

Glider Pilot

Aeronautical Knowledge Review

by Frank S. Phillips, Jr.

It's a beautiful day! Let's go soaring!

How many times have you heard or said these words? Before you go, here's a refresher list of things you should remember from your student pilots days. It's also a good reminder of the many facts needed to pass the glider practical test.

Remember, for any flight, determine runway(s) length, get all available information, and use checklists!

WEATHER

Briefing

800-WXBRIEF: give "N" number, type of aircraft, location, planned route (if cross-country), time of flight, etc. Ask for NOTAMs (distant and local).

TERMS

AIRMET

Issued for moderate icing and turbulence, winds 30 KTS +, visibility less than 3 miles, ceilings below 1,000'.

SIGMET

Issued for all aircraft for severe/extreme turbulence, icing, obstructions to visibility.

Convective SIGMET

Issued for tornadoes, lines of thunderstorms; embedded thunderstorms; hail 3/4 inch +.

Ceilings

Lowest reported broken, obscuration, or overcast cloud layer (height AGL).

Cumulonimbus

Clouds with the greatest *turbulence*. (avoid by 20 NM)

Dewpoint

Temperature at which visible moisture forms when the air saturates.

Cloud Base

Temperature and dewpoint in upward moving air converge at rate of about 4.4° F or 2.5° C/1,000 feet (to estimate cloud base, divide Fahrenheit ground spread by 4 [Celsius, by 2.2] and multiply result by 1,000 feet).

Vision Obstructions

Are *fog, haze* (worse when flying into the sun), *rain, smoke, smog*

Front

Is a boundary between *two air masses* and is indicated by *wind change*.

Warm Front

Temperature inversions (goes up with altitude); poor visibility; smooth/stable air; stratiform clouds; drizzle; fog (forms from evaporation of precipitation).

Cold Front

Temperature goes down with altitude; good visibility; turbulence/unstable air; cumuliform clouds.

Soaring Forecast

Thermals depend on sinking cold air that forces warm air upward.

Thermal Index (TI)

The strength of thermals (TI) is shown by difference between the dry adiabatic lapse rate (5.4°F/3°C per 1,000' from the forecast maximum or trigger temperature) and the actual lapse rate. The greater the negative difference at a given altitude, the stronger the lift will be at that altitude.

Thunderstorms (TS)

Lifting, moisture, unstable air, and lightning (always); developing/cumuliform stage = updrafts; mature = rain; dissipating = down drafts. *Avoid TS!*

Squall Line TS

Narrow band of thunderstorms and are *most intense hazard* to aircraft.

Winds

Reported aloft true direction, in knots; on the ground, reported as magnetic.

THE PILOT

I'M SAFE?

Illness?

Medication?

Stress?

Alcohol?

Fatigue?

Eating?

Self-Certification

Know of or reason to know of any condition that affects ability to fly safely.



Alcohol	Do not fly within 8 hours of use; under the influence; or with more than 0.04% BAC.
To Act as PIC	Must have pilot <i>certificate</i> and had a <i>flight review</i> w/in 24 calendar months. (WINGS Program may substitute for flight review.)
To Carry Passengers	3 takeoffs and 3 landings as sole manipulator of glider in preceding 90 days.

THE GLIDER

A R R O W	A irworthiness Certificate R egistration Certificate R adio License (on international flights) O perating limitations W eight and balance information or data
Airworthiness Assembly	Owner/operator maintains, but PIC responsible to determine airworthiness. A pilot certificate holder may assemble or disassemble a glider if specified in the glider flight manual. <i>Pilot must make a maintenance record entry of the work performed with description, pilot's name, and date.</i>
Control Check	<i>Always! Perform positive control check after each assembly!</i> <i>Always! Perform a positive control check before each flight!</i>
Inspections	Must have annual inspection and comply with AD's. A 100 hour, if for hire.
Towline Strength	Towline: not less than 80% nor more than twice the gross weight of glider. If towline strength more than twice, install safety (weak) links: one at glider, 80% to twice gross weight; and one at tow plane, greater in strength than one at glider, but not more than 25% greater or twice glider gross weight.
Oxygen System	PRICE check: P ressure, R egulators, I ndicator, C onnections, E mergency

