



ANAC | Administración Nacional
de Aviación Civil





VUELO EN MONTANA

FUNDAMENTOS

**CHOLILA
OCTUBRE 2014**

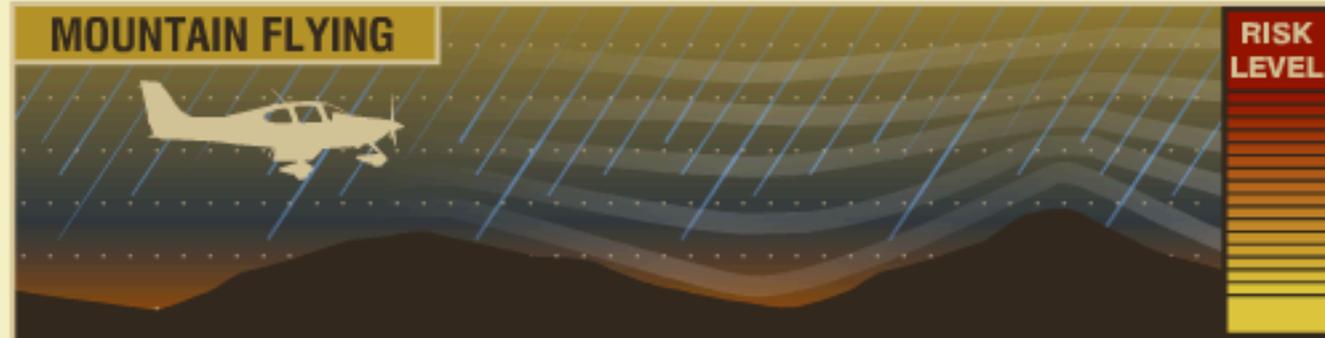
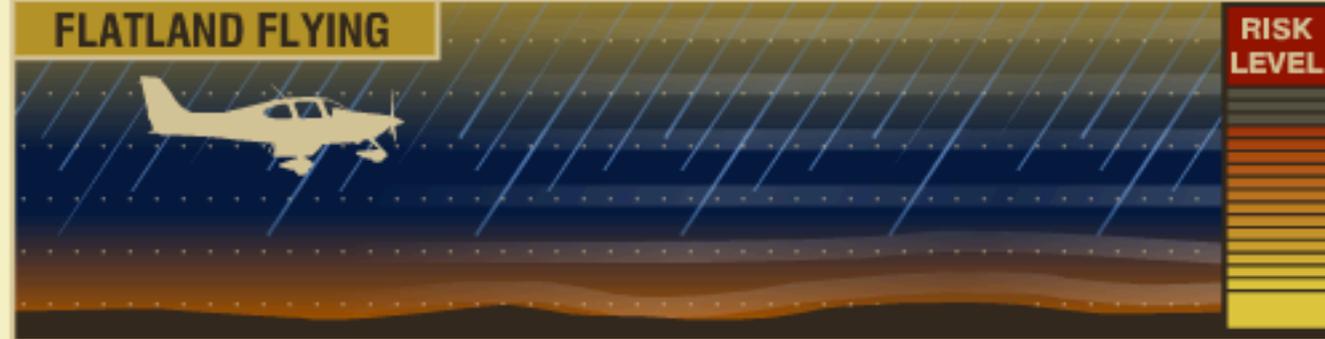
ANALISIS DE RIESGOS

Mountain Flying Risks

Mountain flying can be far more challenging than flying in the flatlands.

Click each factor below to see the risks.

-  Density Altitude
-  Night
-  Weather
-  Wind



An aerial photograph of a mountainous landscape. In the foreground, a river with a braided channel flows through a valley. To the right, a large, turquoise-colored lake is visible. The middle ground is dominated by steep, forested mountains. In the background, a range of snow-capped mountains stretches across the horizon under a clear blue sky.

