Gliding and mountains

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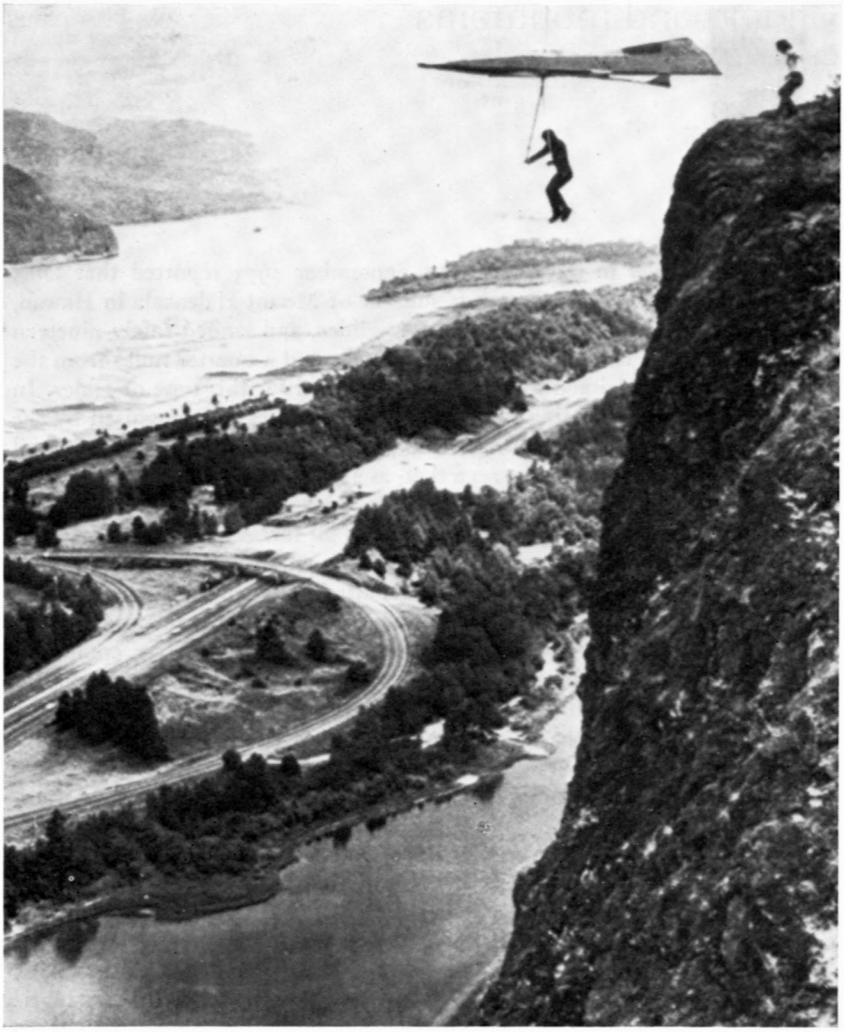
Flight International in its issue of 13 September 1973 reported that Dick Eipper had leapt from the 10,023-ft summit of Mount Haleakala in Hawaii, clutching his modified Rogallo-type hang-glider, and landed safely nineteen and a half minutes later 8362 ft below and nine and a quarter miles from the summit. This was claimed to be a distance record for this type of glider. In view of the fact that existing world records for gliders, as recognised by the Fédération Aeronautique Internationale, stand at 46,250 ft for altitude and 907 miles for distance, it can be seen that, as a sport, gliding now offers a wide diversity of objectives for its devotees and of apparatus for their achievement. Dependant as they are upon potential energy, all forms of glider require the initial provision of some favourable elevated situation before they can commence the effortless flight that is their chief attraction, and this prime requirement has led followers of the sport inevitably to cast their eyes mountainwards. Amongst the hosts of sportsmen with whom mountaineers are compelled increasingly to share their mountains, the pilots of gliders are likely to appear with greater frequency in the future. These brief notes are provided in the hope that they will enable mountaineers not already familiar with gliders to have some knowledge of the aspirations and difficulties that face those pursuing this aerial sport amongst mountains.

Opinion is divided over the cause of this resurgence of activity in the field of hang-gliders, an ancient form of aviating that was supposed to have been supplanted by a more efficient method of gliding devised by the Wright brothers 73 years ago, but it is a fact that hang-gliders, of which the Rogallo is a popular form, are now more numerous than ever before. The Rogallo, and many similar types, consist essentially of a single thickness of synthetic fabric attached, like a sail, to a triangular framework of light metal tubes from which the pilot is suspended. Also attached to the underside of the framework is a rigid form of 'handlebar' against which the pilot pushes or pulls his suspended weight. The resulting reactions can, if skilfully applied, change the attitude of the 'sail' and direction of flight. There is no tail or rudder and the complete equipage must be sufficiently light to enable the pilot, not only to support it whilst standing upon his own two legs, but to run or at least totter downhill. This last requirement makes the hang-glider unique, all other gliders requiring extra assistance in some form to enable them to become airborne.

