High Wind Landings

A discussion of high wind landings and the effects of the wind velocity gradient.

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High Wind Landings

At ASG it is only a question of when, not if, you will have to make a landing in high winds.

You need to remember how to calculate your high wind approach speed.

$$V_{approach} = 1.5\ (V_{stall}) + \tfrac{1}{2}\ (\text{Wind}) + (\text{Gust Factor})$$

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Example: Vstall = 40 Kts
Winds are 20G25 (20 gusting to 25)
Gust Factor = 25-20 = 5 Kts
Vappr = 1.5(Vstall) + ½(Wind) + (Gust Factor)
Vappr = 1.5(40) + ½(20) + (5)
Vappr = 75 Kts

In this example your ground speed on downwind will be over 100 Kts. Seeing the ground "flashing by" can result in several instinctive mistakes.

High Wind Landings

It is important that you keep a command of the situation to avoid making these 2 instinctive mistakes:

- *Raising your nose to reduce airspeed*
- *Turning a normal base leg, or even worse, extending the downwind*

High Wind Landings

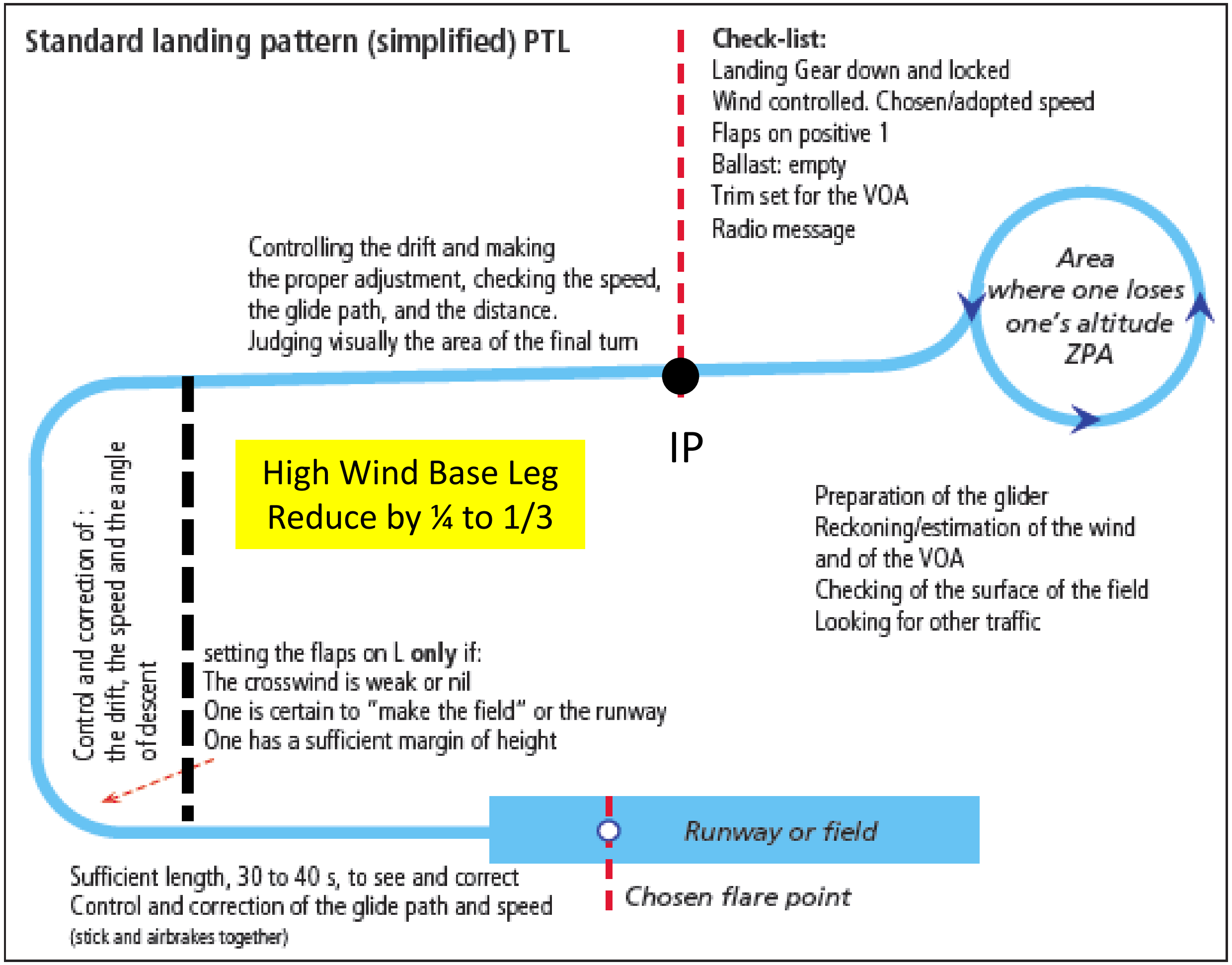
Raising your nose to reduce airspeed

You should already know that your approach air speed was calculated correctly and this high ground speed is the "correct" sight picture.

Turning a normal base leg / Extending Downwind

On final, your glide slope relative to the ground will be steeper than normal. This is because your headwinds are greater than your additional airspeed. The length of your final approach leg will be shorter than normal so you should turn base sooner than normal.

High Wind Landings



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The following example assumes a wind speed of 15 Kts, the lowest wind speed to achieve a fully extended windsock.

The example shows that a glider can cross the R21 boundary at ~ 500’, deploy full spoilers, and not overshoot the end of the runway.

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JAR-22 Design Requirements

"Gliders shall have a glide slope no flatter than 7:1 with spoilers fully extended and flown at an airspeed equal to 1.3 Vso (stall speed in landing configuration)."

Assumptions

Vso is assumed to be 40 (with spoilers extended).
Vapproach is assumed to be 1.3 Vso = 1.3 (40) = 52 Kts.
(This is the JAR-22 no wind approach speed)
Vapproach is assumed to be 60 Kts with this wind speed.
Vertical descent speed is 52 / 7 = 7.4 kts
Resultant ground speed is 60 – 15 = 45 kts
Resultant glide slope relative to ground is 45 / 7.4 = 6.1:1

