Meteorology

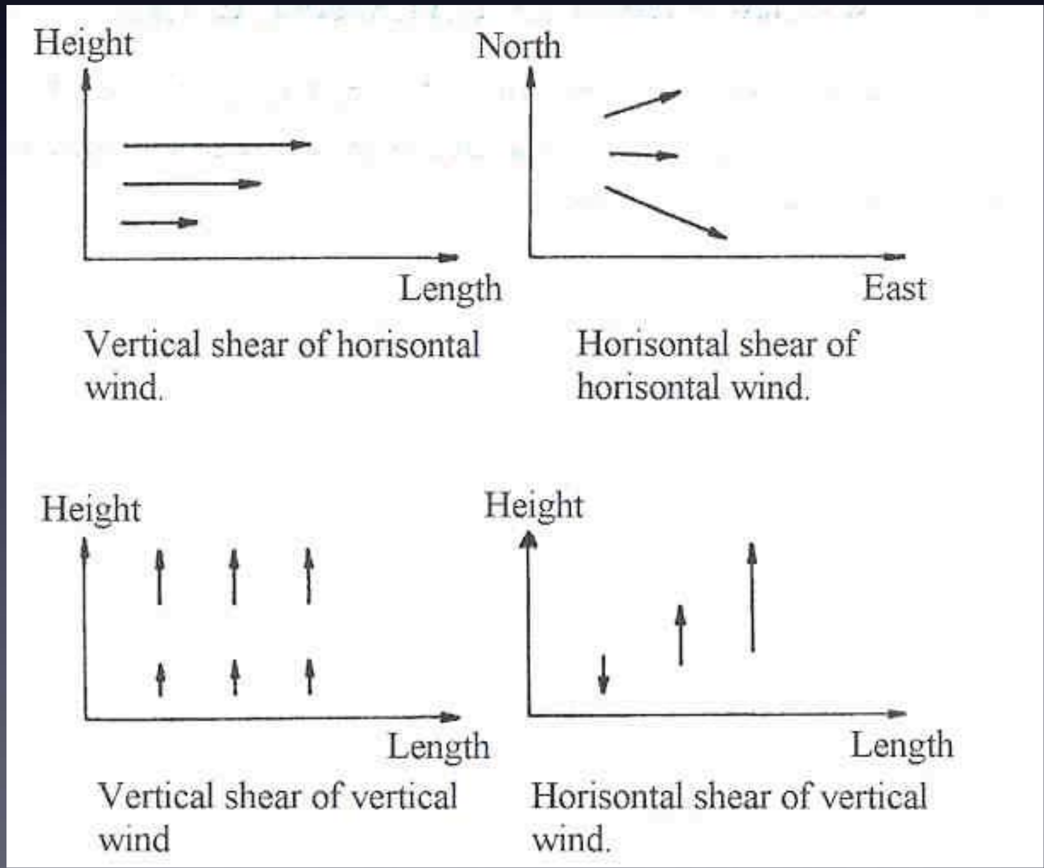
Wind Shear

Wind Shear

Wind shear is a sudden change of direction and/or speed of the airflow.

Wind shear is the difference between the wind in 2 points divided by the distance between them.

(horizontal - vertical wind shear)



Wind Shear

The following criterions of the wind change per 1000 ft may be used for the intensity of wind shear :

Light 0 - 4 kt

Moderate 5 - 12 kt

Severe > 12 kt

A wind shear taking place below 1600 ft is called a low level wind shear

Wind Shear with Local Obstacles

When the wind near the earth is severe, it will result in local areas of turbulence and wind shear. This is first due to mechanical turbulence.

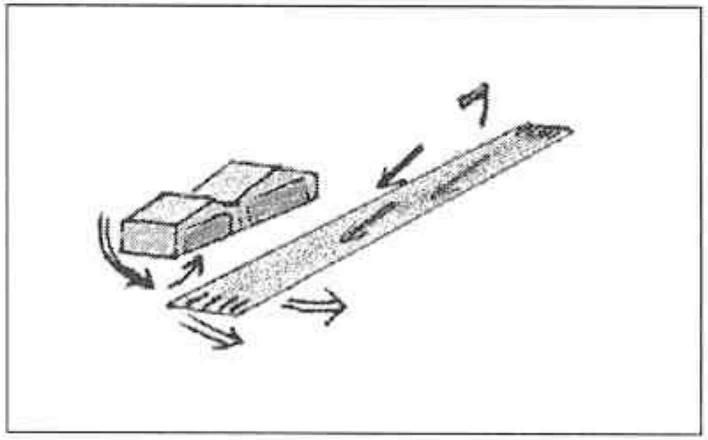


Fig. 16.6.
Windshear near buildings, etc.

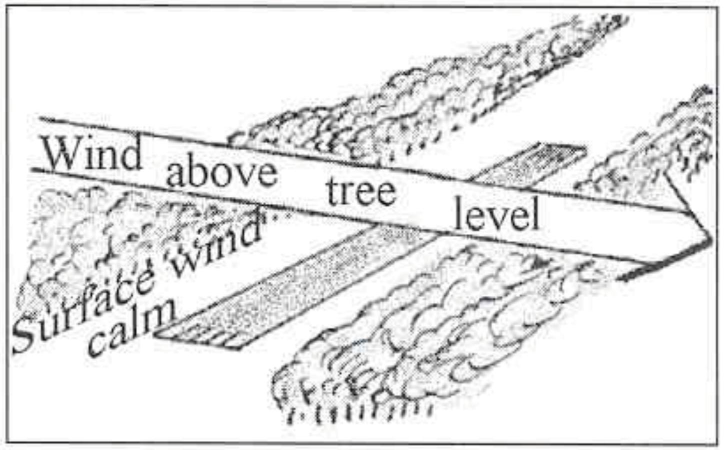
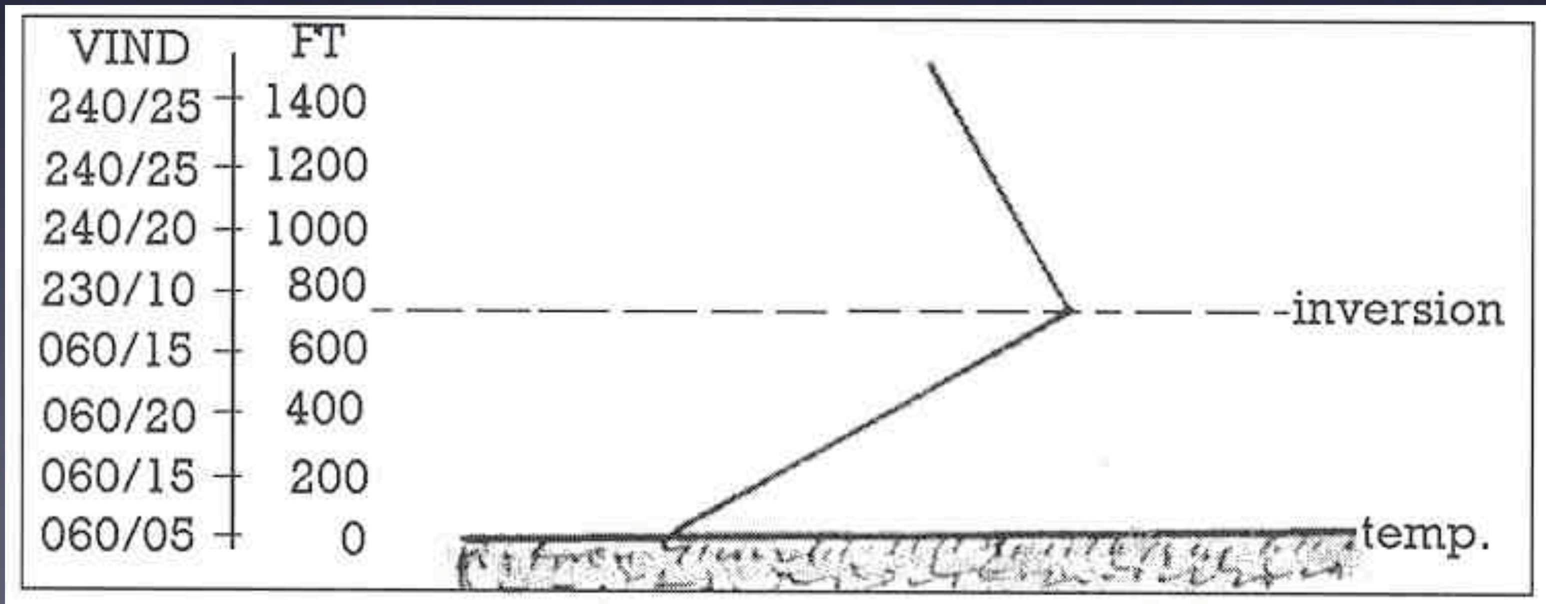