Gliders capable of soaring several hundred miles and climbing silently and effortlessly many thousands of feet are, on the other hand, of elegant aerodynamic form with wing spans of 50–70 ft and weighing, empty 400–700 lb. Their construction employs wood, metal and glass-fibre, the more recent designs tending to concentrate upon the latter two materials. Flights of several hours being common, the pilot is comfortably seated in a reclining position



34 *Descent from Crown Point, Oregon, by hang-glider* Photo: Associated Press Ltd.

in the foremost part of the machine, enclosed within a snugly fitting cockpit, the upper part being detachable to permit his entry, and transparent to permit a good view upwards, forwards and sidewards, but rarely directly downwards. A single wheel is usually provided upon which the glider runs during take-off and landing. Apart from a variety of instruments to assist his performance the pilot may have oxygen and radio installations for use as occasion demands.

Unlike the hang-glider, the pilot of a high-performance glider requires assistance both to get into the air, and to effect removal of his craft from the place where he has finally come to rest. Without such assistance his beautiful machine has a pathos comparable to that of a stranded cetacean. There is some evidence that the revival of interest in hang-gliders has been stimulated by pilots who have found themselves in this position far too frequently. Because

of its simple construction the hang-glider is a practical do-it-yourself proposition, and even if bought ready-made from a manufacturer has a price advantage over the latest high-performance glider of at least 20 : 1.

Hang-gliders were pioneered during the last decade of the nineteenth century, by Lilienthal in Germany, Pilcher in England and Chanute in the USA, and their success as the first men to fly with wings owed something to the published scientific works of Sir George Cayley, who had experimented with substantial model gliders some 40 years previously. The short duration of these pioneer flights (48 seconds was considered remarkable) was due to the caution they exercised in confining themselves to short, gentle slopes that afforded a sporting chance of survival in the all too common event of 'pilot error'. It was the Wright brothers, however, who convincingly demonstrated that the duration of a gliding flight need not be determined by the elevation of the launching point, but could be extended if the flight took place in air that was ascending at a rate equal to or greater than the rate at which the glider was sinking through that same air, i.e. if the glider was able to 'soar'. Orville Wright established a record in October 1911, by soaring for nine and three-quarter minutes over the sand dunes of Kitty Hawk, N Carolina, in a gale-force wind. Owing to the overwhelming interest in aeroplanes at this time, ten years were to pass before this record was broken following a renewed interest in gliding that was sparked off in Germany. The lesson of Kitty Hawk was not forgotten, and it was concluded that if puny sand dunes could produce rising air capable of sustaining motorless flight, more substantial barriers to the wind would produce rising currents that were correspondingly more extensive, both horizontally and vertically, and thus enable gliders to travel considerable distances. Now that the mechanics of soaring flight were understood it was also appreciated that weaker currents could be utilised for soaring if the rate at which the glider sank through the air could be reduced. As a result the aerodynamic form of gliders improved conspicuously between 1921 and 1931 and the increase in glider performance that followed improved lift/drag ratios led to a spate of record-breaking that showed that gliders could not only remain airborne over a windward slope for many hours, but travel several miles in such 'slope lift' by following a suitable route along ranges of hills and mountains, even crossing intervening gaps if these were not too wide. Because the energy that supported him was invisible and its supply could not be gauged as readily as fuel in a tank, the glider pilot was always conscious that a sudden landing might become inevitable either as a result of a change in the wind speed or direction, or because he had misjudged the airflow over a slope. It was only natural, therefore, that in the search for suitable sites to exploit this new and rapidly expanding sport, inhospitable country was avoided. The gliding sites that became permanent establishments at this time featured extensive ridges with vehicular access to their summits, and slopes that descended sharply to plains or broad valleys that afforded a safe landing area for gliders.

The most renowned region during this rapidly developing phase of the sport was the Rhön mountains, where a gliding school was established upon the Wasserkuppe. This school became the prototype for similar sites, established in the Sudeten mountains, the Carpathians, the Yaila mountains of the Crimea,

in the Auvergne and the northern end of the Allegheny mountains. Successful expeditions for the express purpose of raising the duration record were made into the Atlas and the mountains of Hawaii. At the latter location Lt Cocke, in December 1931, remained aloft for 21 hours 34 minutes.