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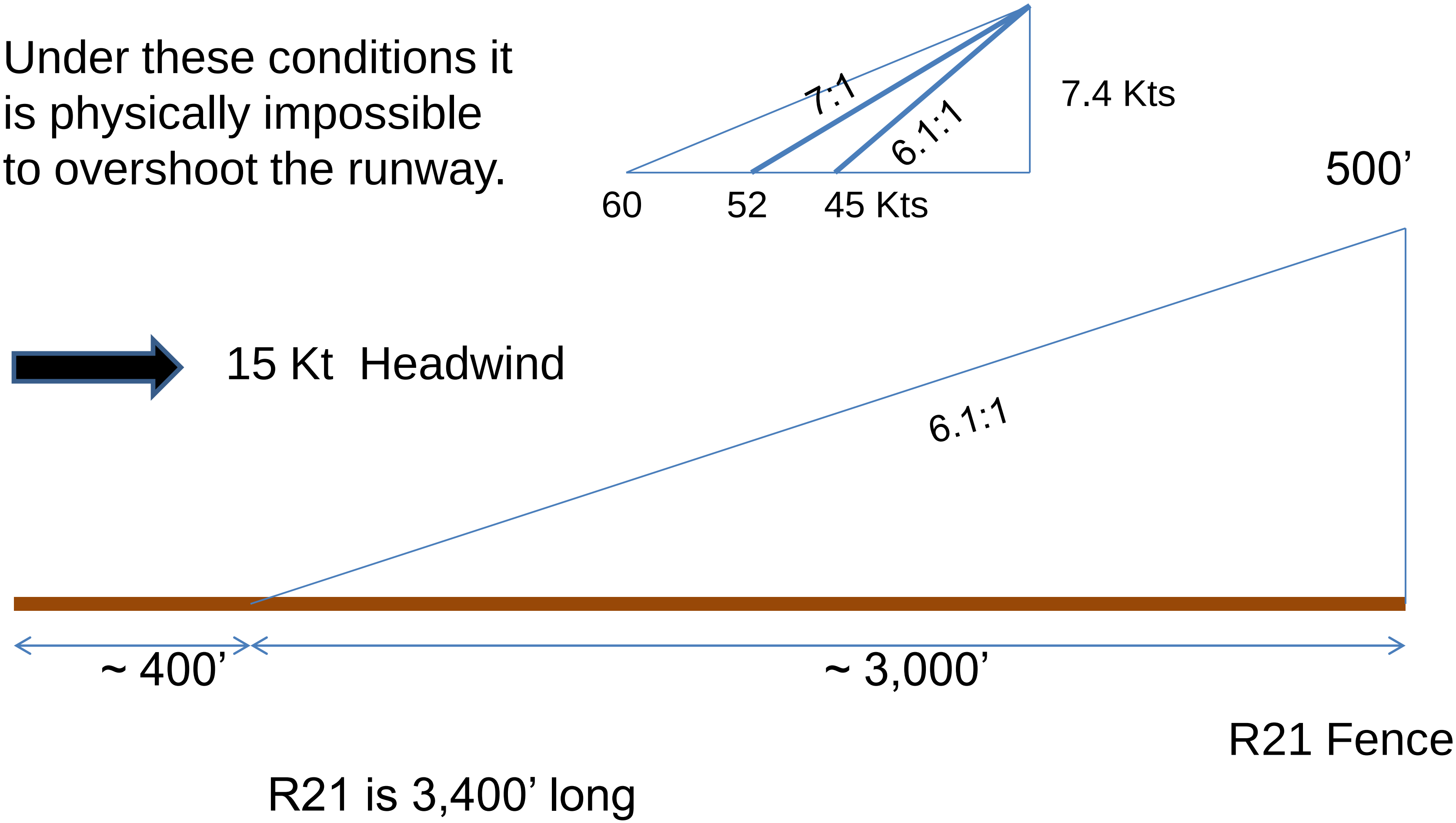
Under these conditions it is physically impossible to overshoot the runway.



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Is this calculation conservative?
The following suggest that it is:

- *Newer gliders are 5:1 not 7:1.*
- *The use of a slip.*
- *A wind velocity greater than 15 Kts (not detectable by the wind sock).*
- *The presence of a wind shear gradient.*
- *Additional altitude loss on final approach*

An altitude of 500’ AGL amounts to 4,800’ MSL, the lowest altitude that needs to be achieved during the base leg of the landing to R21.

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If you want data on the wind velocity gradient close to the ground; who do you talk to?

FAA ?

USAF ?

NWS ?

……… NO !!!!!