PERFORMANCE AND FLIGHT PLANNING

Weight & Balance	Weight = basic empty weight (including optional equipment) + occupants and gear.
Center of Gravity (c.g.)	AFT - Worse stability, lower stall speed, better performance. FORE - Better stability, higher stall speed, worse performance.
Ballast (check)	If needed, <i>install properly!</i> Use to <i>adjust c.g.</i> or to meet c.g. limits. Ballast (often water) may be used to alter the best L/D speed (see below).
Density Altitude (DA)	Determines performance. As DA increases, performance will decrease. DA increases as temperatures increase; DA increases as pressure lowers.
Pressure Altitude	Set altimeter to 29.92" (or calculate: 1" Hg = approx. 1,000 feet of altitude)
L/D (Lift/Drag) Ratio	When L ift over D rag ratio is greatest (maximum lift, minimum drag), best glide is achieved (most horizontal distance for each foot of altitude lost). Best L/D speed varies with weight. As weight increases, best L/D speed increases. (L/D is a function of wing design and is constant, regardless of weight.)
Minimum Sink Speed	Speed at which least loss of altitude occurs in a given period of time. As weight (load factor) increases, <i>minimum sink speed</i> (sink rate) increases.
Rules of Thumb	Speed up in sink (between thermals). Slow down in lift (minimum sink speed).
Speed to Fly	With sufficient altitude, when using variometer speed ring, fly down rate = to average rate of climb in last thermal, or with less sophisticated instruments, - In good conditions, fly approximately 20% above best L/D. - In poor conditions, fly the best L/D.
Cross-country Profile	Used to determine minimum enroute altitude at any particular point in flight. Safety margin: plan using 1/2 of published L/D for loss of expected lift Glide ratio varies with wind (head wind decreases it; tail wind increases) - For a tail wind component, plan to fly using the best L/D airspeed - For a head wind component, plan to fly L/D plus 1/2 estimated head wind - Plan to leave departure airport and arrive destination airport at 1,000' AGL - Plot minimum altitude lines for glide to departure and destination airport - Lines will show go-ahead minimum altitudes for flight



AERODYNAMICS

Angle of Attack (AOA) Angle between relative wind and chord. Increasing AOA, increases lift and drag.

[NOTE: If weight or wing loading is increased, more lift will be required].

Stalls Occur at a specific AOA. A stall can occur at any airspeed or any attitude.

Stall speed increases with weight (higher angle of attack to get more lift).

Turns increase stall speed due to higher load factor.

Spins A glider must be stalled to spin (a spin is an aggravated stall).

Three Forces in Flight **Lift**, **drag** (induced and parasite), and **gravity** (glider weight acting downward).

Total drag = induced (decreases with speed) + parasite (increases with speed)

FLIGHT OPERATIONS

Local Procedures Be familiar with local field conditions and signals (may vary from site to site)

Pre-flight Briefings Pre-flight discussion with tow pilot on all procedures, including emergencies

Plan of action Before each launch, have a plan of action (situational awareness)

Passengers On how to exit; *on seat belt use*, and notify to *fasten* before takeoff/landing

Parachutes If used, review procedures for use and brief passengers on proper use

Airspeed Indicator White arc shows flap range

Green arc shows normal range

Yellow arc shows caution

Red line shows never exceed speed

Magnetic Compass Lags North of East and West headings; and leads South of East and West

ANDS On East or West heading, **Accelerate**, it turns **North**; **Decelerate**, **South**.

Take-off Roll At lift off avoid excessive back pressure, wait for tow plane to lift off and climb

Towline Break: Fly glider first, then evaluate situation: wind, obstacles, altitude, etc.:

- If safe landing can be made ahead, land ahead, into the wind;
- If sufficient altitude has been attained to return *safely* to field (usually at least 200 feet or more above the field elevation), return to field.