Doubts about the need for mountains to sustain gliders upon cross-country flights arose following flights by R. Kronfeld in 1928 and 1929. This pilot, after climbing in slope-lift over the Rhön mountains, found that he could attach himself to passing clouds by remaining in the rising air he found beneath them, and in this way he put up a distance record of 89 miles, the previous record of 43 miles being made the previous year by Nehring, who had been confined to successive mountain slopes. By 1931 a new method of launching gliders had become well established, by towing them behind aeroplanes until they had sufficient height to cast off and soar beneath clouds as Kronfeld had demonstrated. The possibility of achieving flights of a considerable distance after being launched in this fashion meant that many gliding enthusiasts turned their attention away from the mountains at this time and towards the plains of northern Europe, Russia and the Middle West of America. Here increasingly long flights were being achieved by flying down-wind beneath 'cloud streets' of fair weather cumulus. By the end of 1939 the world distance record stood at no less than 465 miles, attained by Miss Olga Klepikova, flying across the Russian plain south-eastwards from Moscow.

But the attraction of gliding from mountains remained and following demonstration flights from the Jungfraujoch by the Rhön's ace pilot Groenhoff in

35 *Glider above German hills*, 1935 Photo: West German Tourist Office

1931, gliding developed in Switzerland and Austria. By 1935 a Swiss pilot, Schreiber, also launched from the Jungfraujoch, made the first crossing of the Alps by glider, landing at Bellinzona, and by 1937 the movement was sufficiently advanced in Austria for an international meeting to be held at Salzburg. However, pioneering flights of an entirely different kind were taking place amidst less spectacular mountain scenery in the Sudeten Mountains, where in 1933 it was discovered that it was possible to soar to a considerable height to leeward of these mountains when the local föhn was blowing. This condition is sometimes marked by parallel bands of lenticular cloud, perpendicular to the wind direction, that remain stationary for hours, despite the strong wind blowing through them. Numerous exploratory flights were carried out in the region of the Schneekoppe mountain, and in November 1938 a record altitude of 22,434 ft was reached. This phenomenon has some similarity to that known in hydraulics as 'standing wave', although most meteorologists now prefer the term 'lee wave'. Considerable interest was aroused in official circles by these flights, since the existence of such behaviour by our atmosphere had never been suspected. Moreover, the magnitude and extent of the vertical movements

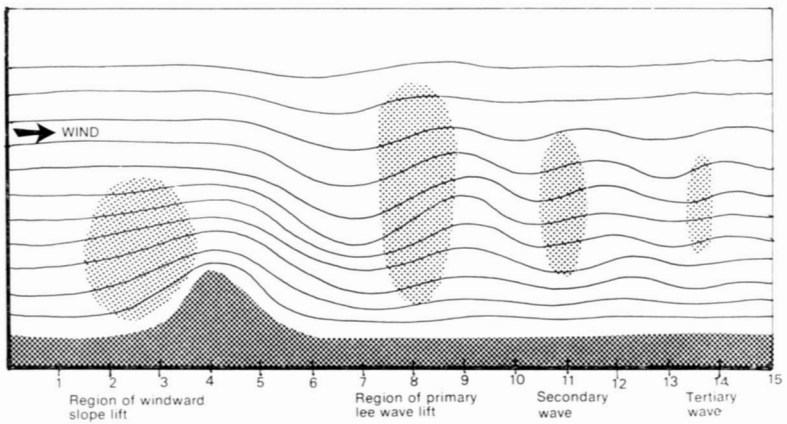
36 *Soaring above Austrian snowfields* Photo: Austrian National Tourist Office

made them of considerable interest to commercial and military aviation. Consequently in 1941 the German government supported a highly competent and well-equipped team to explore this effect during an Alpine föhn over the region of the Hohe Tauern. The results were spectacular and on 11 October 1941 Klockner soared to 37,600 ft.

Official interest in lee waves continued for many years after these events and was stirred by the knowledge that shortly commercial aircraft would have to fly at these altitudes, and ignorance of conditions that might prevail in these little-known regions could not be tolerated. During these years numerous flights into the stratosphere were made by gliders riding upon gigantic invisible waves. Apart from the Austrian Alps and the Sudeten mountains this activity was centred mainly upon the French Alps, the Tatra and the Californian Sierra Nevada, where Bikle, in February 1961, established the height record mentioned at the beginning of this article, of 46,250 ft, in the lee of Mount Whitney. Bettering this figure involves the overcoming of a formidable engineering problem; to go higher it is essential that the pilot receives his oxygen in a pressurised environment. Pressure suits and pressurised cabins have been in use for some years, but so far none has been tailored for the glider pilot. Apart from this problem, which is likely to be overcome only by the design and construction of a special high-altitude glider, there is no reason to suppose that lee waves cannot carry a glider much higher; and the region producing the highest waves may not be that with the highest mountains. Sightings by meteorologists indicate that the region most likely to achieve this distinction lies in the lee of the Norwegian Plateau, where 'mother of pearl clouds' indicative of wave formation have been measured to a height in excess of 90,000 ft.