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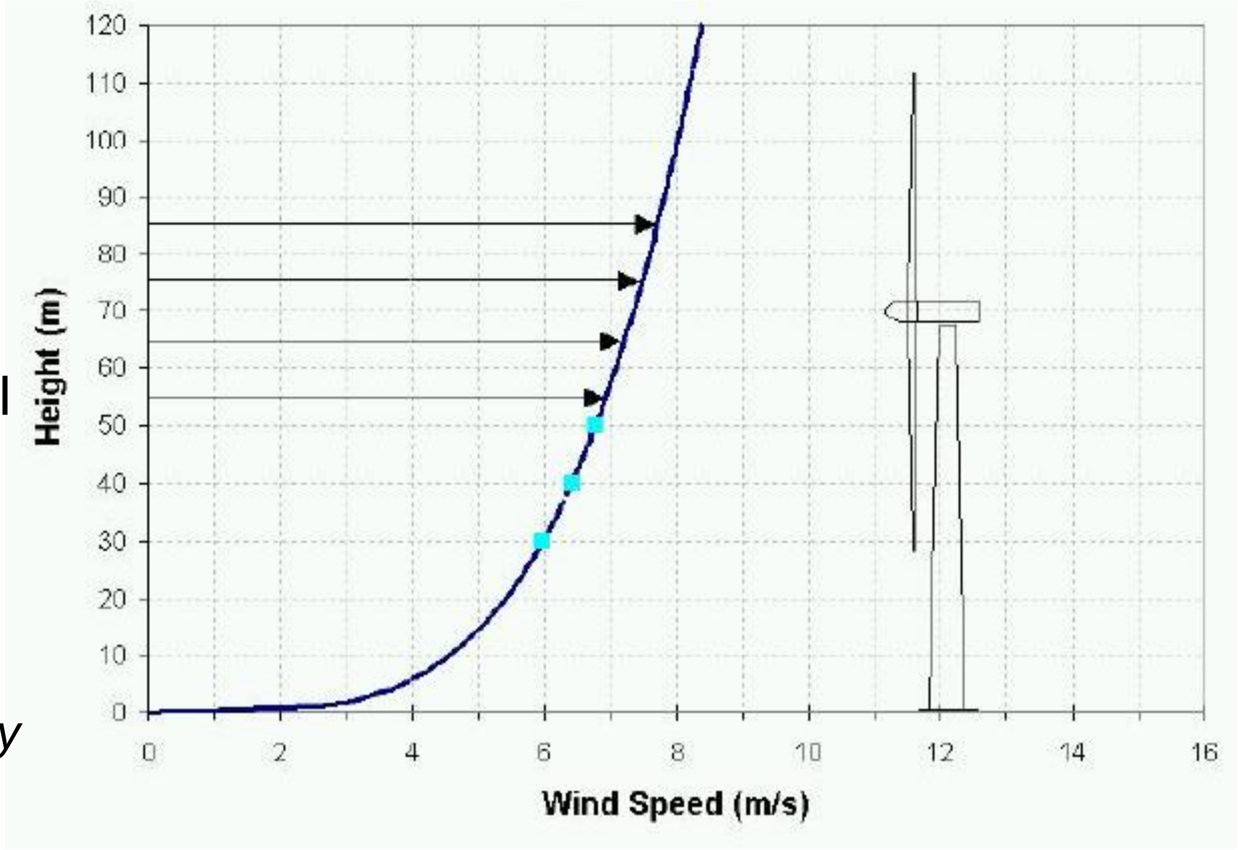
Talk to the Windmill people !!

Windmill efficiency is a function of height.

Blade design is an issue due to differential loading top versus bottom.

