

EIGHTH EUROPEAN ROTORCRAFT FORUM

Paper No 12.8

IDEAL CHARACTERISTICS FOR A  
MOUNTAIN RESCUE HELICOPTER

R. FRAISSINET

SECOURS AERIEN FRANÇAIS, FRANCE

August 31 through September 3, 1982

AIX-EN-PROVENCE, FRANCE

ASSOCIATION AERONAUTIQUE ET ASTRONAUTIQUE DE FRANCE

## HISTORICAL ASPECTS

Over 25 years have past since a French Air Force Sikorsky was lost on the Mont Blanc following what was probably the first attempt to rescue mountain climbers at high altitudes by helicopter.

Now every serious accident occurring to mountain climbers calls for helicopter rescue, and it seems unbelievable that mountain climbing existed so long without helicopters.

In fact it even seems unbelievable that people could have lived so long in mountains without helicopters, quite apart from any climbing activity. Driving by road from many villages in the French Alps to the nearest major hospital may take 3 hours or more.

By helicopter it is never more than 20 minutes and obviously this difference may mean life or death not only to the fallen climber but also to any seriously sick person requiring immediate medical assistance from a far away sophisticated hospital.

Helicopter rescue and medical transport operations in the Alps or similar type of country, carried out throughout the year, by day and by night, raise however many questions and problems. Until came the Alouette II, the first turbine helicopter 20 years ago, very little could be achieved at high altitude by the piston powered light machines such as the BELL 47.

Although the supercharged version improved the high altitude performance, cabin space was scarce and the early rescue operations carried out with this type of machine during the Korean, Vietnam and Algerian wars frequently saw the patient lying outside the helicopter, on the skids, out of any possible medical care.

With the ALOUETTE II, obsolete today, but unbelievably performing by those days standards, significant progress was made towards modern rescue operations and medical transport in high altitude country.

Out of ground effect hover performance became available at reasonable weights up to 6 to 8.000 feet, and cabin space permitted both medical doctor and patient to be carried side by side in the cabin.

The early BELL JET RANGERS followed with similar performance and commodities, but it is only with the advent of the ALOUETTE III, specifically designed for mountain rescue operations, that practically any type of rescue or medical transport required within high altitude country became possible.

Thanks to a spacious cabin accommodating one patient, pilot, technical assistant and doctor, together with winching capability directly into the cabin at practically any European mountain altitude, this remarkable machine let to modern techniques in the field of high altitude rescue.

## WHAT FEATURES ARE DESIRABLE FOR A MOUNTAIN RESCUE HELICOPTER ?

### Power to weight ratio

The most important feature.

A mountain rescue helicopter operating in Western Europe must be capable of hovering easily out of ground effect in spite of unfavourable aerological conditions up to 15.000 feet, with pilot, assistant, doctor or mountain guide on board, and the rescued person hanging on the winch.

### Engine reliability and single engine performance when the helicopter is a twin

Here again we have a highly commendable item when flights over high ground with frequent hovers are involved.

Should the mountain rescue helicopter be single or twin engined ?

Obviously twin engine is better if the engines are long time proven and highly reliable. However out of ground hover performance should then be retained on one engine at high altitude and typical operational weights, which is presently not obtainable except on the PUMA.

If you cannot have such single engine performance, my personal opinion is that one is better than two for high altitude mountain rescue because the chances of failure when hovering are doubled with two, but this is a highly controversial matter.

### Visibility

It is of paramount importance that the pilot has unobstructed view in every direction including downwards and sideways.

Landing in the snow at high altitude on unknown spots by poor visibility is always difficult and perfect visibility in all directions is essential.

### Good controllability in high gusty winds blowing from any direction

Due to environning terrain, it is seldom possible to hover into wind and controllability in gusts which may come from any direction is therefore essential.

### Capability of winching directly into the cabin

Wounded people are frequently unconscious or unable to move.

It is therefore required that they can be winched directly in the cabin which is usually not possible with skid equipped helicopters because an unconscious person cannot get across the obstacle of the skids when reaching the cabin on the winch cable.

Also lateral stability problems on light helicopters forbid the use of winch arms reaching sufficiently out sideways to pull up vertically clear of the skids. Therefore, capability to winch directly into the cabin is of paramount importance.

#### Rescue winch characteristics

The rescue winch should have as long and strong as possible cable. In this respect the solutions currently available for light rescue helicopters are not quite satisfactory.