A feature of lee waves already mentioned, is that they occur across the wind, successive crests recurring at a regular wavelength, but with diminishing amplitude. This presents a special problem if the pilot wishes to soar a considerable distance, since flying down wind will quickly place him in air which

The regions of rising air used by gliders in the neighbourhood of mountains, The extent and location of these regions vary according to the temperature and velocity gradients through the atmosphere



is descending as fast as that which raised him in the first place. The technique, of course, is to fly across wind on the upwind and rising side of the wave to gain the maximum height before dashing down wind to the next crest in the series. An error that results in the pilot flying across the wind on the leeward side of the crest can have that pilot on the ground in a very short time indeed. On the other hand, if the pilot wishes to travel across the wind, a lee wave is an ideal means of doing this, since, if he is sufficiently skilful, he need not experience any loss of height in the process, i.e. he flies along the wave upwind of the crest. The distance he can fly in this fashion will depend upon the extent of the wave system, and this will in turn depend upon the topography upwind. By discovering such wave systems glider pilots have been able to make some outstanding 'goal and return' flights. That is to say, the pilot makes an open declaration of his intention to fly to a stated 'goal', takes a photograph of it and returns to his starting point. Because they avoid the inconvenience and expense of being retrieved by aeroplane, or by car and trailer from some distant field, such flights, and especially record ones, are regarded in the gliding world as of outstanding merit and in consequence give rise to the keenest competition. For some years now the world records in this 'goal and return' category have been held by pilots who have planned their flights along mountain ranges to take advantage of lee waves, or at a more lowly level, the slope lift that they generate in suitable winds. To achieve the same purpose it is surprising that two mountain ranges as different as the Alleghenies of the USA and the Southern Alps of New Zealand should be used. To gain his record of 622 miles in September 1972, Georgeson used lee waves from the Southern Alps and was on oxygen for much of the eleven and a half-hour trip, making a double traverse of South Island, from NE to SW and back. He lost this record shortly afterwards to rivals in the USA who started from opposite ends of the Alleghenies. Striedieck, on 7 October 1972, raised the record to 635 miles by flying from Port Matilda, Pennsylvania, to N Tazewell, Virginia and back, only to lose it to Smiley on 9 October, who started from Bluefield, Virginia and turned S of Loch Haven in Pennsylvania, a distance of 648 miles. Then a week later, on 15 October, Striedieck returned to the fray and raised the record to 678 miles by extending his turning point southwards to Rosedale. The alignment of the Alleghenies being NE–SW these flights were made possible by strong winds from a north-westerly quarter, but in striking contrast to Georgeson, the two Americans concentrated upon flying in the slope lift to windward of a chain of comparatively lowly ridges, the gaps in the chain being their main problem. They did not attempt to climb as high as possible except when it was necessary to cross gaps, generally using the strong slope lift to increase speed until the sinking speed of the glider cancels the upcurrent. By this means Smiley averaged nearly 72 mph for his trip.

The New Zealander concentrated upon waves in the lee of the Southern Alps and by this means reached 26,000 ft. It will be interesting to see whether the New Zealand gliding fraternity, a small but exceedingly active body, will mount a new attack upon the record and if they do, whether it follows the previous pattern of wave flying or resorts to slope lift to windward of the Southern Alps, using the American technique. There is a significant gap between Smiley's 72 mph and Georgeson's 55 mph.

It may well be that a double traverse of the Southern Alps on the Tasman side is impracticable and if so it will be for the same reasons that have left the grandest mountain ranges unflown by gliders. In the first place a suitable launching site must be found in the right place for a record attempt, and secondly, for reasons explained earlier, there is a need to avoid inhospitable country. The hazards facing the glider pilot who is forced to make an emergency landing are very real, but not always obvious. Even if he suffers no personal injury his glider may be extensively damaged by running into fences, mole hills, standing corn, sheep or rough, uneven pasture. Although such hazards are accepted as a normal risk when flying over an inhabited countryside, it is difficult to assess the prospects of the pilot who is forced down in the wilder and remoter mountain regions, unless he has first-hand knowledge of the area. Gliders have been landed without damage upon lakes and snowfields, but a successful landing is only part of the problem. Unless the glider is to become a total loss, it will need to be recovered, and if the pilot is not to succumb likewise he must receive assistance or be able to reach civilisation without delay, since his survival kit will be minute. Should the hapless pilot misjudge his approach and overshoot into the more common mountain scenery, he is unlikely to escape injury, and since the most frequent types of injury in these circumstances involve the lower limbs and/or spine, he will be totally immobilised. The prospects of a full-scale search and rescue operation must be considered, therefore, by anyone planning such a flight, and it is likely that this will continue to be a major discouragement to soaring the most majestic ranges.

37 *Soaring flight in Switzerland* Photo: Swiss National Tourist Office