VUELO EN MONTAÑA

**IRREGULARIDADES
DEL TERRENO**

An aerial photograph of a mountain range. The central focus is a sharp, rocky peak with patches of snow. Below the peak, a valley opens up, showing a winding river and green forested slopes. The background features more mountain ridges and valleys, extending towards the horizon. The sky is clear and blue.

VUELO EN MONTAÑA

NO HAY HORIZONTE

An aerial photograph of a rugged mountain range. The peaks and ridges are covered in snow, while the valleys and lower slopes are dark, suggesting dense vegetation or bare earth. The lighting creates strong shadows, emphasizing the terrain's complexity. The text is overlaid on the upper and lower portions of the image.

VUELO EN MONTAÑA

**LA NIEVE / AGUA CAMBIAN
LAS REFERENCIAS**



Base de conocimiento

**ZONA A SOBREVOLAR
AERODROMOS / LADs**

Base de conocimiento



LIMITES PERSONALES
CONCIENCIA SITUACIONAL

Base de conocimiento



**AERONAVE
PERFORMANCE**

Changes in Density Altitude

Cool Morning

Press Alt: 6,500 msl
Temp: 50° F / 10° C
DA: 7,418 msl

Afternoon

Press Alt: 6,500 msl
Temp: 68° F / 20° C
DA: 8,539 msl

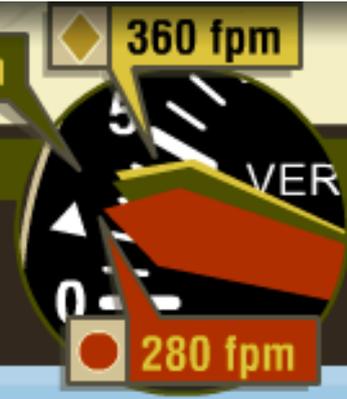
Hot Afternoon

Press Alt: 6,500 msl
Temp: 104° F / 35° C
DA: 10,135 msl

335 fpm

360 fpm

280 fpm



RISK LEVEL

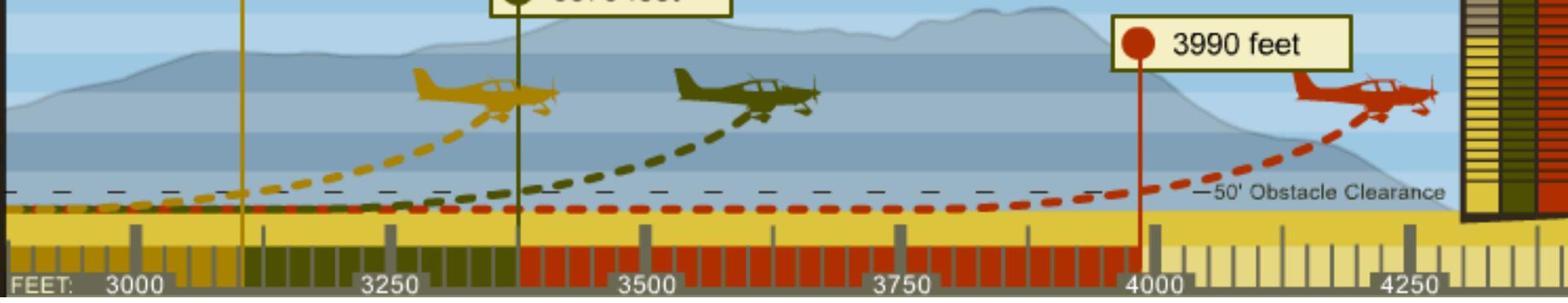


INSTRUCTIONS +

3110 feet

3375 feet

3990 feet



Climb Gradient

Unlike rate of climb, which is measured in feet per minute (fpm), climb gradient is measured in feet per nautical mile (nm) and is a function of rate of climb *and* ground speed. The faster an aircraft's groundspeed, the greater the rate of climb needed to avoid obstacles.

