APPENDIX
FLYING IN MOUNTAIN COUNTRY

This appendix, issued to supplement the information given in the Flight Manual, may be modified by specific amendments independent of those issued against the basic Flight Manual.

LIST OF EFFECTIVE PAGES

All the pages which constitute this document are listed below.
This list is re-issued with each amendment.

Page	Code	Page	Code
Page 1	1.88		
Page 2	1.88		
Page 3	1.88		
Page 4	4.76		
Page 5	4.76		
Page 6	4.76		
Page 7	1.88		

Pages

1. GENERAL 3

2. PARTICULAR ASPECT OF LIMITATIONS 4

3. MOUNTAIN FLYING IN WINTER 6

Printed in France

0 - GENERAL

With a turbine engine, power fall off with altitude is slower than with a piston engine. Furthermore, as will be seen later on, there is a convenient means of ensuring that the limit load condition is not exceeded and, at limit load, the available power reserve is considerable.

With any helicopter, flying in mountainous country presents some special aspects which derive from the following :

- presence of vertical air currents (updrafts and downdrafts of dynamic or thermal origin).

- disappearance of visible horizon, when the helicopter flies lower than the crests facing the pilot.

- lower air density.

As regards the first two points, there is nothing special to say on the Alouette (except that with its fast climb capabilities, it is well preserved againts downdrafts) and the considerations briefly outlined hereafter are applicable to all type helicopters.

However, the lower air density is the source of some special aspects in regard of a turbine-powered helicopter.

A. PRESENCE OF VERTICAL AIR CURRENTS

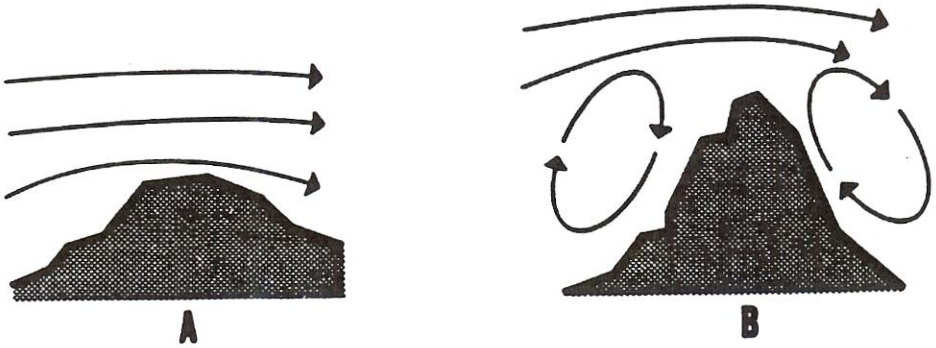
Vertical air velocities in mountainous country, even out of the clouds, can attain considerable levels (15 m/sec. (3000 ft/min.) and more quite impossible to offset by the vertical speed of the aircraft itself. Hence, it is essential to know how they should be anticipated and what action should be taken.

B. DYNAMIC AIR CURRENTS

Winds are disturbed by topographical features since they are compelled to get around them.

- If the topography is relatively flat, and the wind is slight, the mass of air will flow over the mountains in laminar fashion (i.e. no turbulence) : upward current or updraft on the near side relative to the wind direction and a downward current or downdraft on the far side (view A).

- When the topography is abrupt, and in strong wind conditions, the air flow is no longer laminar : turbulence occurs on both the near side and the far side relative to the wind direction and as a result, there is a downdraft close to the near side of the mountain and an updraft close to the far side (view B).



C. THERMAL AIR CURRENTS

In low or zero wind conditions, and in sunny weather (anticyclones in the summer), the air masses are unevenly heated on the spot and, as a result, thermal vertical air currents are set up :

- updrafts above the mountain sides exposed to the sun and, in the evening, updrafts above the forests in which is stored the heat generated during the day.
- downdrafts above the mountain sides in the shade and above the glaciers.

1 - DISAPPEARANCE OF VISIBLE HORIZON

The pilot who is deprived of visible horizon, has no visual reference in regard to aircraft attitude. Instead of flying at constant attitude he will have a tendency to maintain the crests at a constant height relative to the fuselage centre line, hence, to lift the nose of the helicopter when approaching the mountain side.

Therefore the airspeed indicator must be read very frequently.

2 - EFFECT OF DECREASE IN AIR DENSITY

When hovering in ground effect, the decrease in air density, for a given weight, has the following effects :

- higher collective-pitch requirements
- higher tail rotor blade angle entailing smaller rudder pedal margin
- less available power reserve.

As a result, the maximum operating weight (taken as the maximum weight sustainable in hovering flight with ground effect) is reached when any one of the following limits is attained :

- maximum collective-pitch
- maximum rudder pedal position (allowing for a minimum margin)
- maximum engine power.