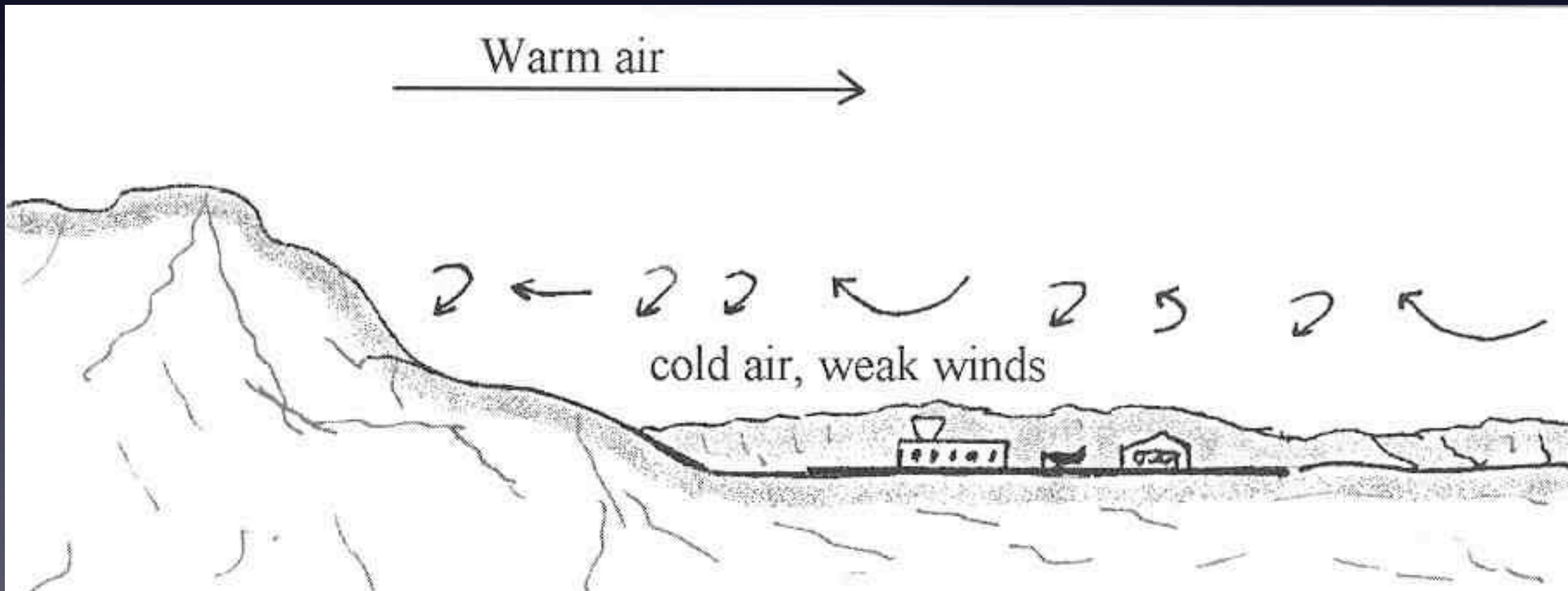
Fig. 16.7.
Windshear near trees.

Wind Shear with Surface Inversion

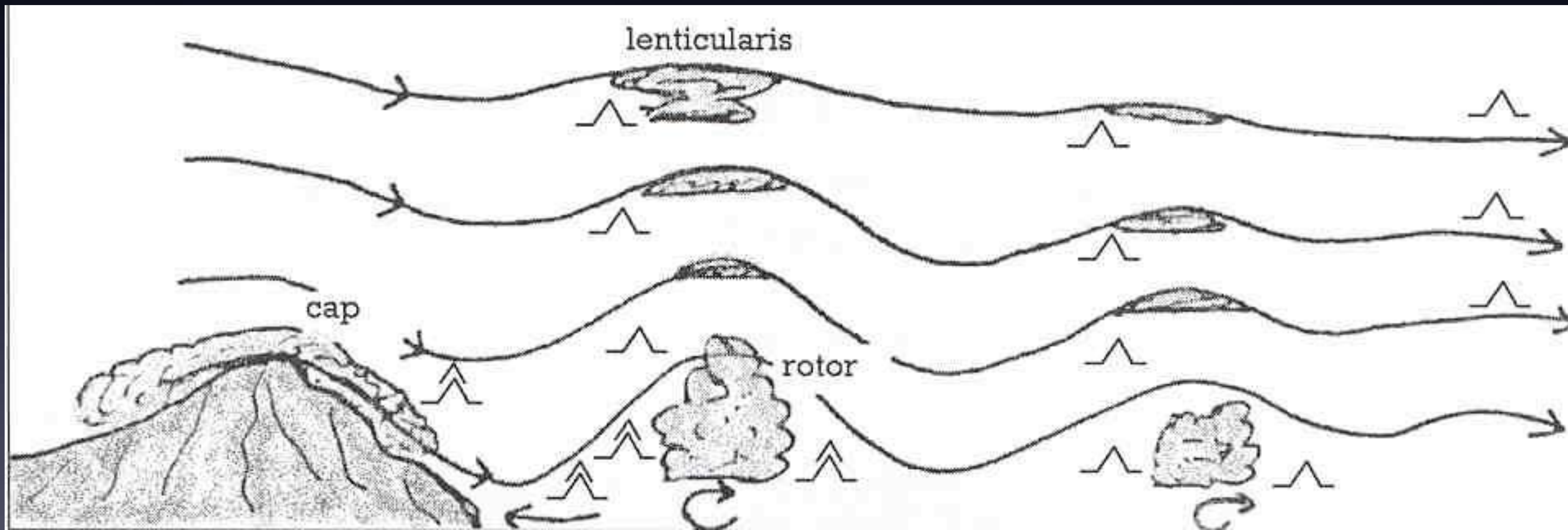
The cooling of the earth results in a cold stable layer in the lower layer. The larger the temp. change between surface and top of the inversion layer, the larger the possibility of a wind shear in the intermediate layer between the weak wind in the inversion layer and the severe wind above the inversion.