- *Stress*
- *Vibration*
- *Aerodynamic efficiency*



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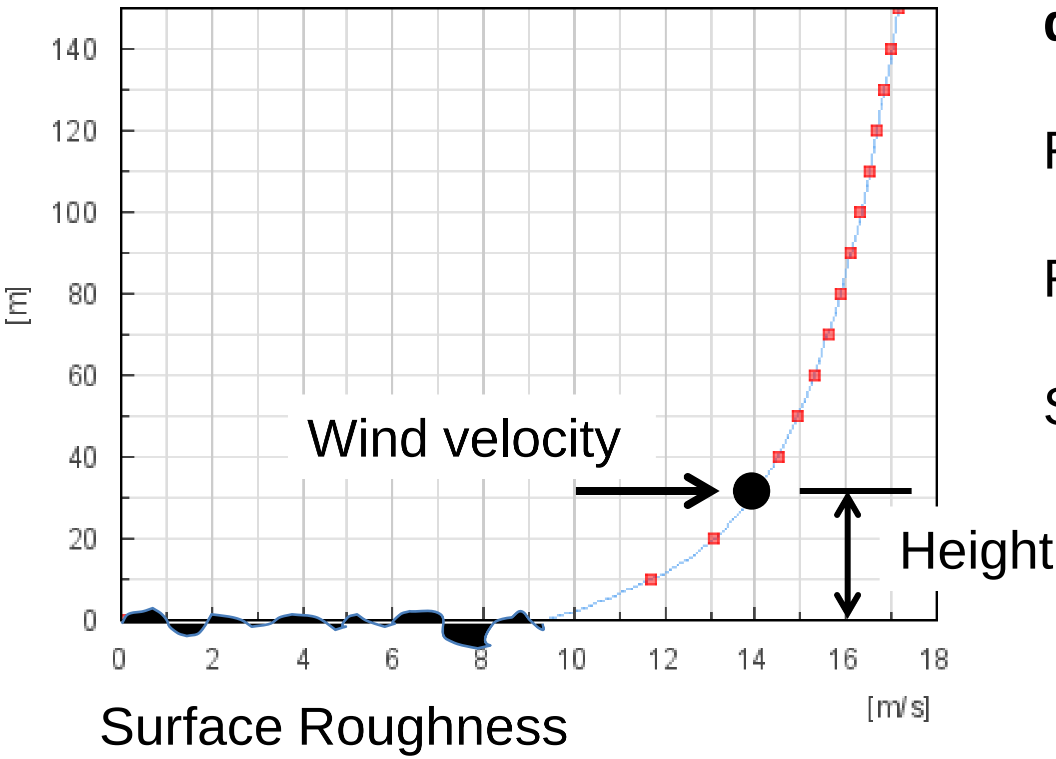

The wind gradient profile is determined by three inputs;

Ref. Point Height

Ref. Point Wind Velocity

Surface Roughness

High Wind Landings

Surface Roughness Definitions	Water	Concrete Runway; Sheep Grazed Land	Open agricultral area w/o fences and hedgerows. (Air Sailing)	Sheltering Hedgerows	Trees, Buildings Cities	
Surface Roughness Class	0	0.5	1	2	3	4
Ratio $\frac{V500'}{V015'}$	1.34	1.44	1.67	1.87	2.35	3.98

~ 70% increase in velocity at 500’ based on a 20 Kt wind at the Windsock

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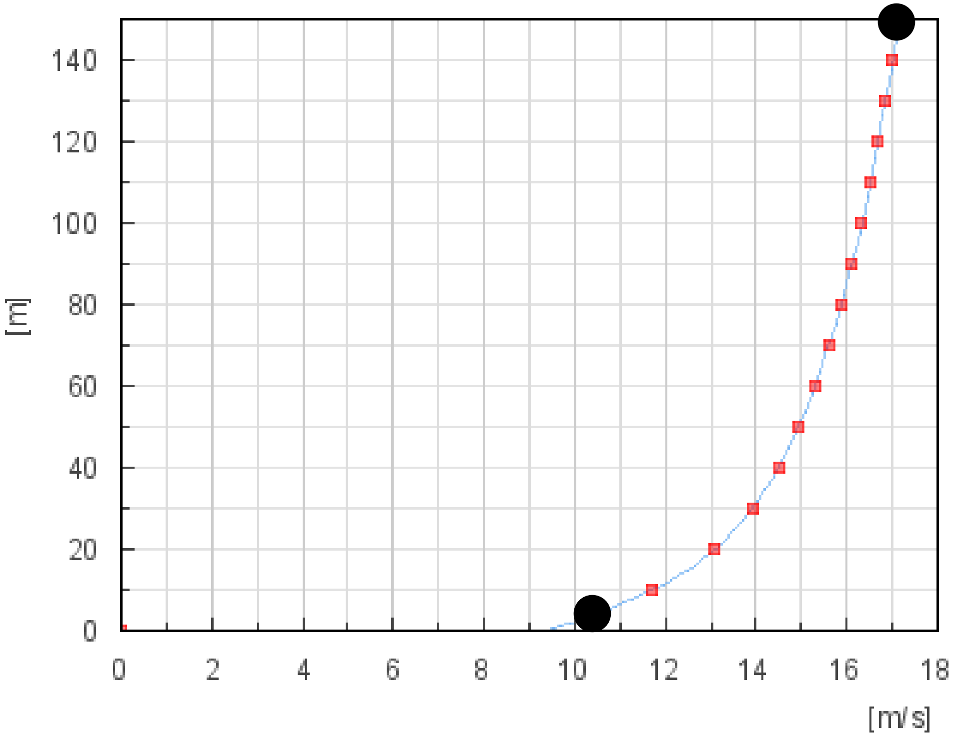
V500’ = 33.3 Kts