#### The type of door

Mountain rescue helicopters should have sliding doors easily manoeuvrable by anyone and fully failproof in any wind condition. Also the doors must be wide enough to permit easy embarkation of wounded or sick person on a stretcher.

#### Good autorotation characteristics

In case of engine failure, good autorotation characteristics are essential in mountain countries.

#### High main and tail rotor clearance

Landing one skid on a slope which is excessive for a full landing but not steep enough to justify winching, calls for high rotor clearance, and same applies to tail rotor over rough ground.

#### High altitude and low temperature starting capability

In rescue operation within mountains you frequently have to stop your engine at altitudes as high as 12.000 feet and temperatures as low as -30° Centigrades. Naturally you must be sure to start up in this adverse environment and here again we have a highly desirable feature.

#### Good cargo sling capability

Some rescue operations cannot be carried out by the winch and require cargo sling operation. Therefore good performance in this respect is also desirable.

#### Clearance between main rotor and tail rotor boom with capability to start in high gusty winds

In mountain rescue operations, you frequently have to start and stop in high gusty winds and therefore capability to cope with such conditions is important.

#### Capability to perform full landings on slopes as steep as possible

This is an obviously desirable feature in mountain rescue operation.

#### Capability to sustain some degree of main rotor icing

Some types of rotor (fully articulated) will prevent you from starting up after a cold night with high humidity and iced up rotor when others (rigid type) will be much less sensitive in this respect.

### Cabin space

Cabin space must be sufficient to accommodate pilot, assistant, doctor or mountain guide, and the rescued person on a stretcher. Also the required medical instruments and tooling such as oxygen, heart monitoring, breathing assistance etc., must conveniently take place in the cabin.

### Helicopter size weight and rotor diameter

The helicopter must not be too large. Big rotor diameter prevents the pilot from hovering close enough to near vertical cliffs when winching. Also powder snow will be raised that much higher when the helicopter is of large size and weight, which complicates landing operations in difficult points during winter.

### Instrument flight capability

Full IFR is not essential because you can, if required, change for an IFR machine after the rescue has been accomplished, but minimum instrument flight capability is necessary for short periods under emergency or by night.

### Speed

Although desirable, speed is not essential because in Western Europe the mountain rescue helicopter will seldom have to fly more than 50 nautical miles to hospital. Over this kind of distance the difference between 90 knots and 130 knots will not exceed 10 minutes. Also, the speed to be considered is that achievable at high altitude.

### Comfort

Low noise and vibration levels are also desirable for the patient's health although not of prime importance for this type of operation.

### Night research equipment

People may have to be rescued by night in the mountains and availability of a powerfull orientable searchlight coupled with a radio altimeter can be useful.

### Patient's position in relation to doctor in the helicopter

Best position is to have the doctor sitting behind patient's head and strictly in line with the body.

This position is the only one permitting convenient intubation, which is not possible or, at least, very difficult on the ALOUETTE III, but quite easy on the BO 105. It is also useful that the doctor be in a position permitting to reach the lower part of the patient's body. This is only possible in the ALOUETTE III if you reverse both central and left front seats, the doctor then sitting on the reversed central front seat, about mid-body in relation to the patient. It is difficult on the BO 105.

Importance of actual intubation in flight is a highly controversial matter since many doctors claim all actions of this nature must be done before take off. Some doctors also claim, with an helicopter, you can usually perform an immediate landing any time in order to carry out on the ground whatever urgent action which may be required. This emergency landing, however, would not be possible when flying above a solid layer of clouds or in IFR conditions.

Importance of reaching the lower part of the body in flight is also a controversial matter. Many French doctors feel it is very important, but German and Swiss doctors make extensive use of the BO 105 for ambulance flights (not high altitude actual rescue) and therefore do not share this opinion. Not being a doctor myself, I have no valid opinion on the subject.

#### HEAVY HELICOPTERS IN MOUNTAIN RESCUE

Although seldom used in this type of operation, primarily because of cost, heavy helicopters, such as the PUMA and the BELL 214, can be quite efficient in mountain rescue operations. I have personally flown a PUMA 330J in mountain rescue during one winter season and was extremely satisfied.

Disregarding the cost aspects, drawbacks from a technical standpoint were the size of the helicopter, the rotor diameter and also the rotor blow. In compensation, the capability to hover OGE on one engine at rescue operational weights up to high altitudes, together with a 140 kts. cruising speed above 10,000 ft., a 50 meter cable electrical winch, very high tail rotor clearance, great hover stability, large sliding door combined with wheel gear configuration, considerable cabin size and full IFR capability, were very positive assets indeed.