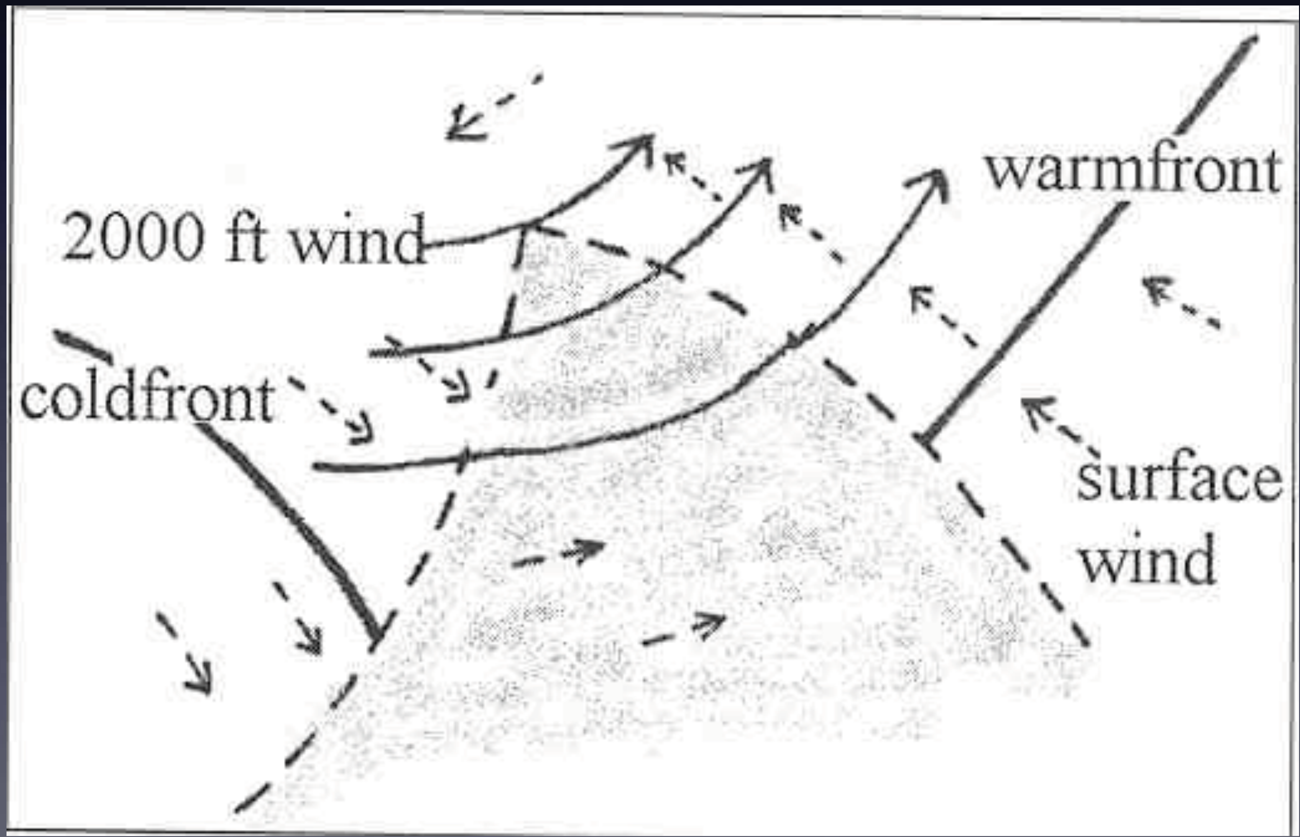
Wind Shear with Kata-Anabatic Wind



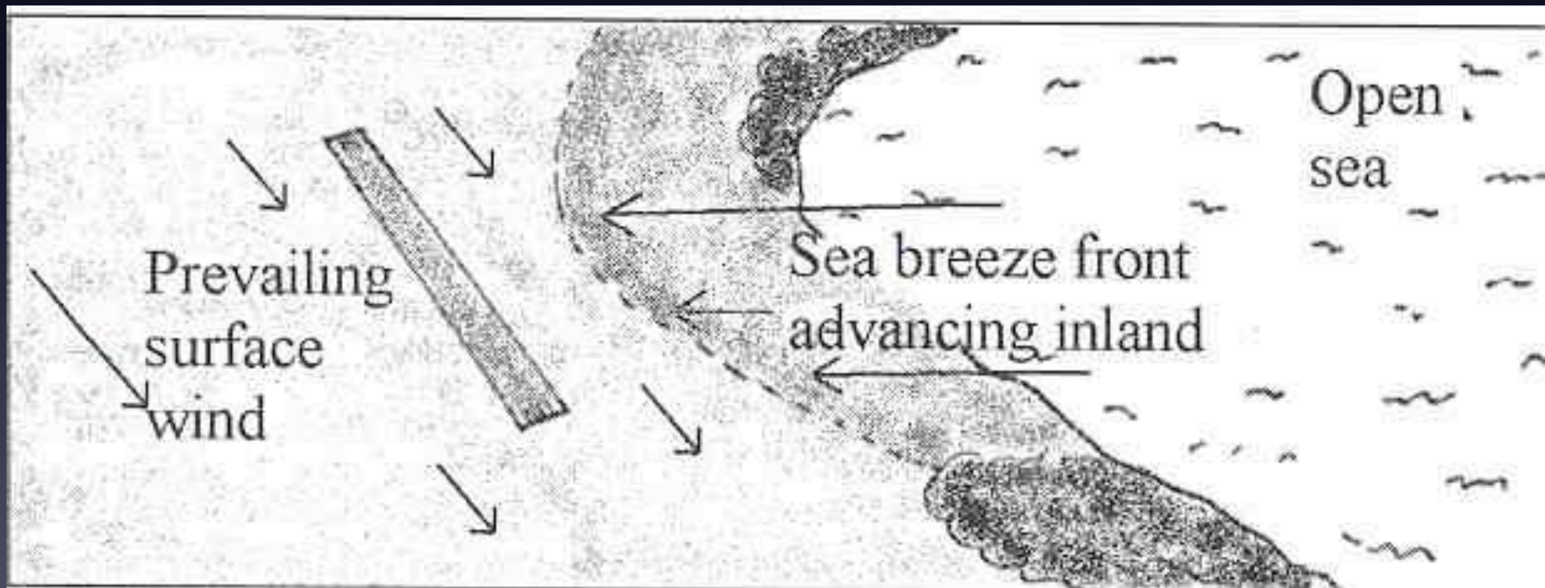
Wind Shear with Mountains Waves



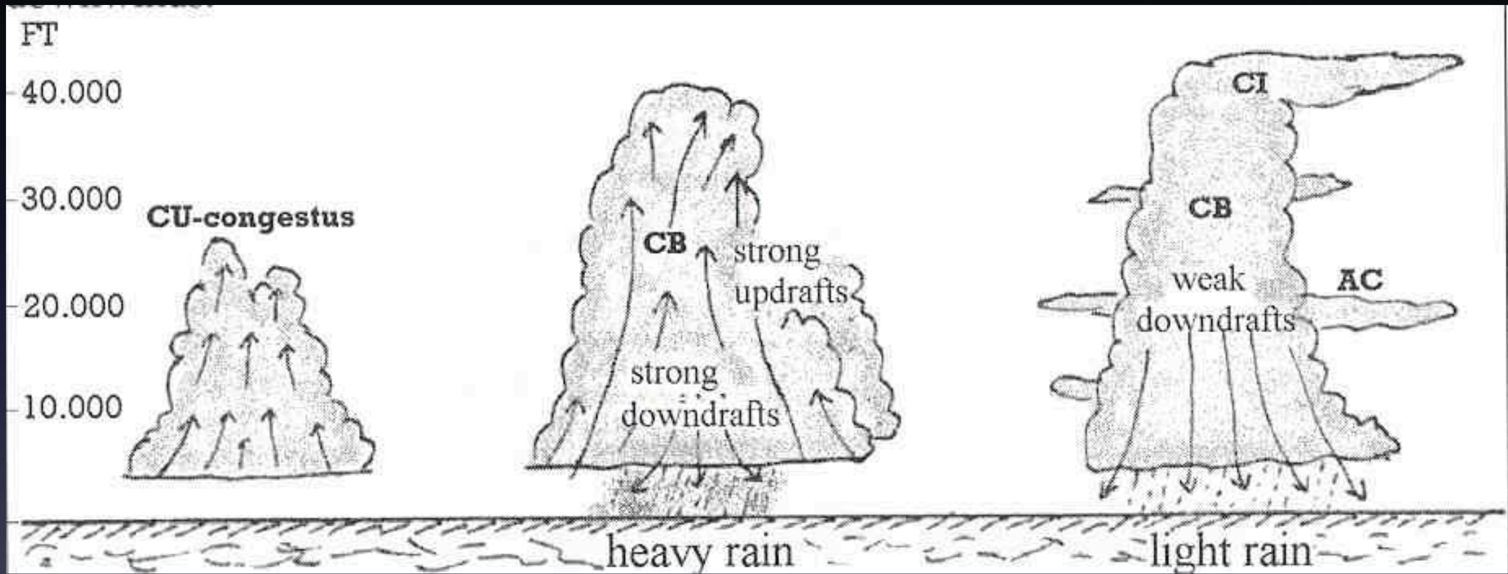
Wind Shear with Frontal Surface



Wind Shear with Sea - Land Breeze



Wind Shear with Cu fr Clouds

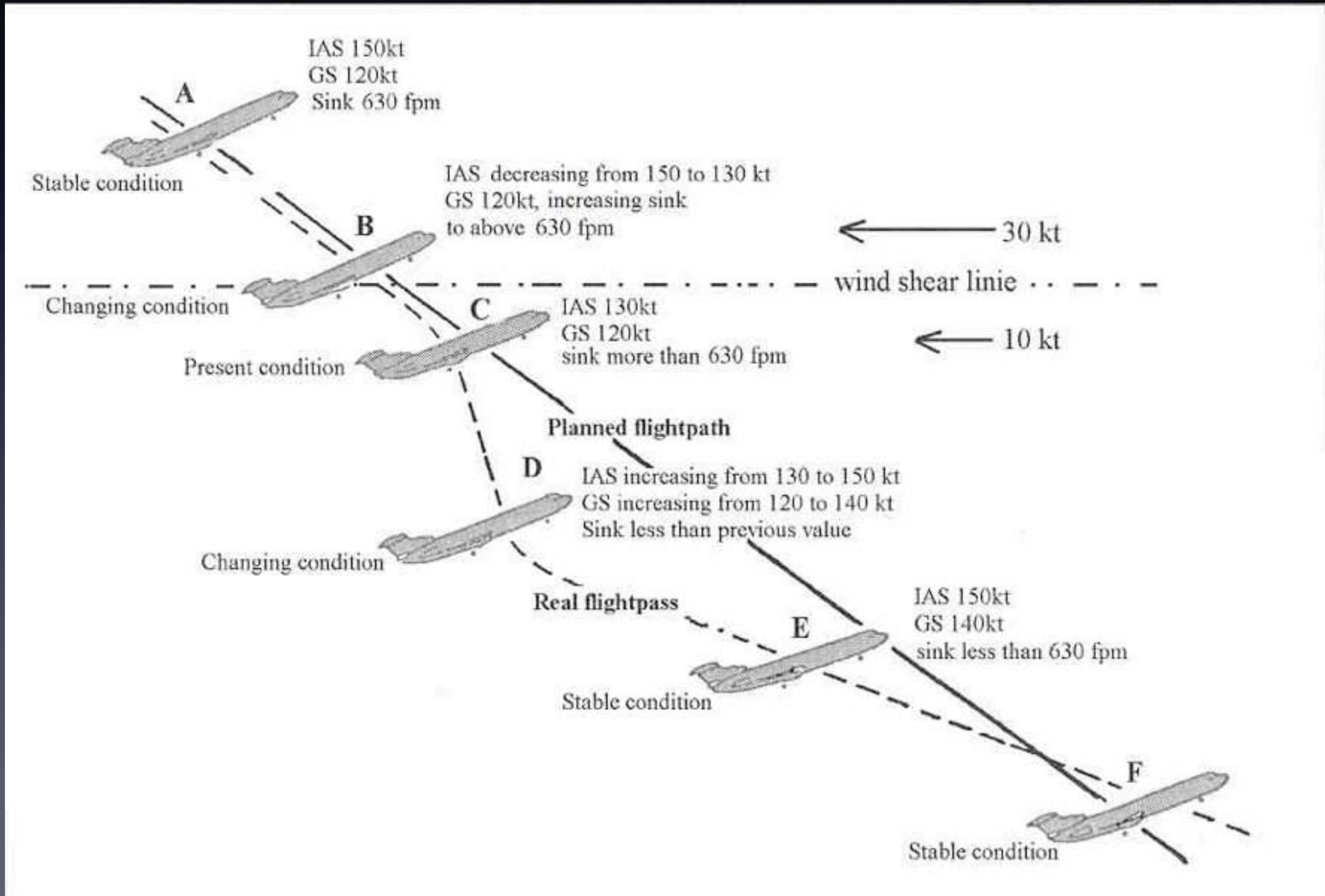


