

Definitions

1. Inertia – A body at rest will remain at rest, and a body in motion will remain in motion at the same speed and in the same direction unless acted upon by some external force.

2. Acceleration – The force required to produce a change in motion of a body is directly proportional to its mass and rate of change in its velocity.

$$A = \frac{\text{Force (f)}}{\text{Mass (m)}}$$

3. Action-Reaction – For every action, there is an equal and opposite reaction.

4. Torque Effect – Rotors have a counterclockwise rotation, causing the aircraft to move clockwise.

5. Bernoulli's Principle - states that as the speed of a moving fluid increases, the pressure within the fluid decreases. As static pressure decreases, dynamic pressure increases.

6. Law of the conservation of energy – energy is neither created nor destroyed.

7. Venturi Effect - the increase in velocity of a fluid as it passes through a constriction; used, in a Venturi tube, to measure fluid speed.

8. Airfoil – A surfaced body or structure designed to produce lift or thrust force when subjected to airflow.

9. Leading Edge – rounded portion that projects into the relative flow of air. **Relative wind.**

10. Trailing Edge – Tapered portion that trails from the relative flow of air. **Relative wind.**

11. Chord – The length of the cord from leading edge to trailing edge.

12. Chord Line – A straight line intersecting leading and trailing edges of the airfoil.

13. Camber – shape or curvature.

14. Mean Camber line – A line drawn halfway between the upper and lower surfaces.

15. Span – The length of the rotor blade from the point of rotation to the blade tip.

16. Center of Pressure – The point along the chord line through which all aerodynamic forces are considered to act.

17. Aerodynamic Center – The point along the chord line where all changes to lift effectively take place.
18. Symmetrical Airfoil – Equal camber on each side of the chord. Constant center of pressure; ease of construction; cheap; less lift; undesirable stall characteristics.
19. Asymmetrical Airfoil – Cambered upper surface; flattened lower surface; increased lift/drag ratio; better stall characteristics; expensive; center of pressure causes twisting force and stress on the airfoil.
20. Rotational relative wind – Flow of air parallel to and opposite the flight path of an airfoil.
21. Airspeed relative wind – The component of the total relative wind velocity created by the directional flight velocity/airspeed; airspeed + rotational relative wind.
22. Induced Flow – a downward flow of air.
23. Resultant relative wind – airflow from rotation that is modified by induced flow.
24. Up Flow – Airflow approaching rotor disk from below or from blade flapping, alters AOA.
25. Angle of Incidence – Angle between chord line and plane of rotation (tip path plane). Collective pitch changes it; mechanical angle.
26. Angle of Attack – angle between relative resultant wind and chord line; aerodynamic angle; large angle equals lift; small angle equals reduction of lift; critical angle is 15 to 20 degrees; stall occurs after critical angle is exceeded.
27. Dissymmetry of lift – Difference in lift between advancing half of rotor disc and retreating half. Aircraft would roll left and pitch up. Blade flapping - upflow of air resulting in greater AOA and cyclic feathering – angle of incidence increased in retreating blade and decreased in advancing blade.
28. Translational Flight - relative wind velocity equals blade speed plus airspeed.
29. TAF – lift and drag.
30. Lift – useful component of TAF. Decreases at stall angle.
31. Drag – Non-useful component of TAF. Parallel to and in the same direction as resultant relative wind.

32. Induced Drag - results from lift – vortices and induced flow. Tilts TAF backwards.
33. Profile Drag – causes by friction of the rotor blade.
34. Parasite Drag – drag created by non-lifting portions of the helicopter.
35. Un accelerated Flight – no change in direction or speed. All forces equal.
36. Accelerated Flight – unequal forces in flight.
37. Lift needs high pressure, low temperature, low humidity $L = C_l \cdot \frac{\rho}{2} \cdot V^2 \cdot S$
38. Rigid rotor – hub rigidly to mast, blades rigidly to mast, blades flex.
39. Semi-rigid – Two bladed, tilting disc relative to mast, opposite unit work simultaneously.
40. Articulated – multi-bladed; blades flap up or down, lead or lag, hinged independently.
41. Centrifugal force – Provides rigidity to the blades.
42. Coning – Upward flexing of blades. Greatest at blade tip compromise lift and centrifugal force, lift stronger blades flex upwards.
43. Excessive Coning – low RPM, High gross weight, High “g” maneuvers, turbulent air. 15-3.6, 30-15.4, 45-41.4 60-100. Loss of disc area, loss of lift, stress on blades.
44. Precession – causes right turn to nose up, left turn to nose down.
45. Straight Blade – high speed, high lift at tip, coning would occur.
46. Tapered Blade – Less lift, does not affect lift at hub, loss of total lift.
47. Twisted Blade – more lift at hub, less lift at tip, most popular.
48. Blade out of Track – low frequency vertical vibration; increased instability.
49. Right yaw – greater power to engine.
50. Left Yaw – Decreasing power to engine.
51. Translating Tendency – correction by left cyclic, tilting of the mast slightly, rigging of cyclic pitch system.

52. Semi rigid Rotor – rotation, flapping, one flaps up, other flaps down; cyclic feathering, increases pitch of one blade, while decreasing pitch of another for directional control and dissymmetry of lift.

53. Articulated Rotor – rotation, independent flapping, feathering, collective and cyclic, Hunting – lead or lag of blade

54. Total Force – Acts perpendicular to the tip path plane; total force tilts with rotor disc tilt. Thrust is produced by tilting tip path plane; vertical component of total force opposes weight; horizontal component of total force opposes drag.

55. IGE – one rotor disc diameter, no-wind, smooth surfaces, reduction of rotor downwash; loss caused by trees or brush, tall grass, uneven surface, translational movement, hovering into wind.

56. OGE – greater than 1 rotor disc, hovering at higher altitudes; increase in rotor downwash and blade-tip vortices.

57. ETL – relative wind more horizontal resulting in more vertical lift, less induced drag, increased AOA; less turbulent air; at 16-24 knots; nose pitches up, add forward cyclic.

58. Transverse Flow Effect - downwash of wind to aft section of rotor system; makes blade vibrate.

59. Settling with Power – settling in your own downwash; high vertical rate of descent; high rate of descent 300FPM modified by gross weight, rotor rpm, and air density; slow airspeed; high power consumption; loss of collective pitch effectiveness; vibrations.

60. Settling with power OGE above hovering ceiling, within hovering ceiling without precise altitude control; formation flights; mask/remask operations; downwind approaches; a steep powered approach in which airspeed drops to zero; corrective actions increase speed with cyclic and reduce collective pitch and adjust rotor rpm to normal range.

61. Angular Unbalance – inequality of hunting action of the rotor blades.