Faster Groundspeed

150 knots

Climb:
250 ft. per nm



625 fpm

Slower Groundspeed

80 knots

Climb:
250 ft. per nm



333 fpm

Rate of Climb Table [VIEW](#)

Required Climb Gradient	Groundspeed (KNOTS)												
	30	40	50	60	70	80	90	100	110	120	130	140	
100	300	330	360	390	420	450	480	510	540	570	600	630	660
200	600	660	720	780	840	900	960	1020	1080	1140	1200	1260	1320
300	900	990	1080	1170	1260	1350	1440	1530	1620	1710	1800	1890	1980
400	1200	1320	1440	1560	1680	1800	1920	2040	2160	2280	2400	2520	2640
500	1500	1650	1800	1950	2100	2250	2400	2550	2700	2850	3000	3150	3300
600	1800	1980	2160	2340	2520	2700	2880	3060	3240	3420	3600	3780	3960
700	2100	2310	2420	2630	2840	3050	3260	3470	3680	3890	4100	4310	4520
800	2400	2640	2880	3120	3360	3600	3840	4080	4320	4560	4800	5040	5280
900	2700	2970	3240	3510	3780	4050	4320	4590	4860	5130	5400	5670	5940
1000	3000	3300	3600	3900	4200	4500	4800	5100	5400	5700	6000	6300	6600

Diminishing Climb Performance

At high density altitudes, many normally-aspirated engines can only provide enough power for a 200 or 300 foot-per-minute climb...and a mountain downdraft can easily reduce that to zero (or even turn it into a descent).

Select each departure altitude at the top of the chart to see the effect on climb performance.



True Airspeed

True airspeed increases with altitude.

Pilots making their first high-altitude takeoff or landing are surprised to see how fast the ground is whizzing by, even though they are correctly using the same indicated airspeed as at sea level.



Weight Considerations

Select An Airplane Or Compare Both:

Airplane 1

Airplane 2

View the Performance Numbers

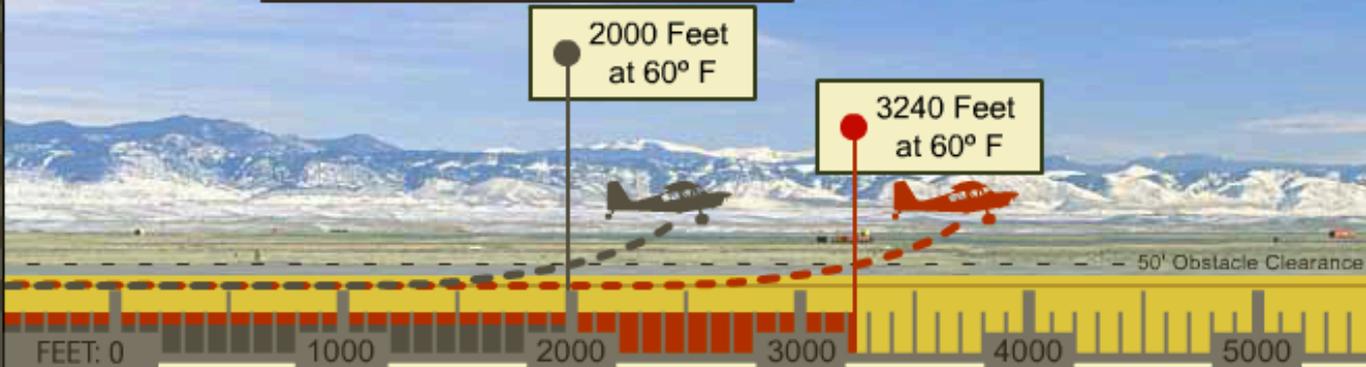
Select A Temp:



Airport: 8000' msl
Alt. Setting: 29.92



INSTRUCTIONS



Operating at maximum gross weight may not be an option in the mountains. If it isn't practical to take fewer passengers or less cargo, consider reducing your fuel load—even if it means making an extra fuel stop en route.