Cumulus Congestus (TCu)

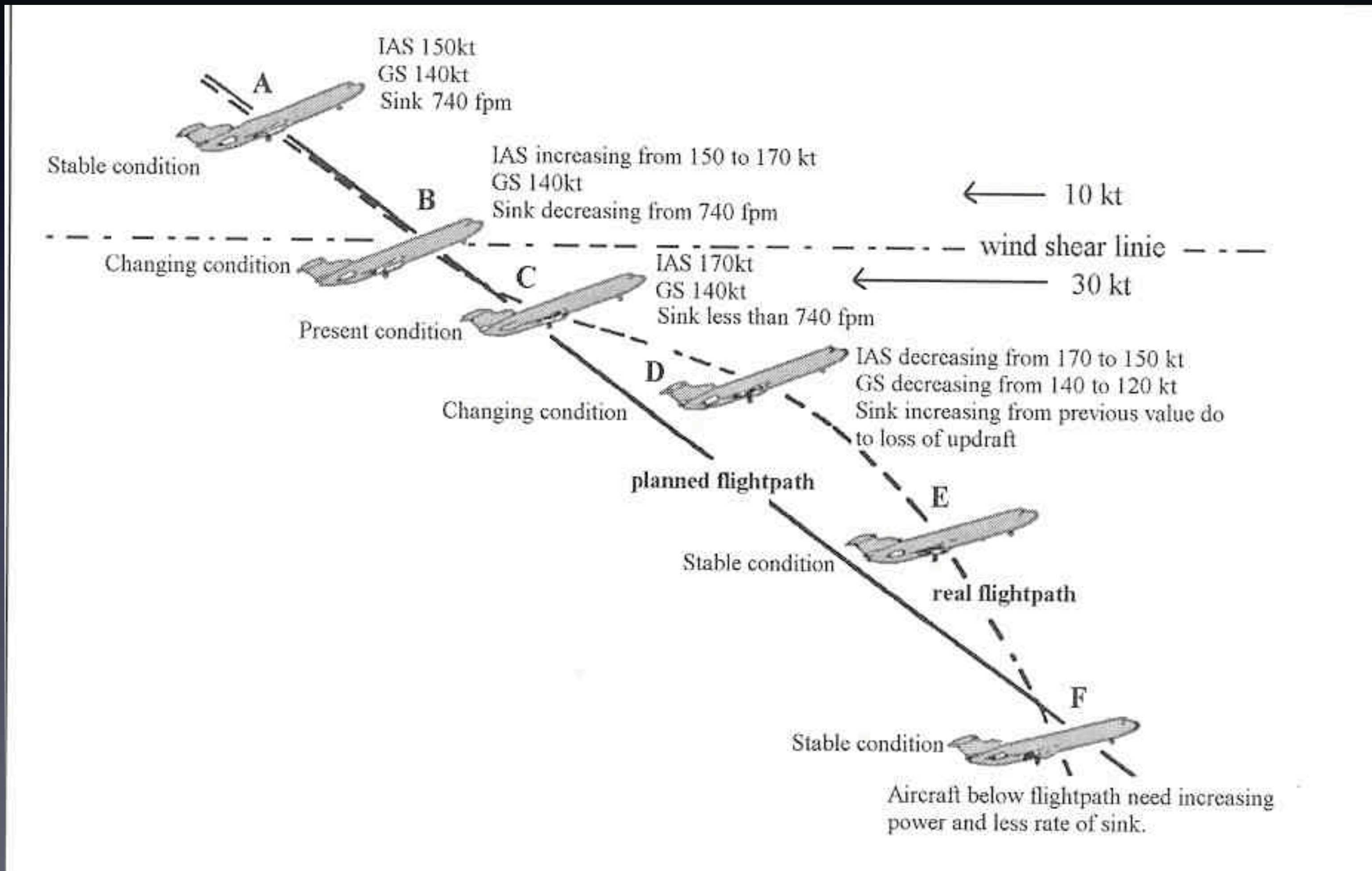
Cumulus Fractus (Cu fr)

Fractus clouds are small, ragged cloud fragments which, usually found under an ambient cloud base, form or have broken off a larger cloud, and are generally sheared by and shredded-looking due to strong winds.