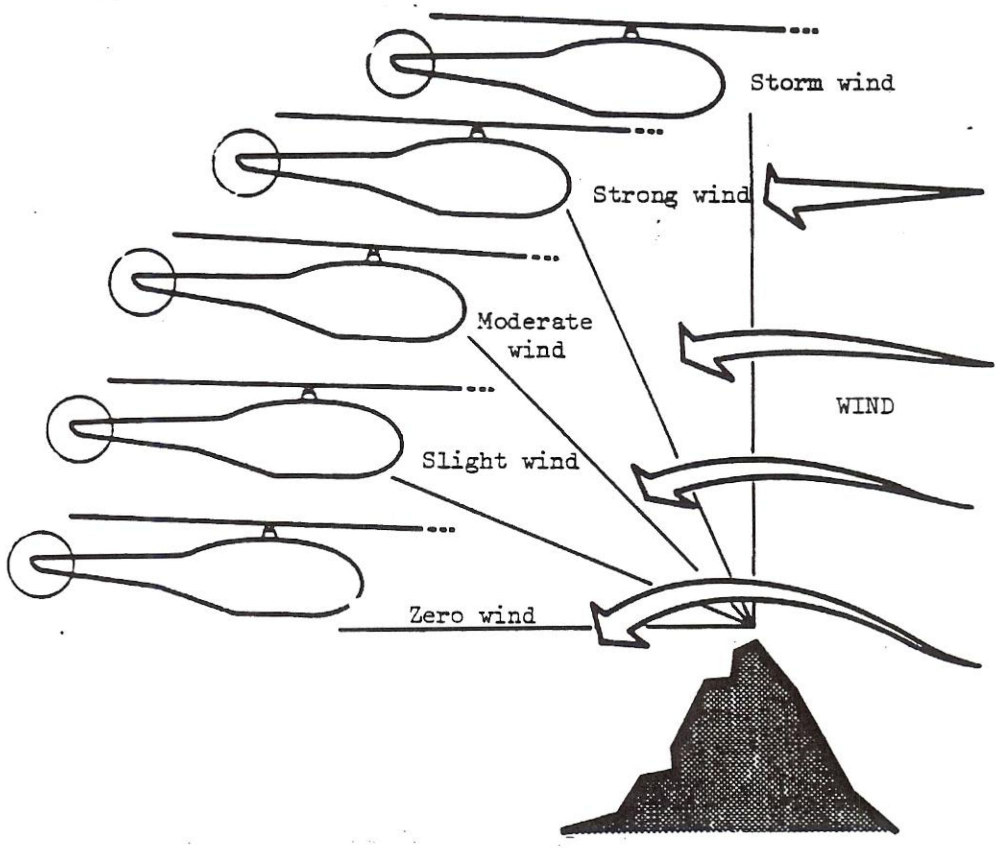
3 - FLIGHT PATH REQUIREMENTS

A. LANDING APPROACH OR FLIGHT PATH AFTER TAKE-OFF

The weight limitation being determined, the pilot must choose an approach or take-off flight path which he will be able to follow without having to exceed operating limitations, due consideration being given to the downdrafts liable to be encountered. Optimum flight paths, therefore, are those requiring the smallest collective-pitch angle during the manoeuvre.

Whenever possible, the pilot should land on a bump or crest, so as to be able to choose any approach axis in azimuth and elevation, depending on the wind. Furthermore, this will enable him to easily accomplish another circuit in the event of a faulty approach. Finally, he will also be able to redure engine power immediately after take-off.

The golden rule of mountain-country flying is to select an approach angle all the more steep that the wind is stronger, up to vertical approach in a windstorm.



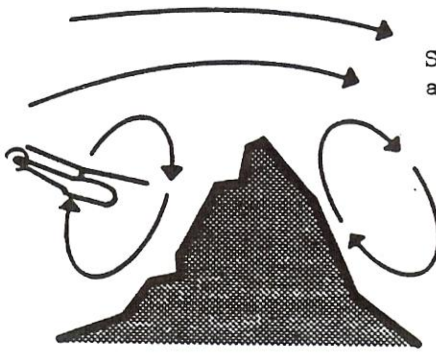
When there are no downdrafts to be feared, flat approach is the form which authorizes minimum collective-pitch to establish hovering flight, as there is no vertical speed to be cushioned. In windy conditions, this advantage is offset by the presence of downdrafts behind the crest, a factor which grows in importance as the wind increases.

Gathering of speed take-off should, of course, be accomplished into wind ; so should deceleration prior to landing but the slow-down must be very gradual. During final approach, the airspeed indicator should be watched very carefully, especially in slight or zero wind conditions, in order to make sure that the airspeed does not fall off completely before the helicopter is over an area possible to land on.