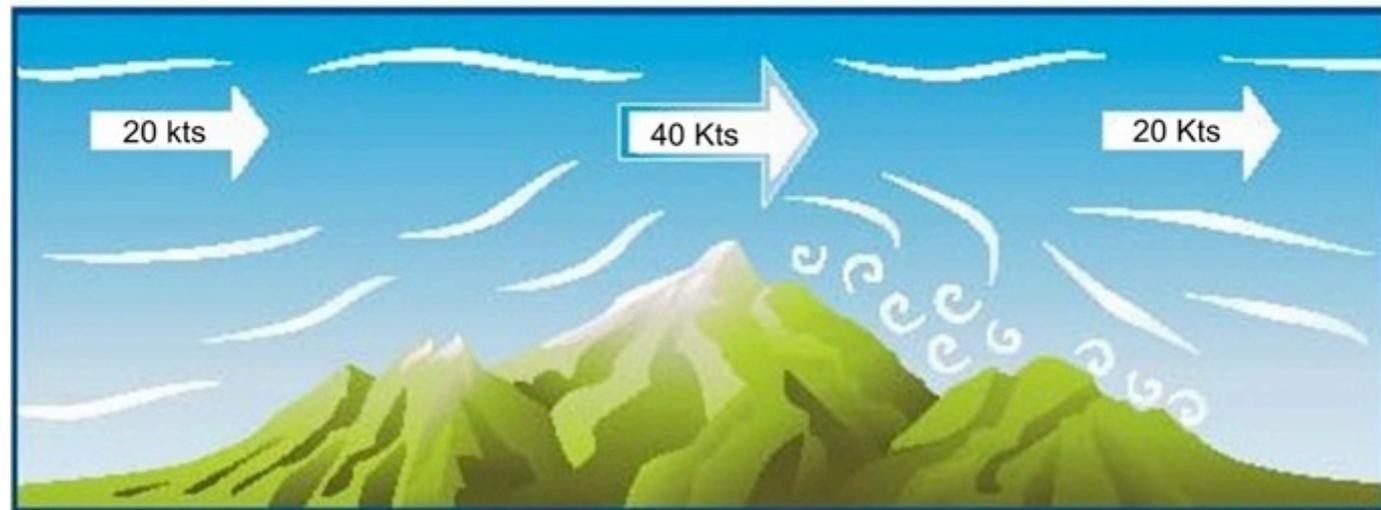
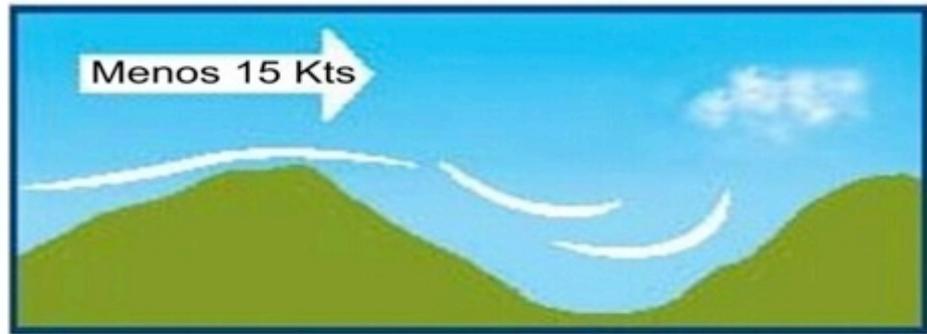
Base de conocimiento