Consequences of Wind Shear

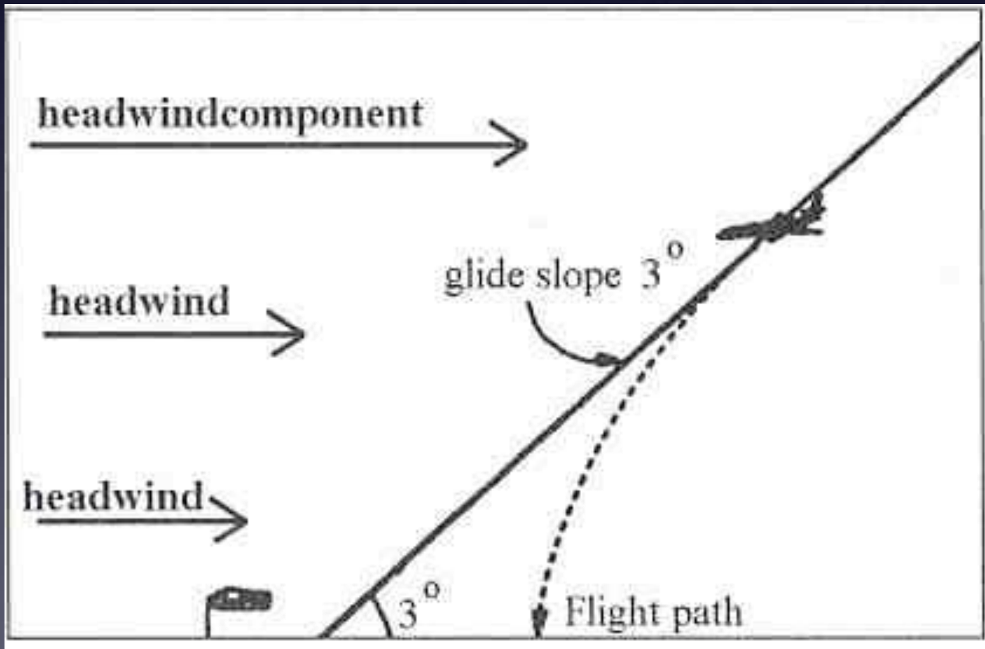


Consequences of Wind Shear



Consequences of Wind Shear

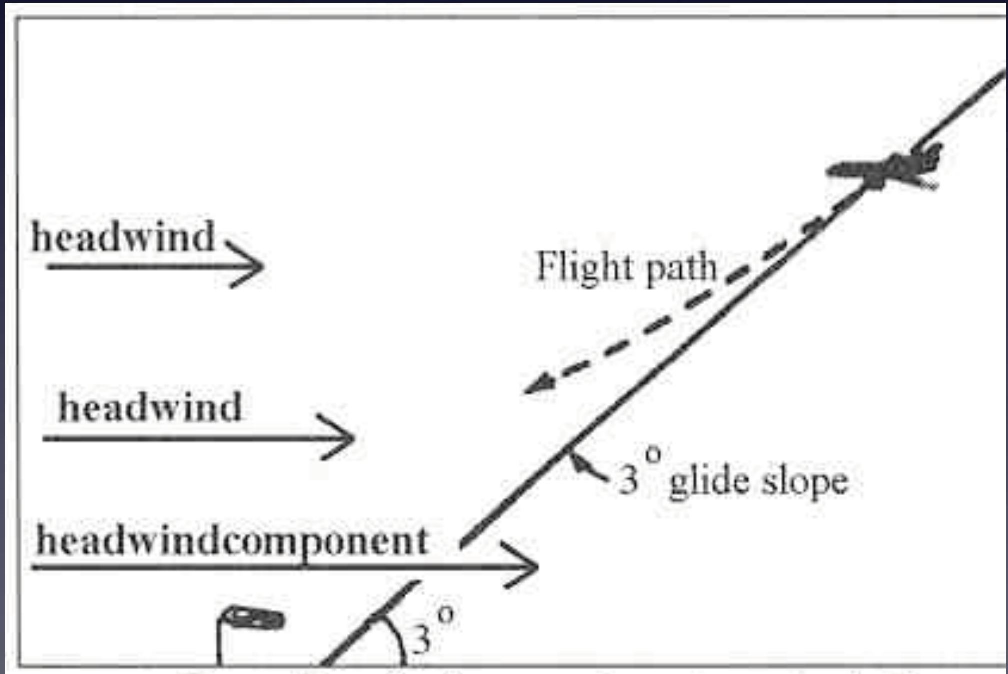
With a decreasing headwind component, the result may be a landing before the threshold



Landing in decreasing headwind

Consequences of Wind Shear

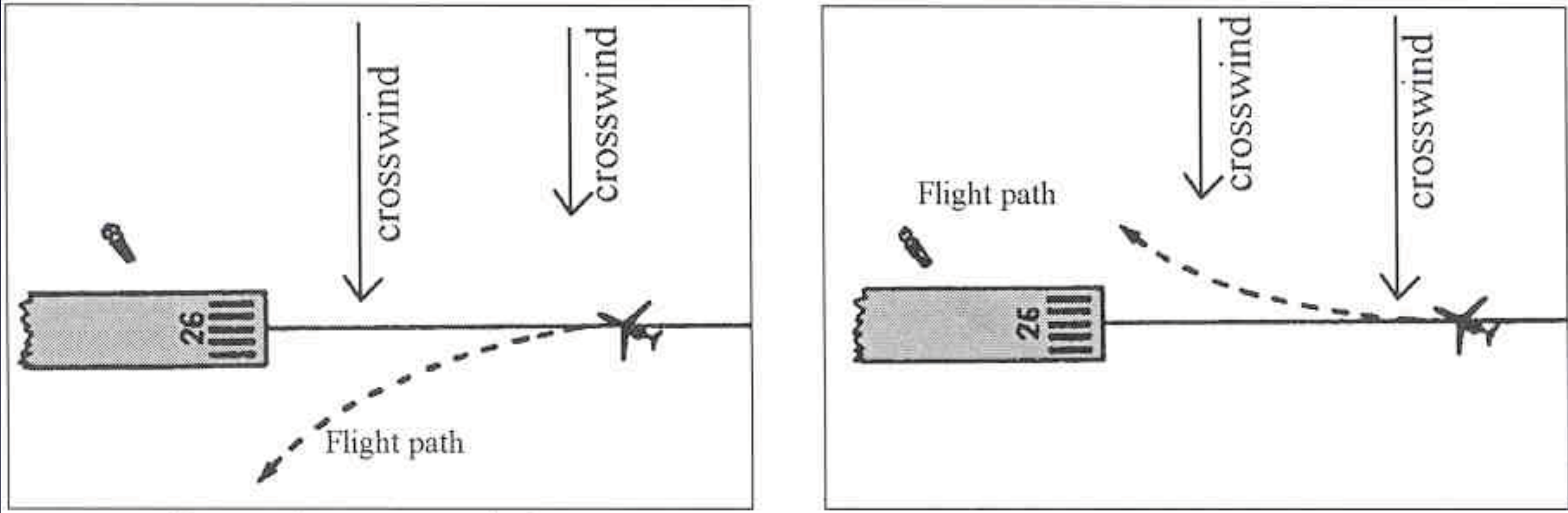
With an increasing headwind component the aircraft may land later on and exceed the runway



Landing in increasing headwind

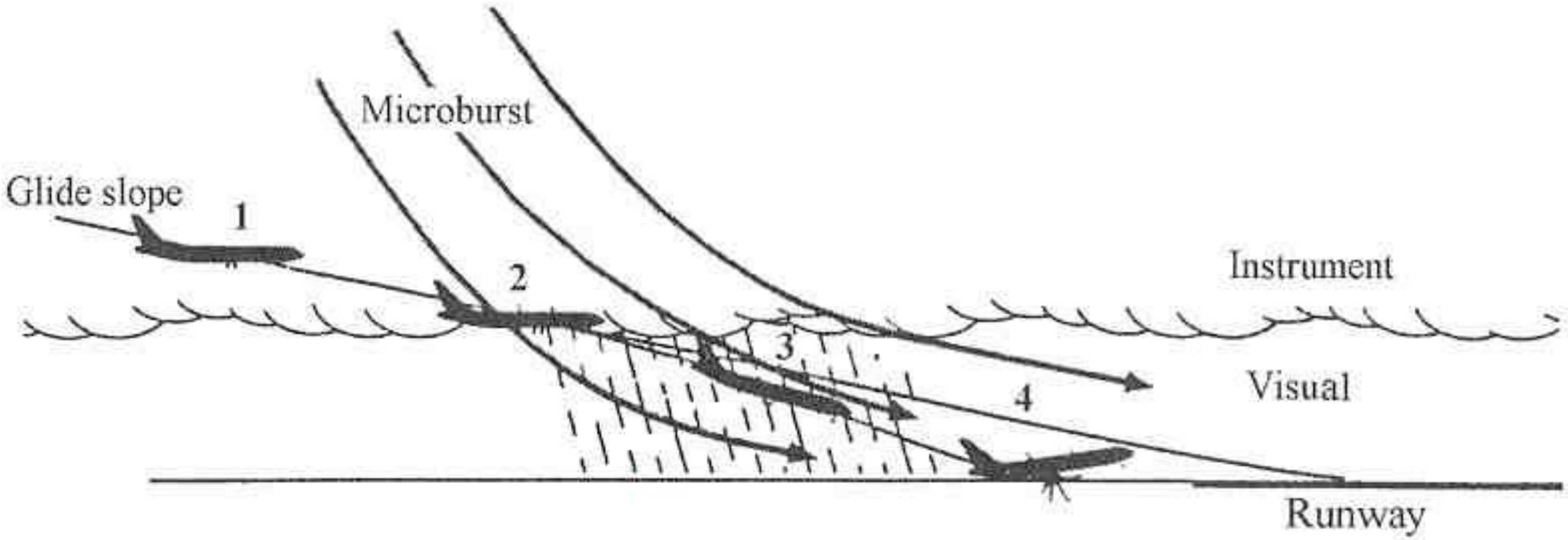
Consequences of Wind Shear

With the effect of a crosswind shear , the pilot will have to change the heading of the aircraft in order to keep on track