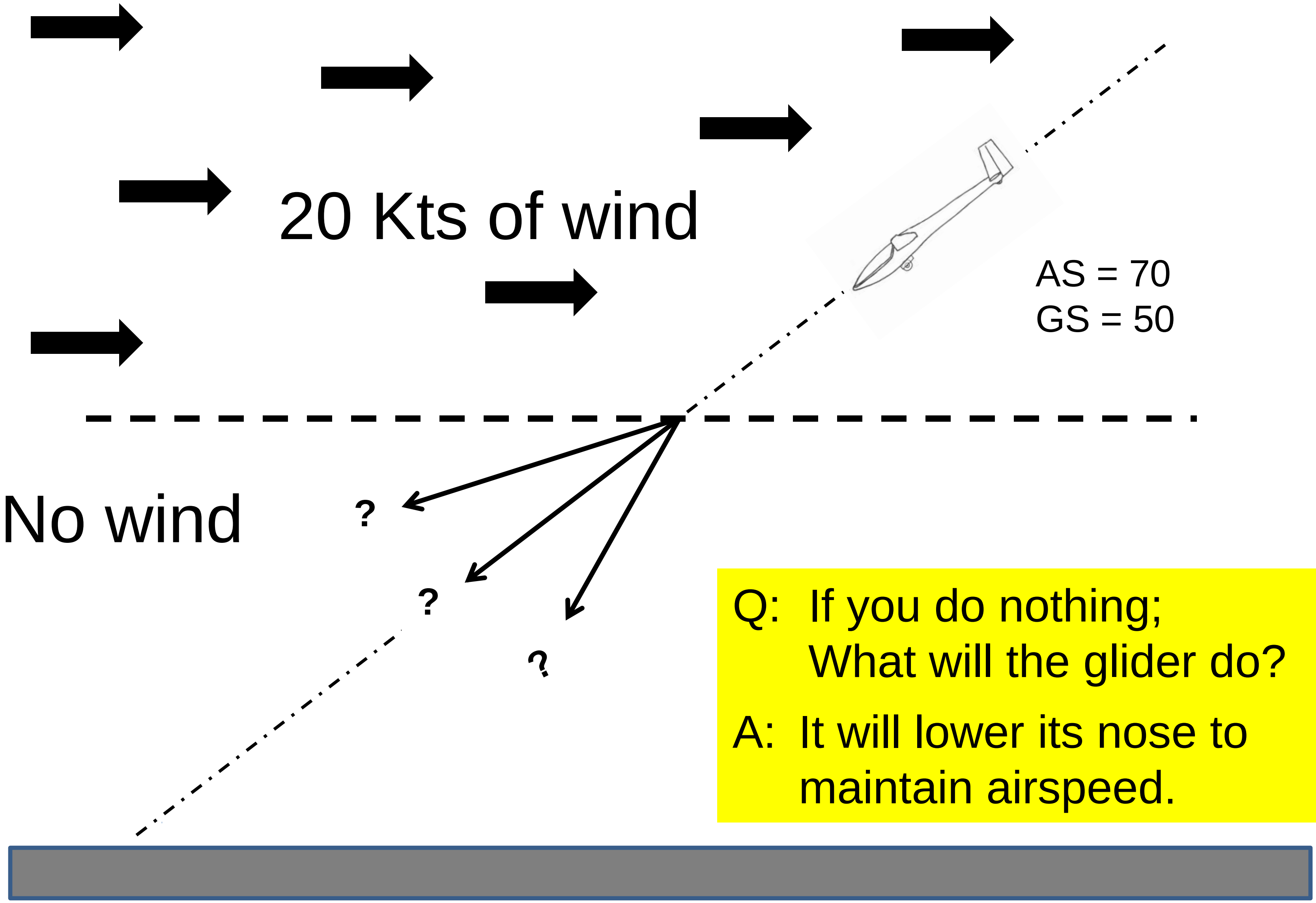
V015’ = 20.0 Kts

This is the wind shear gradient for Air Sailing.

20 Kts at the wind sock means 33 Kts at 500 feet.

The change in the gradient is greatest closest to the ground.

What is the effect of Wind Shear?



Q: If you do nothing;