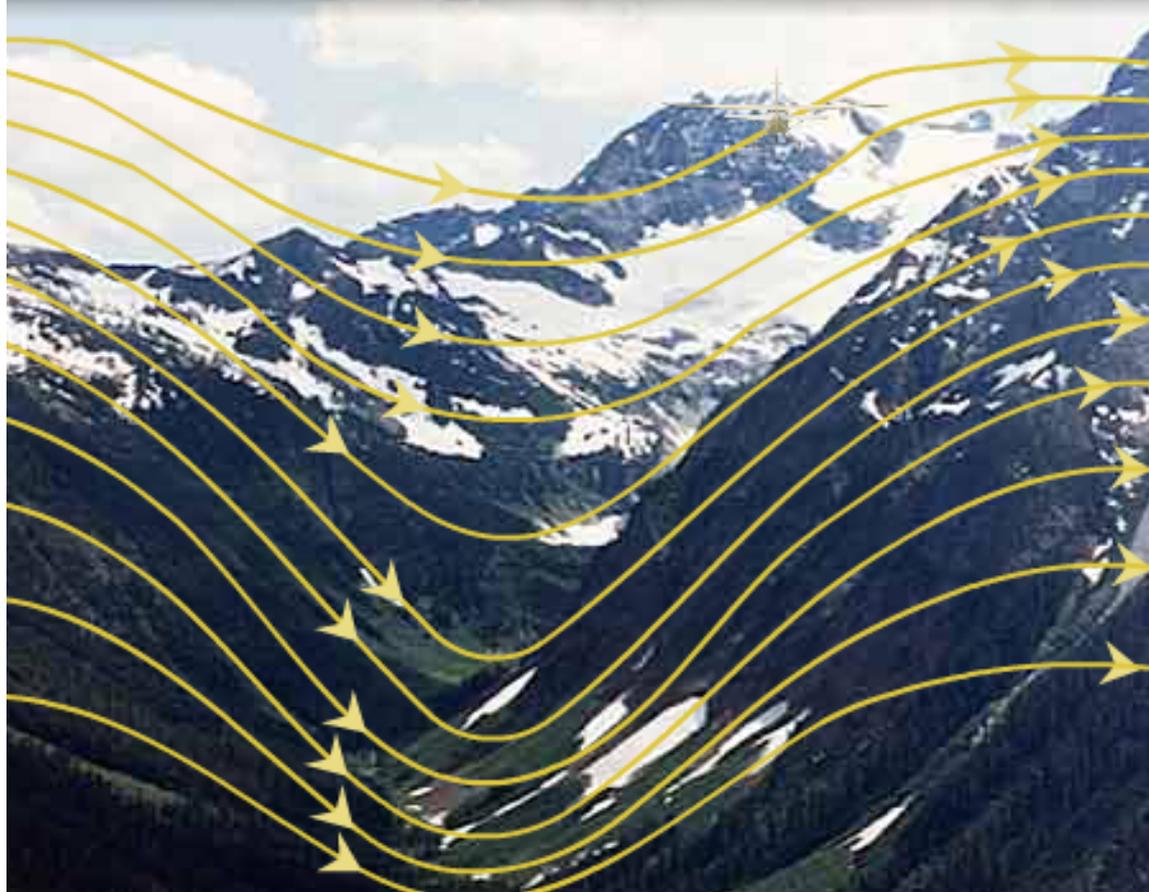
**METEOROLOGIA
HORA DEL DIA**



El aire no se mueve en forma laminar

**El aire tiene
diferentes
velocidades**





Downdrafts:

Downdrafts occur on the leeward (downwind) side of mountains. Watch your airspeed and altitude, and keep a safe distance from terrain: Strong downdrafts can easily exceed aircraft climb performance.



Turbulence / Wind Shear:

Turbulence and/or wind shear can occur where downdrafts and updrafts meet (i.e., in the canyon valley). If you must fly in this area, maintain sufficient altitude and distance from terrain to safely turn around.



Updrafts:

Updrafts occur on the windward (upwind) side of mountains. Use caution to avoid being "lifted" into thin air and/or adverse weather.



Cloud Types

Cloud types often indicate what kind of air—smooth or turbulent—you're likely to experience in flight. Roll over each area for more information.

- Caution! Strong turbulence and/or wind shear.
- Typically smoother air—good for gliders.



Cap Clouds
 Cap clouds are formed by moist air that is pushed up the windward side of the mountain, where it cools and condenses, and down the leeward side where it warms and dissipates.