Airborne Signals

Turns **Left**, glider moves to right and gently pulls tow plane tail.

Right, left, then same

Speed change • *Faster*, glider rocks wings directly behind tow plane

• *Slower*, glider fish tails directly behind tow plane

Spoilers Out Tow plane waggles rudder (not a yawing motion).

Emergencies • If tow plane rocks wings, *release immediately! Mandatory release!*

• If glider cannot release, maneuver to a tow position visible to tow pilot and rock wings. After assuring tow pilot understands, maneuver back to normal tow position that will avoid tow rope coming back over wing.

• If tow pilot unable to release, tow pilot signals with yawing motion.

Severe Turbulence Maintain level flight attitude and use *V_a* (maneuvering speed) or lower speed

NOTE: *V_a* (not shown on airspeed indicator) varies with weight
as weight goes down, *V_a* (maneuvering speed) goes down.

FLIGHT ENVIRONMENT AND PROCEDURES (AIRSPACE, SECTIONALS, AIRPORTS, ETC)

Class A (18,000' MSL to FL600) set altimeter to 29.92"; requires IFR or ATC authorization (Air Traffic Control facility having jurisdiction for the specific Class A airspace)

Class B (Blue line) must have ATC clearance and Mode C transponder to enter.

Class C (Magenta line) must establish 2-way communication with ATC & Mode C transponder.

Class D (Dashed blue line) has operating control tower; must establish communications.

Class E Blue tinted line indicates a floor 1,200' AGL or greater that abuts Class G airspace. Magenta tinted line indicates floor at 700' AGL. Dashed magenta line indicates Class E starts at surface (surface area Class E). Broken blue line (off set, jagged line) indicates floor of Class E greater than 700' AGL. (See aeronautical chart)

Class G Is any airspace other than controlled airspace (outside of Class A, B, C, D, and E).

Class E or G Operating control tower shown as blue airport; communication 4 NM, 2,500' AGL



MOA	(Magenta colored line with magenta hash marks) military operations, use caution.
Restricted Area	(Blue "R", blue line with blue hash marks) enter only with controlling agency okay.
Prohibited Area	(Blue "P", blue line with blue hash marks) do not enter; it's a "NO, NO" to be there!
Gray line:	Military training route with speeds greater than 250 knots; VR indicates VFR; IR, IFR 4 digits indicates flights at and below 1,500' AGL; 3 digits, from surface up.
Federal Airway	4 nautical miles either side of blue (Victor airway) line, from 1,200' AGL to FL180.
Traffic pattern	Traffic pattern indicators depicts the direction that <i>airplanes</i> turn in pattern.
VASI	"All red, you're dead (low); red over white, you're all right." (all white, too high)
Transponder	7700 - Emergency use 7600 - No radio 7500 - Hijack 1200 or as ATC assigns - VFR As assigned by ATC facility - IFR (glider pilot must have instrument airplane rating)
Mode C:	Over 10,000 MSL, B and C airspace; above C; and Mode C veil (30NM of Class B)
Oxygen	Crew 12,500 – 14,000' MSL over 30 minutes; crew above 14,000' MSL; all over 15,000'.
ELT	Test during first 5 minutes after hour; replace battery after 1 hour cumulative; charge at 50%.
Emergencies	Pilot may deviate from any rule to meet an emergency and if requested and get handling <i>priority</i> , must submit <i>detailed report w/in 48 hrs if requested</i> by ATC manager. <i>Declare emergencies to ATC, or if not talking to ATC. use 121.5 MHz or 243 MHz</i>
EFAS	For enroute weather advisories (above 5,000' AGL) <i>contact: FSS 122.0 MHz.</i>
Right of Way	Aircraft (a/c) in distress have right of way (ROW) over all other a/c; balloons over other a/c; gliders over airplanes, rotorcrafts, and airships; a/c towing or refueling over other <i>powered</i> a/c. When head-on, go to right. Overtake other a/c, pass to the right (note ridge below). Landing a/c has ROW. Lower a/c on final has ROW.
Ridge Flying	<i>The industry guidelines for ridge soaring</i> (check for local conditions that vary): approach ridge at shallow angle; never pass directly over or under other gliders flying the ridge; pass slower gliders on inside toward the ridge; make all turns away from ridge into the wind; if approaching each other head on, give way to the right.
Thermals	Fly at minimum sink speed, make turns in same direction as other gliders
No Aerobatics	No intentional abrupt maneuver unnecessary for normal flight over <i>congested area or open air assembly</i> ; on <i>Federal Airway, below 1,500' AGL; or less than 3 miles visibility.</i>
Light Signals (from control tower)	On GROUND: Green - takeoff Flashing Green – taxi Red – stop Flashing Red - clear runway Flashing White - return to starting point In FLIGHT: Flashing green - return for landing Green - land Red - give way/circle Flashing Red - airport unsafe Red/Green - use caution
Minimum Altitudes	
Sparse Areas	500' AGL. No hazard to and 500' from persons/property.
Congested Areas	1,000' above highest obstacle within 2,000' radius.
Altimeter Settings	Use reported barometric pressure. If none available, use field elevation. Over 18,000' MSL (must have ATC authorization), set altimeter to 29.92".