Increasing crosswind component   Decreasing crosswind component

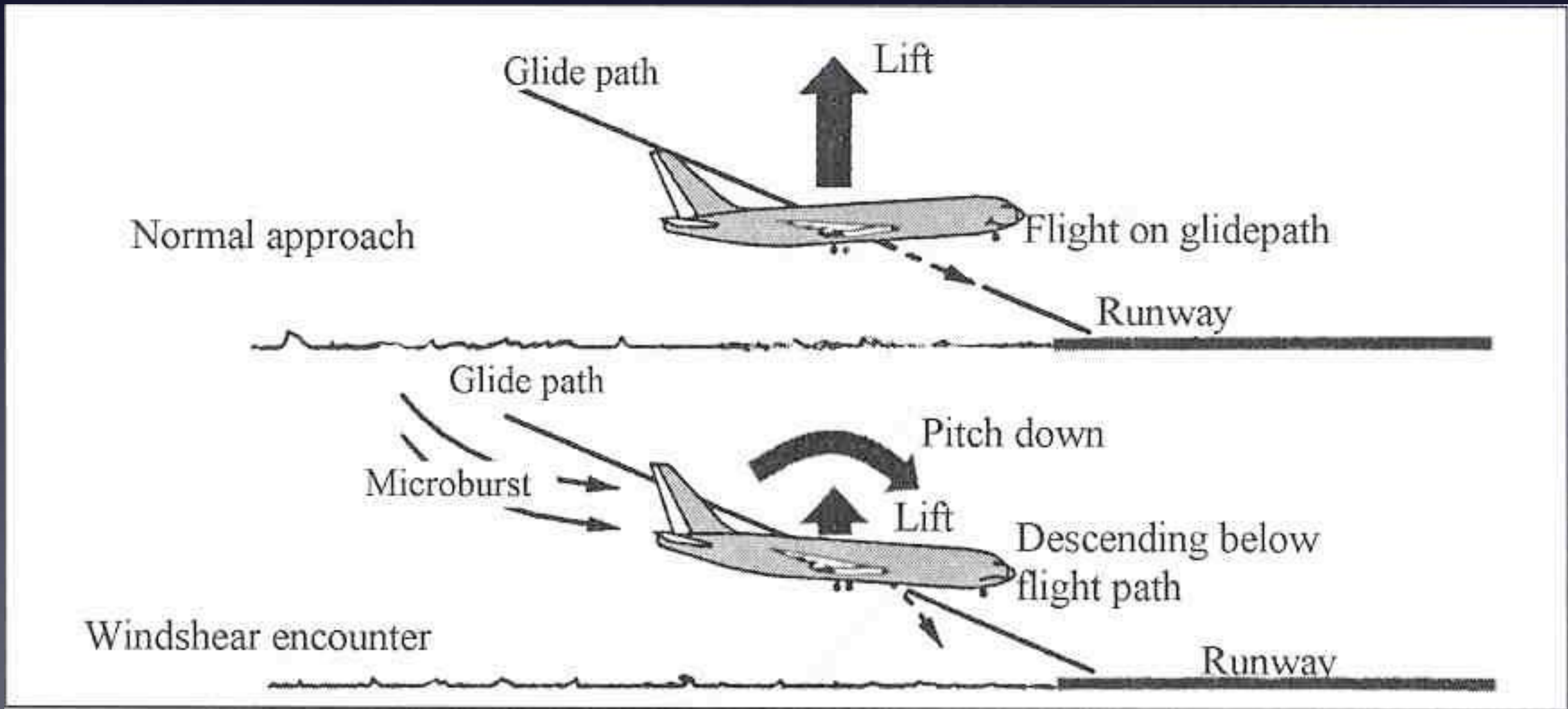
Consequences of Wind Shear



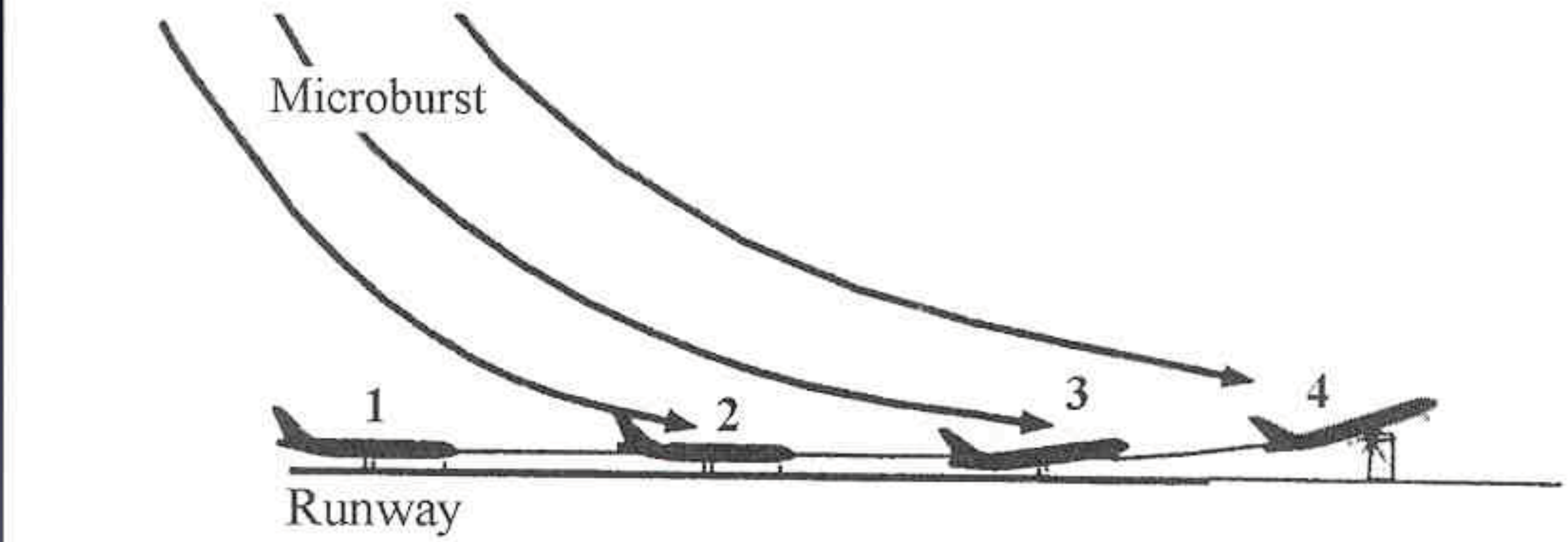
1. Normal approach.
2. Increasing downdraft and tailwind.
3. Decreasing airspeed and reduced visibility results in reduction of pitch attitude.
4. Aircraft chrash short of approach end of runway.

Consequences of Wind Shear

Tailwind reduces airspeed and lift at normal attitude which results in pitch down tendency to regain airspeed



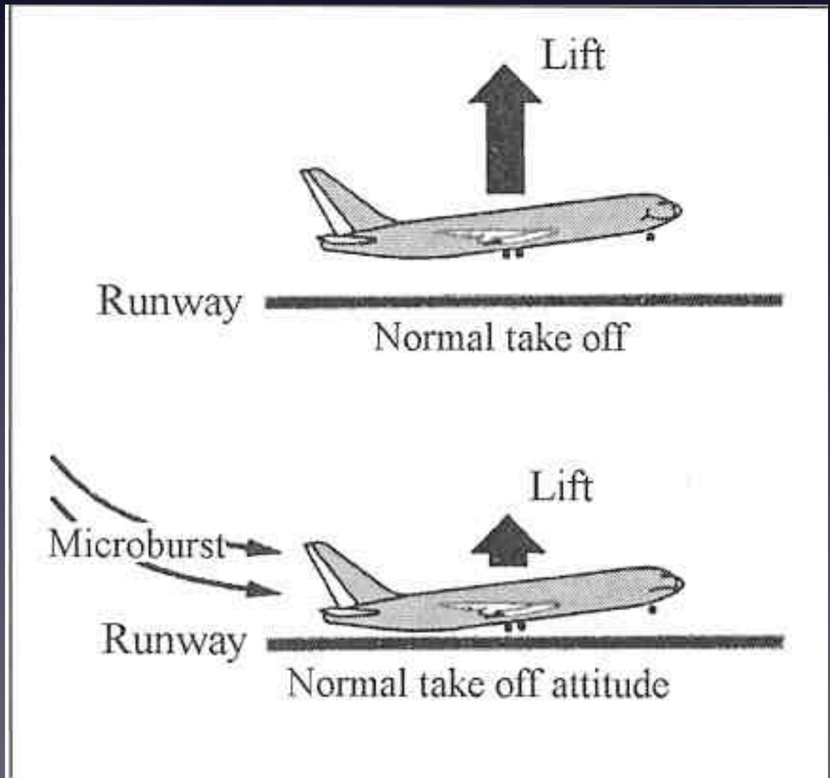
Consequences of Wind Shear

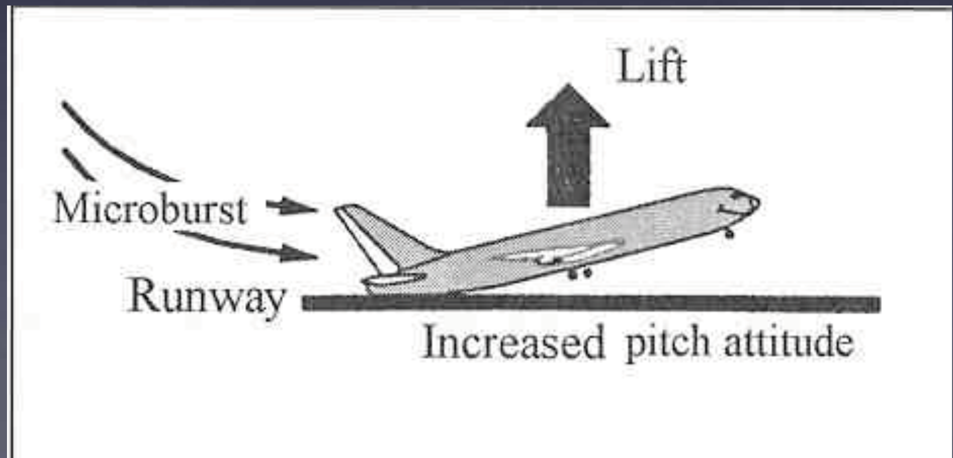


1. Normal take-off.
2. Decreasing airspeed due to windshear.
3. Aircraft reaches V_R near end of runway,lifted off but failes to climb.
4. Aircraft contacts obstacle off departure end of runway.