What will the glider do?

A: It will lower its nose to
maintain airspeed.

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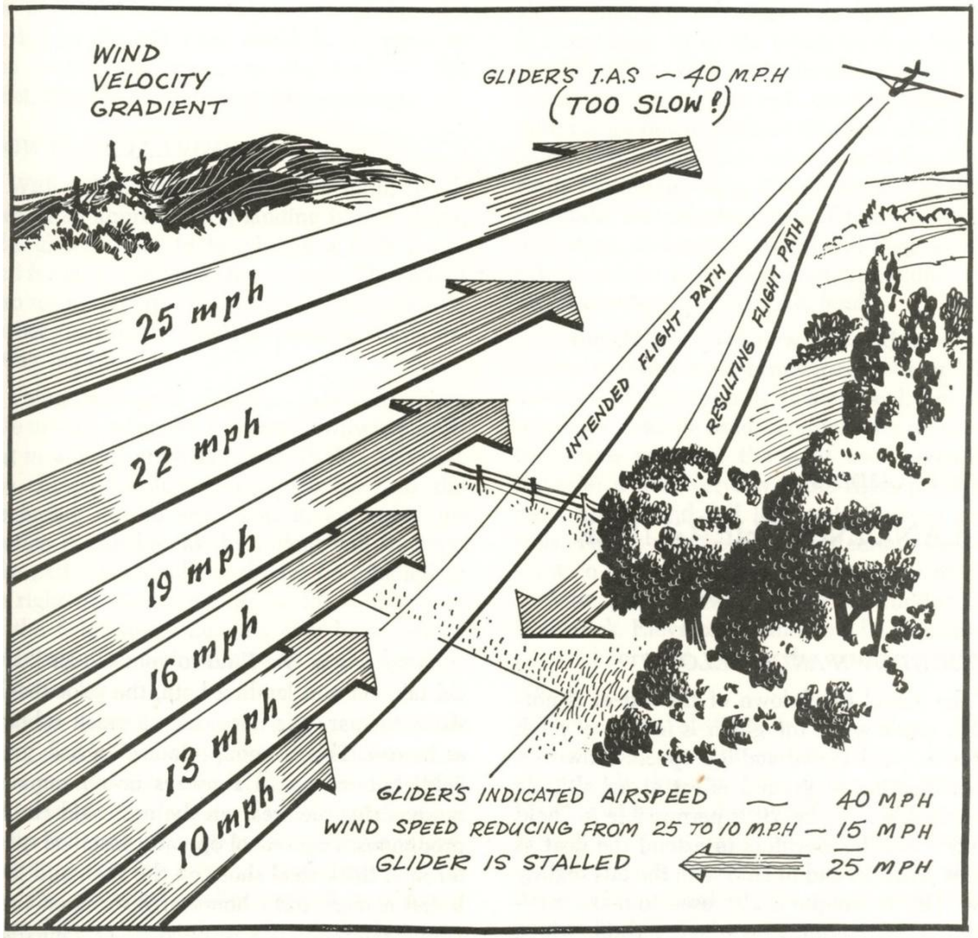
Descending thru wind shear means:

Progressively lowering your nose to maintain <u>airspeed</u>.

