourner, 549
 solar radiation 394
 solar wind, 503, 507-508
 solid propellants, 466
 sound barrier, 129, 176
 South Korea, 119
 Soviet Union, 113, 119, 147
 Soyuz, 595
 Spaatz, General Carl, 114
 space, 499
 Spacelab, 590, 597-599
 Space Shuttle, 588-592
 Atlantis, 589
 Challenger, 589
 Columbia, 589
 Discovery, 589
 Endeavour, 589
 Space Station Alpha, 602
 space suits, 601
 special-use airspace, 238
 specific impulse, 455
 Spencer, Chauncy, 71
 Spirit, 550-554
 Spirit of St. Louis, 59-60
 Spoilers, 203-204
 SPS, 253
 STOL airplanes, 339-340
 Sputnik 1, 554
 St. Petersburg-Tampa Airboat Line, 32
 stationary front, 408
 stalls, 184
 Star Wars, 147
 Stearman, Lloyd, 61, 62
 strafe, 81
 stratocumulus, 412
 stratopause, 382
 stratosphere, 382
 stratus clouds, 410
 Stringfellow, John, 14
 Sun, 501-505
 Sunspots, 502, 503
 sunsynchronous orbit 490
 supernova, 542-543
 supersonic flow
 compression wave, 187
 expansion wave, 187

 shock wave, 187
 supersonic transport (SST), 168
 swept-back wings, 132
 Symington, Stuart, 114

T

Taylor, Charles, 25
 Taylor, G.C., 62
 technical/vocational schools, 366-367
 temperature, 391
 Tet Offensive, 139-140
 Thaden, Louise, 56
 The 100-Hour War, 153
 The Korean War, 119-123
 thermosphere, 382, 384
 Thirty-Eighth Parallel, 120
 Thompson Trophy Race, 55
 Thompson, Charles E., 55
 thrust, 183
 thrust vectoring, 185
 thunderstorms, 430-431
 tiltrotor, 268
 TLAMs (Tomahawk Land Attack Cruise Missiles), 151
 Tonkin Gulf Resolution, 136
 tornadoes, 431-432
 Torricelli, 6
 total velocity requirement, 482
 Towers, Commander J., 45
 Trainers, 326
 trajectory, 477
 tranquillityite, 528
 transports and tankers, 322-326
 Treaty of Versailles, 77
 Trenchard, General Hugh, 40,94
 tropic weather, 437-438
 tropopause, 382
 troposphere, 382
 trough, 397
 Trout, Bobbi, 53
 true airspeed, 241
 true-course line, 239-240
 Truman, President Harry, 108
 Truman, Senator Harry, 71
 Turbine engines, 196-197
 Turbofan engines, 199
 Turbojet, 303-306
 turboprop, 125, 303
 turboprop engines, 199
 turbulence, 184, 419
 Tsiolkovsky, Konstantin, 446
 Types of landing gear, 207-209

U

ultralights, 294-295
United Nations, 119
Unmanned air vehicles, 343-344
upslope fog, 415
Uranus 534-535
US Air Force Academy, 373-374
utility aircraft, 327

V

Van Allen Radiation Belts, 509
velocity requirement, 480
Vega, 61
vengeance weapons, 116
Venus, 524-525
Venus Express, 542, 544
Vietnam Conflict, 134-143
Vietnamization, 140,141
Viking 1&2, 529
Visibility, 424
visual flight rules, 424
vomit comet, 517
von Braun, Wernher, 116, 551-552
von Clausewitz, Carl, 150
von Guericke, 6
von Richthofen, Baron Manfred, 37
von Zeppelin, Ferdinand, 11
VOR receiver, 248, 250-251
Voskhod 594
Vostok 594
VTOL (vertical-takeoff-and-landing), 129, 340-343

W

WAFS, 91
Walker, Joe, 159
Walleye, 139
warm front 407
WASP, 92
wave drag, 187
waverider, 223
weather radar, 250
Weather satellites 567
 Nimbus, 567
 Tiros, 567
weight 388
weight distribution, 185
Wenham, Francis H., 12
West Virginia Institute, 71
Westwind, 305
WFTD, 92
White, Dale, 71

White, Ed 586
whiteout 426
Whittle, Frank, 115
wind 394
wind shear 417
wind triangle, 241
winglets., 163
wing-warping technique, 16
Women's Air Derby, 56
World War I, 33-41,47
World War II, 77-109
Wright brothers, 16-19, 22-23, 178

X

X-prize, 635-637

Y

Yeager, Charles E. "Chuck", 130, 176

Z

zeppelins, 11