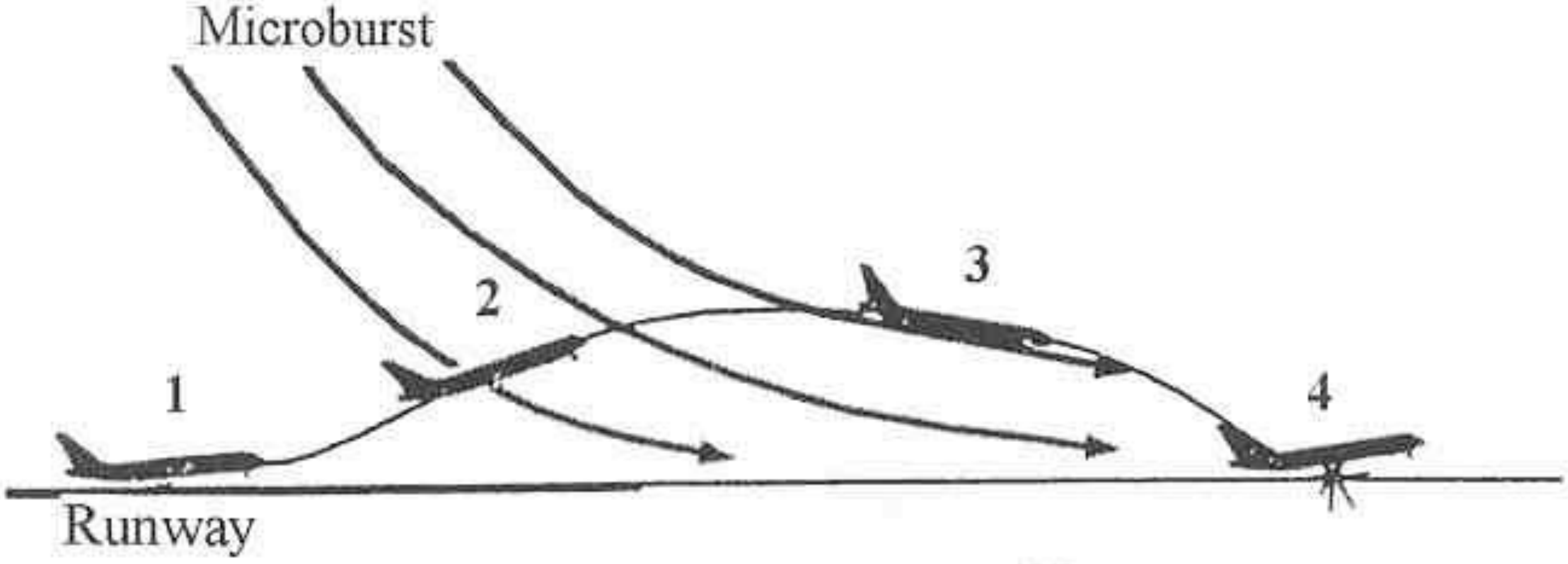
Consequences of Wind Shear

The tailwind increases the take-off speed and a normal take-off attitude will not be sufficient to make the aircraft climb.





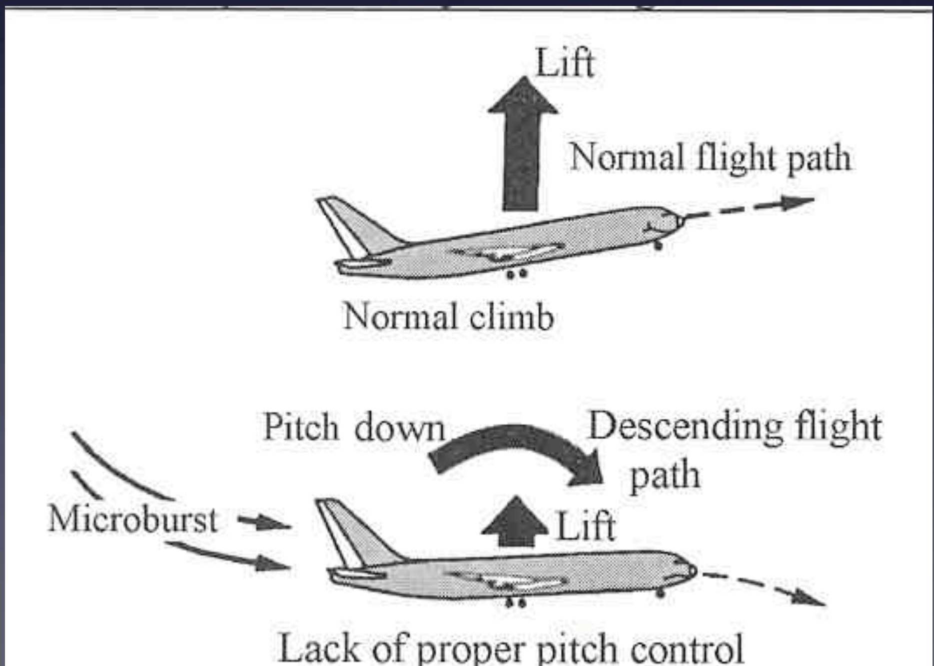
Consequences of Wind Shear

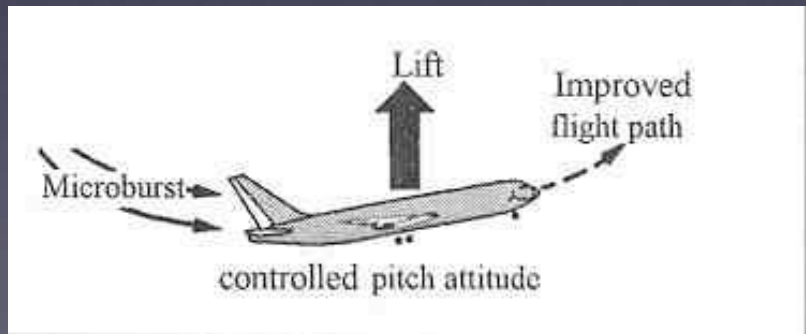


1. Normal take-off.
2. Tailwind-shear encountered just after liftoff.
3. Airspeed decrease results in pitch attitude reduction.
4. Aircraft crashes off departure end of runway 20 sec. after liftoff.