And

Progressively closing spoilers to maintain <u>glideslope</u>.



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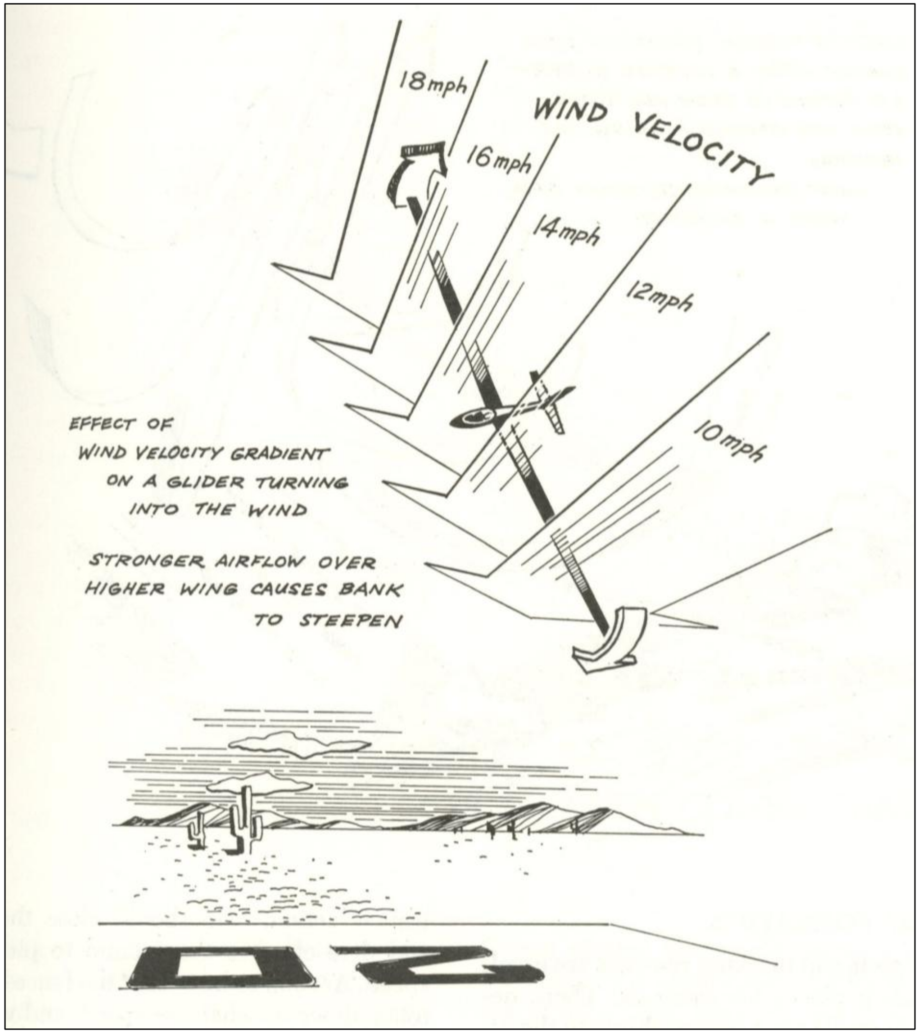
The wind velocity gradient is greatest close to the ground.

A steeply banked turn at low altitude can result in a unexpected and dangerous overbanking roll.



High Wind Landings

Sooner or later you will need to perform a high wind landing.

Done properly they provide a real sense of accomplishment.

Remember to keep your “head in the game” and a “command of the situation”.

Understand what is happening to you and why.

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THE END