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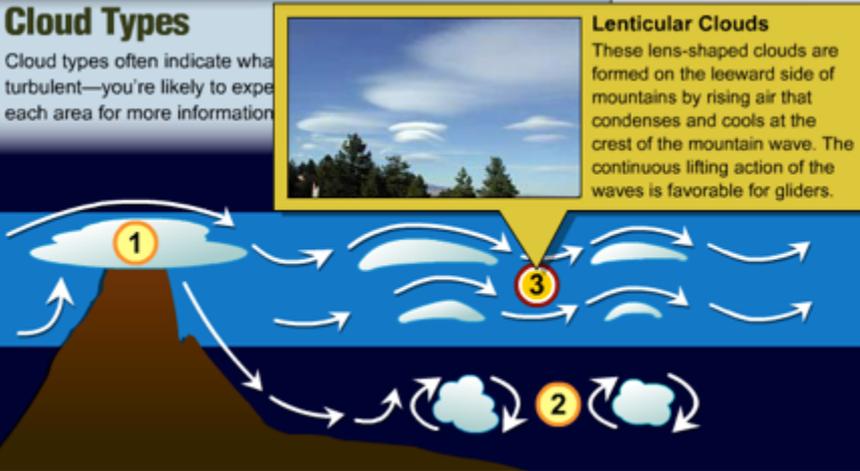


Rotor Clouds
 Also known as roll clouds, rotor clouds form on the leeward side of mountains by strong downdrafts and slower moving air near the surface. This creates severely unstable air, strong winds, and turbulence.

Cloud Types

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- Caution! Strong turbulence and/or wind shear.
- Typically smoother air—good for gliders.



Lenticular Clouds
 These lens-shaped clouds are formed on the leeward side of mountains by rising air that condenses and cools at the crest of the mountain wave. The continuous lifting action of the waves is favorable for gliders.

Cloud Types

Cloud types often indicate what kind of air—smooth or turbulent—you're likely to experience in flight. Roll over each area for more information.

- Caution! Strong turbulence and/or wind shear.
- Typically smoother air—good for gliders.



Kelvin-Helmholtz Clouds
 These clouds are sometimes formed on the leeward side of mountains by two layers of air moving at different airspeeds, which indicate the presence of strong wind shear.

Otras consideraciones

An aerial photograph of a large reservoir, likely a dam reservoir, with a dam visible in the distance. The water is a deep blue, and the surrounding land is brown and hilly. The sky is bright blue with scattered white clouds. The text is overlaid on the image.

HIPOXIA +5k a 10k feet (noche-día)

DESHIDRATACION

SUPERVIVENCIA (KIT)

Otras consideraciones

EFECTOS OPTICOS

Sombras

Escalas relativas



Otras consideraciones

COMUNICACIONES



Otras consideraciones

Consulta a Pilotos Locales



Técnicas y trucos

- **Cruce**
- Vuelo en el valle
- Rutas de escape /
ALTERNATIVAS
/
EMERGENCIAS
- Aproximación y aterrizajes
- Despegues