SOME ODDS AND ENDS

Parachutes	<i>Unless each occupant is wearing an approved parachute, a pilot carrying any person other than a crew member, may not execute any intentional maneuver more than 60° bank, 30° pitch up/down. Always brief on use and proper fit!</i>
Packing	<i>If available for emergency use, must be packed by certified and appropriately rated rigger within preceding 120 days if a chair type, or if other type:</i> Nylon, rayon, or similar synthetic material within preceding 120 days Silk, pongee, or other natural fiber within preceding 60 days



Survival Gear Food, water, clothing, and equipment appropriate to planned flight environment.

Landing Out Be prepared for unplanned landings at all times, especially on cross-country flights. Industry standards recommend to start serious search at 3,000' AGL; at 2,000' AGL, narrow options to select a specific, safe field by 1,500' AGL

MEDICAL

Dehydration

Water depletion: carry and drink water to replenish bodily fluids.

Fatigue

Causes below par performance; get proper rest and stop flying when tired.

Heat

Aggravates dehydration and fatigue

NOTE

Dehydration, heat, and fatigue can impact judgement and performance

Hypoxia

Oxygen deficiency. Go lower or use oxygen. Smoking/night increase effect.

Hyperventilation

Caused by rapid breathing, often from stress; hold breath or breathe into bag

Scanning

Scan in segments of 10° for at least one second to allow eyes to focus.

Spatial Disorientation

Temporary confusion, rely on instrument indications, not body signals.

WAKE TURBULENCE CREATED BY LARGE AIRCRAFT

Avoid large aircraft tip vortices. Avoid flight below, behind, and downwind of its flight path.

NTSB ACCIDENT AND INCIDENT REPORTS (NTSB 830)

Immediately

Must report immediately an in-flight fire, an overdue aircraft, a flight control system malfunction or failure, incapacity of a crewmember to perform duty due to injury or sickness, damage to property (other than aircraft) exceeding \$25,000 (estimated).

Accidents

Must submit report within ten days

Incidents

Report on request.

Have a safe soaring flight!

VFR MINIMUMS (statute mile [SM] visibility and cloud clearance) IN AIRSPACE CLASSES

	A	B	C and D E (under 10,000' MSL) G (at night)	E (over 10,000' MSL) G (over 10,000' MSL and 1,200' AGL)	G (day: surface to 1,200' AGL)	G (day above 1,200' AGL up to 10,000' MSL)
Visibility	N/A*	3 SM	3 statute miles	5 statute miles	1 SM	1 SM
Clouds	N/A*	clear of clouds	1,000' above 2,000' from 500' below	1,000' above 1 statute mile from 1,000' below	clear of clouds	1,000' above 2,000' from 500' below

* No VFR in Class A Airspace, unless authorized by Air Traffic Control facility with jurisdiction.

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