To determine wind direction, in the absence of a flag, smoke or other such means, proceed as follows : make a run at low I.A.S. with no side-slip, at about 50 m (160 ft) above the landing point, and then another run at the same I.A.S. in the opposite direction. Drift, on the one hand, and the difference in ground speed between the two runs, on the other, will give a fairly accurate idea of the wind direction. If the wind is only light, the first two-way run may not be sufficient to establish its direction ; in that case, accomplish a second two-way run at a lower altitude (a few feet above the ground).

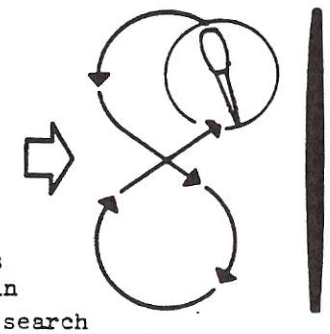
These runs will also permit checking the condition of the ground on the selected landing area.

Should the aircraft be caught in a downdraft which forces it below the desired flight path, the pilot should immediately turn the helicopter in the downwind direction and allow it to be carried by the downdraft, while maintaining the airspeed along the slope. He should move out of the downdraft before attempting to regain altitude.



B. CLIMB

In order to reduce climb time, the pilot should attempt to take advantage of atmosphere updrafts (flight on the near side relative to the wind or, in slight wind conditions, flight above the mountain sides exposed to the sun).



The pilot who gains altitude on the near side relative to the wind should always beware of the downdraft close to the mountain side. If he approaches the mountain side in search of the maximum updraft, he should not do so by facing the mountain side, but by placing the aircraft almost parallel to the latter so as to be ready at all times to move away from it and re-enter the rising current.
If he wishes to gain altitude in a given zone, he should accomplish a series of 8's, always turning in the downwind direction, and not a spiral climb.
Never attempt to take advantage of the updraft on the leeward side of a mountain, for the turbulence on that side can be very dangerous.
Section "PERFORMANCE" gives the rate of climb in relation to altitude and outside air temperature. This chart gives an idea of climb time in the absence of vertical currents.

Printed in France

4 - MOUNTAIN FLYING IN WINTER

Winter operations in mountain-country should be performed only by highly experienced pilots, in view of the following considerations :

1) On landing in powdery snow, the pilot is liable to be deprived of visibility by snow thrown up by rotor downwash.

2) In dull weather it is very difficult to estimate distances and speeds on snow covered surfaces.

3) It is essential to assume flight paths that will not compell the pilot to exceed specified collective-pitch limitation nor cause him to apply full right rudder (during turns on the spot or very low-speed flight, always turn in the direction of rotor rotation, in view of the fact that much power is absorbed in resuming straight flight on completion of a left hand turn).

5 - ENGINE STARTING AT ALTITUDE

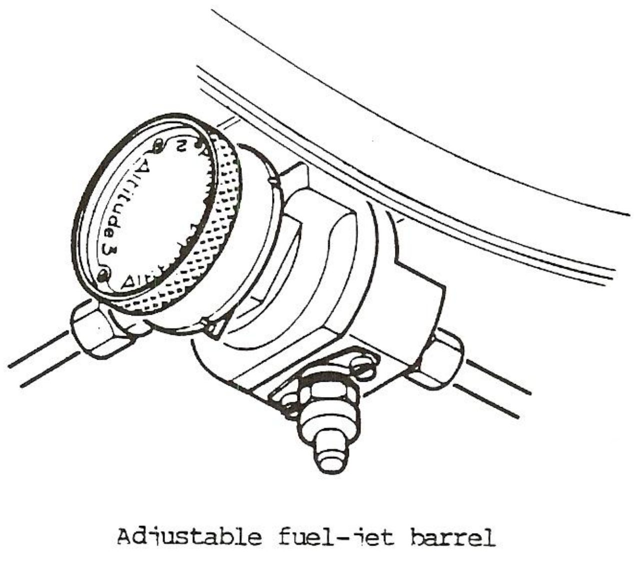
- The engine is normally provided with a barostatic cock which automatically adjusts fuel mixture during the starting cycle for the altitude of operation.

- Some engines are provided with a fuel-jet barrel, adjustable on the ground, for starting at the following altitudes :

  . n° 1 for engine starting up to Zp = 1500 m (5000 ft).
  . n° 2 for engine starting from 1500 to 3000 m (5000 to 10000 ft).
  . n° 3 for engine starting from 3000 to 5000 m (10000 to 16500 ft).

- For these two types of cock, and for engine starting between 5000 and 5800 m (16500 to 19000 ft) a slow-running check must be performed before stopping the engine : Engine idling speed should be 20000 rpm.

  Correct, if necessary, by re-setting the idling adjustment screw.



Adjustable fuel-jet barrel