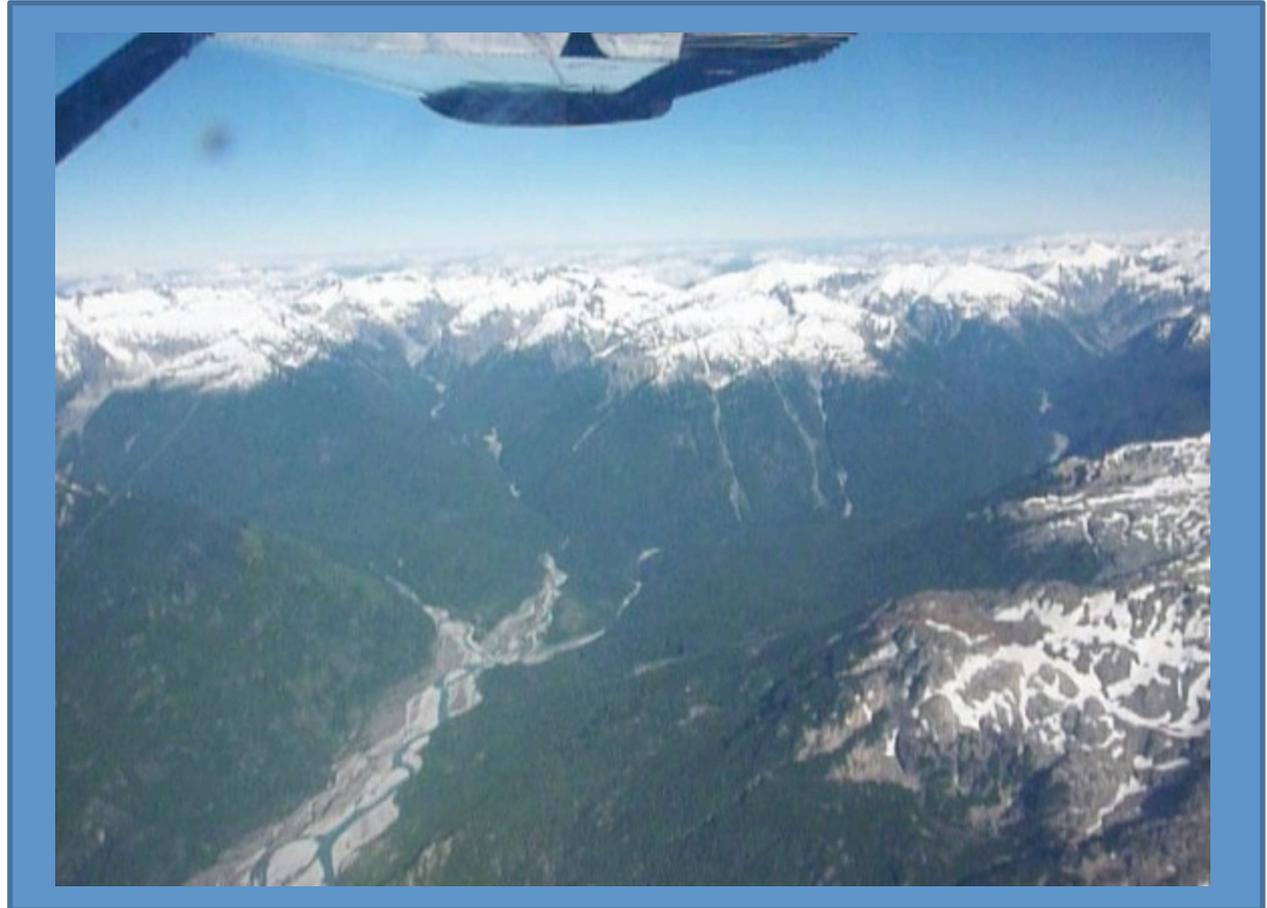
Técnicas y trucos

- Cruce
- **Vuelo en el valle**
- Rutas de escape
- Aproximación y aterrizajes
- Despegues



Técnicas y trucos

- Cruce
- Vuelo en el valle
- **Rutas de escape**
- Aproximación y aterrizajes
- Despegues



Técnicas y trucos

- Aproximación y aterrizajes



Técnicas y trucos

- Cruce
- Vuelo en el valle
- Rutas de escape
- Aproximación y aterrizajes
- **Despegues**



TIPs FINALES

- **Entrenamiento y mantenimiento de la competencia en Vuelo en Montaña.**
- **Recordar en todo momento que la altitud de densidad afecta la performance del avión.**
- **Manejar la corrección de mezcla en aviones pistoneros.**
- **Planificación e información previa al vuelo es mandatorio.**

TIPs FINALES

- Las condiciones meteorológicas pueden cambiar rápidamente. Actualizar reportes y observación de las condiciones (nubes, etc.)
- Evaluar posibles desvíos y aeródromos de alternativa en ruta.
- Si es factible, hacer plan de vuelo y mantener las comunicaciones TWR, TMA o ACC. (SAR).
- VOLAR VFR



MUCHAS GRACIAS