Undoubtedly, some of the 35 rescue missions, including night and partial IFR, which I flew on the PUMA, could not have been satisfactorily executed by any type of light helicopter.

However, the cost of purchase and subsequent operation being about four times that of an ALOUETTE III, it is doubtful this type of machine can ever become a standard mountain rescue helicopter.

#### WHAT WOULD BE TODAY THE IDEAL MOUNTAIN RESCUE HELICOPTER

It is interesting to define the ideal mountain rescue helicopter, and this can conveniently be made by reference to the various existing types.

The ideal mountain rescue helicopter should have :

- the SA 365 DAUPHIN's cabin space and overall size,
- the LAMA's power to weight ratio and OGE hovering capability,
- the TWINSTAR or BO 105 light twin engine configuration but with the PUMA's single engine hover capability i.e. single engine hover up to 3000 meters at light rescue operational weights,
- an electrical winch combining the variable arm facility of the BELL 204/205, and the 50 meter cable of the PUMA together with more cable resistance, and generally speaking more safety items built into the system,
- the speed at high altitude of the BO 105, most performing light helicopter in respect of cruising speed above 10.000 feet,
- the ALOUETTE III combination of sliding doors, wheels and retractable floor to ensure greatest facility of winching unconscious persons directly into the cabin,
- the BO 105's tail rotor clearance to ground,
- the BO 105's tail rotor clearance to tail boom,
- the BO 105's main rotor clearance to ground,
- the BO 105's capability of steep slope landings,
- the BO 105's rigid rotor with capability to start and stop in any wind, also coping satisfactorily with a substantial degree of main blade icing on start up,
- the BO 105 relative position's of lying patient and doctor,
- the ALOUETTE III 316 and LAMA's engine reliability and excellent regulation characteristics,
- the ALOUETTE III's 316 and 319 or LAMAS excellent engine starting behaviour in high altitude and low temperature conditions,
- the LONG RANGER and TWINSTAR's low noise and vibration level for the comfort of seriously wounded people and attending doctors,
- the GAZELLE or BO 105 cockpit visibility (small narrow instrument panel with no obstruction whatsoever to pilots visibility downwards and sideways),
- the HUGHES 500D small diameter rotor,

- the BELL 206 excellent autorotation characteristics,
- the LAMA's good controllability in flight with high gusty winds from any direction.

Obviously, such ideal mountain rescue helicopter does not exist. Having personally flown in high mountain operations and still currently flying many types of helicopters ranging from the BELL 206 to the PUMA through the LAMA, ALOUETTES III 316 and 319, GAZELLE, BO-105 and ECUREUIL, my personal feeling is the old ALOUETTE III in the 319 version remains the best compromise for high altitude mountain rescue. This opinion is substantiated by the fact mountain rescue operations in SWITZERLAND and FRANCE, where this activity is the most important, are carried out at more than 90% by the ALOUETTE III with a very small LAMA, ECUREUIL and GAZELLE 342 contribution.

The ALOUETTE III in mountain rescue operation has strong and weak points, but the strong points are essential ones with which there can be no possible compromise, such as :

- acceptable OGE high altitude capability at operational weights, although this could be better in the 4.000 to 4.800 meters range,
- fairly good cabin size particularly in width, although slightly larger dimensions comparable to the DAUPHIN would be a desirable improvement,
- good wheel, door, and retractable under the winch floor characteristics,
- excellent engine reliability and behaviour in all respects at high altitude,
- good visibility,
- acceptable patient's position in relation to doctor,
- acceptable winch characteristics,
- acceptable controllability in high gusty winds blowing from any direction.

Whereas most of the weak points can be coped with by an experienced crew, such as :

- low speed,
- marginal tail rotor clearance,
- obsolete main rotor characteristics with great sensitivity to any quantity of ice, and also to strong gusty winds on start up,
- sensitivity to strong cross winds because of important fuselage and cabin vertical surfaces.



The ALOUETTE III 319 (the most desirable ALOUETTE III version for mountain operations), is no longer in production, but the ALOUETTE III 316 is built under licence in ROUMANIA. However, with the constant increase of mountain rescue operations, there is an acute need for modern replacement of this good old machine.

I therefore strongly hope some manufacturer will supply, in a very near future, the required ideal mountain rescue helicopter.