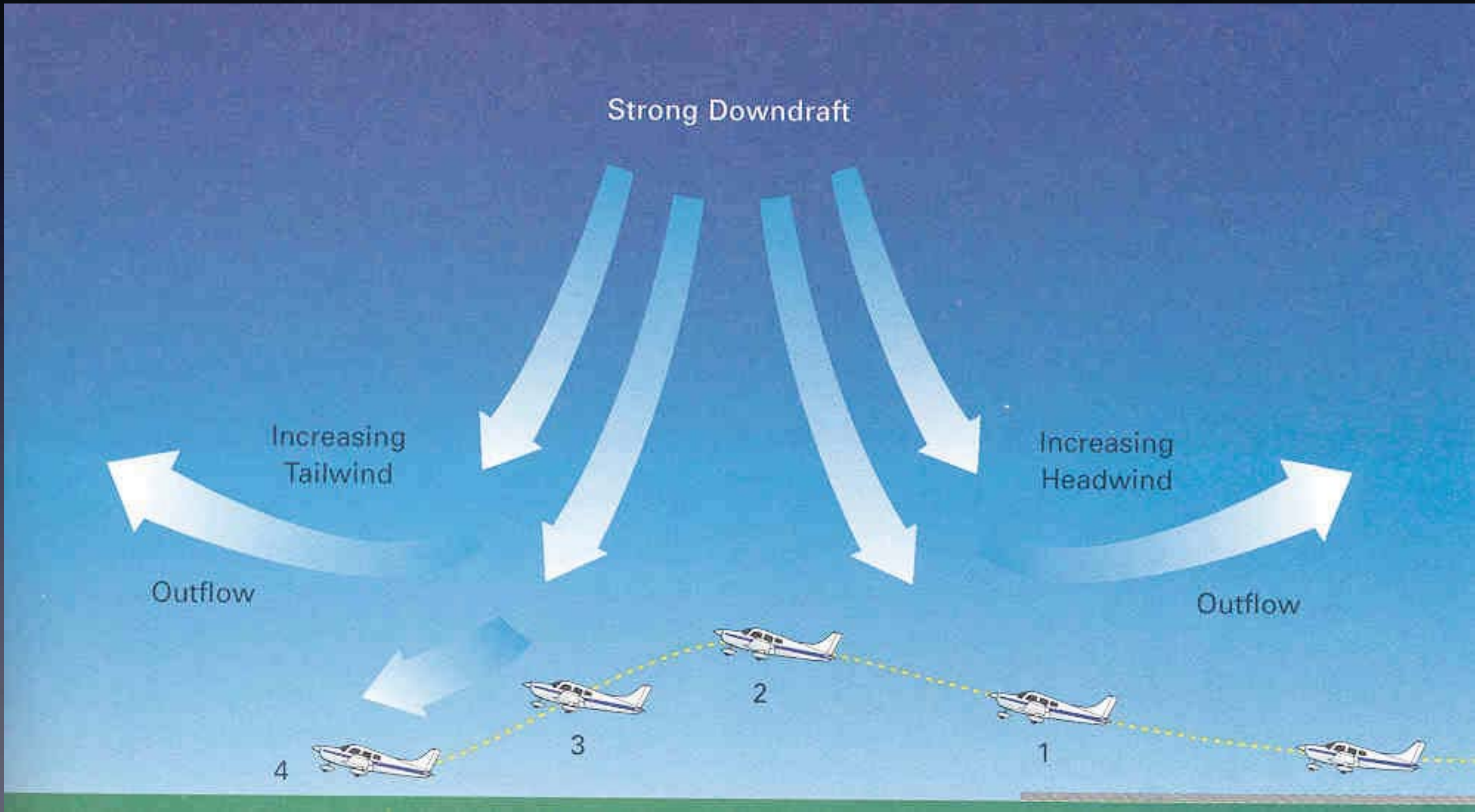
Consequences of Wind Shear

The tailwind reduces the airspeed and the lift at a normal attitude, which results in pitch down tendency to regain airspeed





Consequences of Wind Shear



Consequences of Wind Shear

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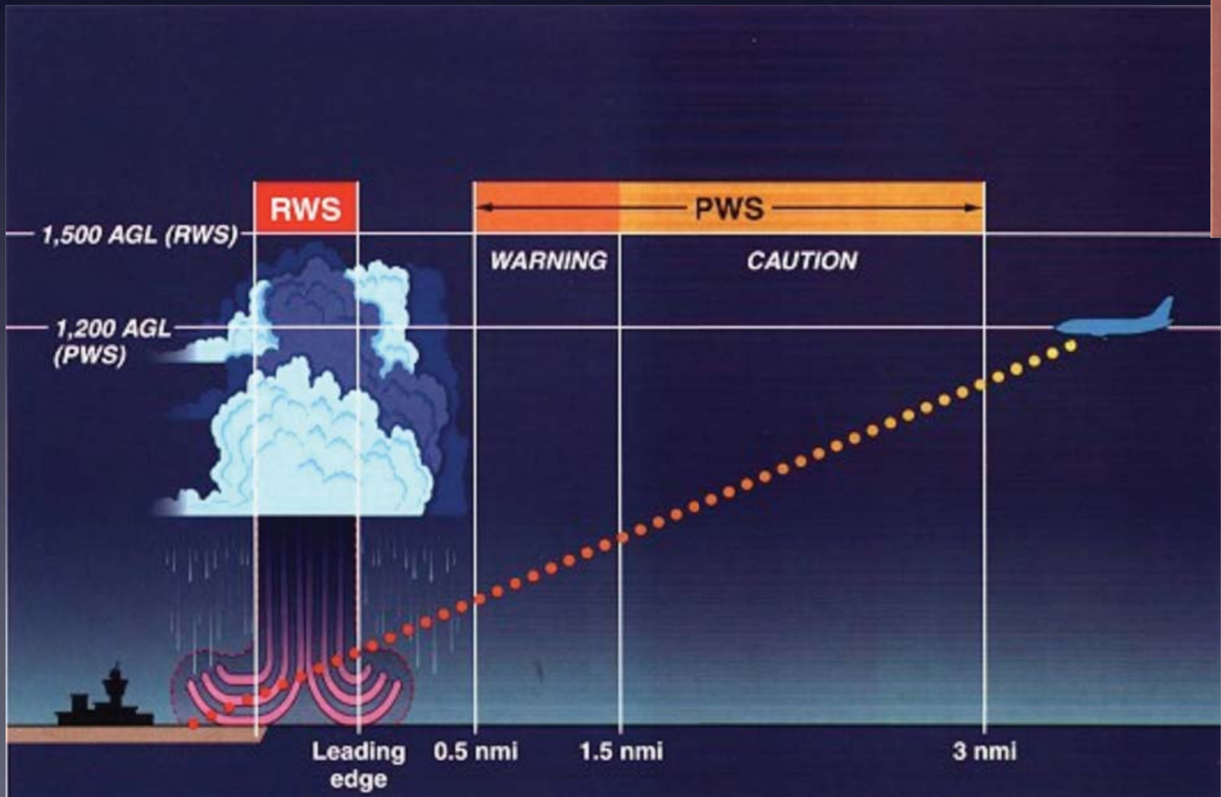
Other than the Reactive Windshear System (RWS), the Predictive Windshear System (PWS) is able to provide a warning to the flight crew before the windshear condition becomes an immediate threat to the airplane.



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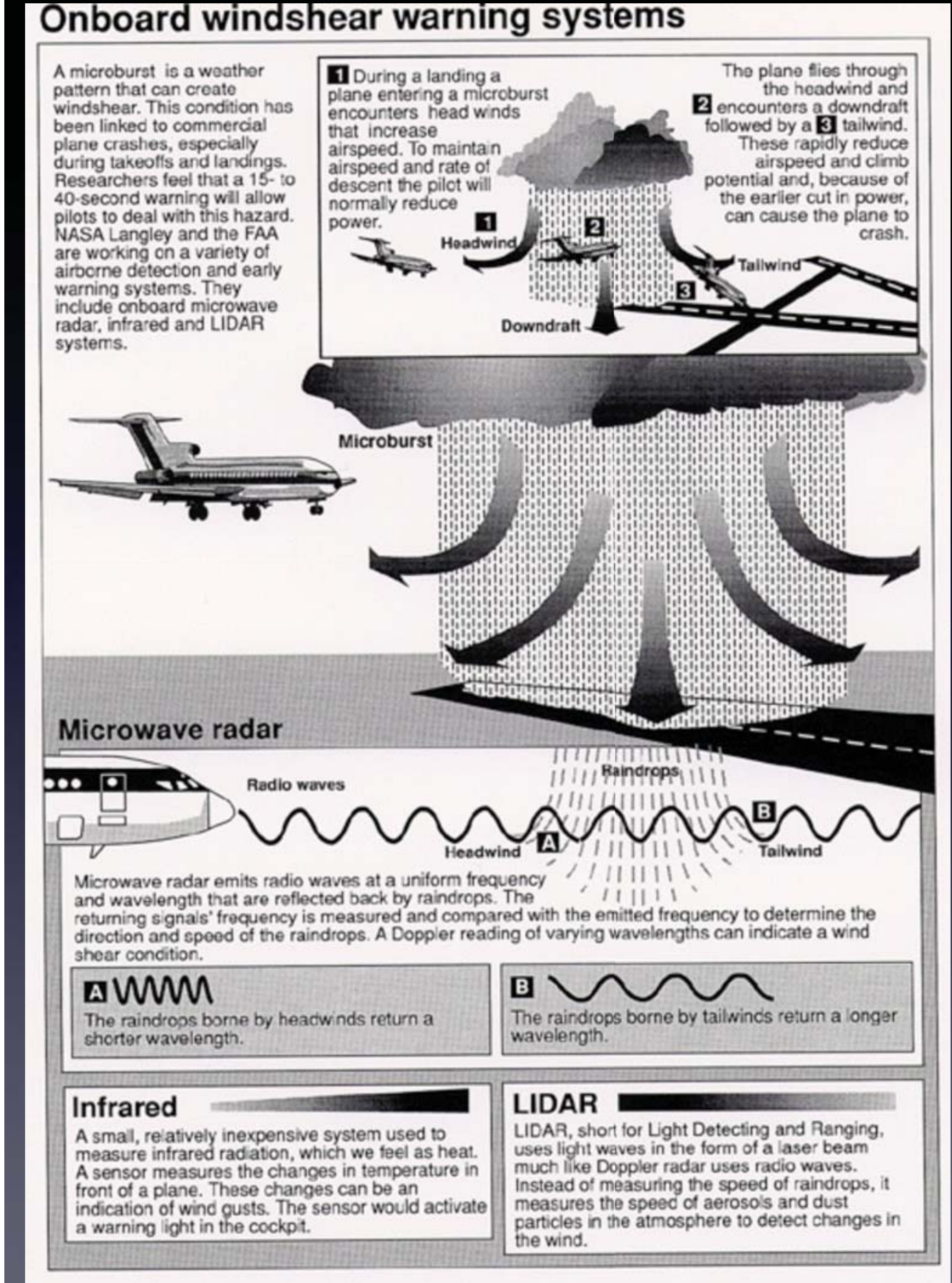

Be Aware!