Mt. Washington Area Wave Cross-Country Glider Flights

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Since the inception of Mt. Washington area wave flights in gliders, such flights have been almost solely regarded as a means of reaching unusual altitudes – the possibilities for distance flights have received little attention. This goal of this document is to consider some aspects of wave cross-country flights originating near Mt. Washington.

Terrain overview

The nature of mountain waves pretty much requires that long flights be across the prevailing wind and parallel to linear terrain features. In New England, wave-generating winds are largely west or northwest, and the mountain ridges (such as they are) are aligned north-south (occasionally northeast-southwest). So wave cross-country flights from Mt. Washington will aim to explore routes heading generally north and south.

The terrain both north and south of Mt. Washington does not look to be especially conducive to long wave flights. The Presidential Range (of which Mt. Washington is the highest point) is actually a mountain ridge about 8 miles long, and under the right conditions can generate a broad wave (though the best wave here is often quite limited in extent). Though the White Mountains of New Hampshire and Maine generally trend north-south, in all but a few areas they appear poorly organized to produce anything other than isolated spots of wave lift.

It's also true that the generally landability of this area is not good and becomes steadily worse to the north. Northern New England is probably 98% forests or lakes; very low population means that airfields and agricultural areas are few and far between (and on a declining trend).

But some recent investigations suggest the possibilities may be considerably better than a quick look at a terrain map might suggest.

A sample flight

An important step was a flight I made on 13 October 2003. This was a day on which, after a long struggle on the Moriah-Carter Ridge, I was able to climb to about 20,000' in the primary Mt. Washington wave. The wind at that altitude was westerly at 65-70 knots. The cross-country prospects did not seem promising: the day was almost entirely cloudless, offering essentially no atmospheric clues as to where wave might be found.

My first investigation was to the southwest – an attempt to follow the ridge line that includes peaks at Lafayette, Cannon and Moosilauke. The wind seemed a bit too westerly to make this generally northeast-southwest ridge promising. But along the route

were a few areas of weak (2 kt) wave lift, so I was able to reach Moosilauke having lost only a few thousand feet. From there I returned rapidly to the Mt. Washington primary wave, losing substantial altitude on this downwind run.

I again climbed in good wave lift, this time to about 15,000'. By this time the sky was entirely blue, but I felt a sortie to the northeast might be worthwhile. With no cloud clues, I simply followed the line of low to moderate peaks that heads northeast toward Sugarloaf ME (the route of the Appalachian Trail). I naturally tried to stay a small distance (about a mile) downwind of the peaks, and I found more or less continuous weak lift. It was rarely above 2 knots, but I was able to maintain about 15,000' to a point about halfway to the Sugarloaf airport, downwind of Lake Mooselookmeguntic.

At this point, my lack of preparation for such a flight told. Though conditions seemed good, it made increasingly little sense to proceed without any real knowledge of the landability ahead. Sugarloaf airport was in reach assuming reasonable luck with lift and sink, but such an assumption is often unwarranted when flying among mountains in 65-knot winds. I had no information about other fields along my route, and no one available as crew for a possible retrieve. So I concluded it was time to retreat and prepare for another day. The leg southwest had a considerable headwind component, but it went well and I arrived back at Mt. Washington higher than when I departed.

My third sortie was to the northwest, past the Crescent Range and along the Pliny and Pilot ranges west of Berlin and Milan. I encountered some weak wave lift here, not nearly as consistent as on the leg northeast. As I was running low on oxygen, I didn't spend time trying to climb, and was actually burning off altitude in preparation for landing.

In post-flight analysis under the rules of the Online Contest, this flight measured 325km. It seems clear that much more is possible.

Routes

Assuming that a climb in wave near Mt. Washington is the starting point, the terrain suggests three possible routes for wave flights:

1. Southwest and then south, at least as far as Moosilauke, and perhaps as far at Newport NH.
2. Northeast, along the Appalachian Trail, to Carrabassett ME (Sugarloaf Mountain)
3. Northwest, then north along high ground that lies east of Berlin, Milan, Errol and Rangeley ME, perhaps as far as Jackman ME.

The first two of these routes have been explored for about half their distance. The third is potentially far longer, but has fewer fields and lies over some of the most remote US territory east of the Mississippi River. It also includes fewer stretches of ridge that look to be likely wave producers.

It should be noted that at least parts of all three routes may be possible on a single flight (as was the case during the sample wave flight described above). It may also be possible to connect routes 2 and 3 at their north end, especially with a downwind transition (say, from north of Rangeley to Carrabassett).

Landability

As noted above, any significant wave cross-country flight originating near Mt. Washington will necessarily pass over terrain whose landability is not nearly up to the standards normally thought safe. But these judgments tend to be based on experience with cross-country flights in thermal lift. Two aspects to wave flying significantly mitigate the problems of staying within reach of an acceptable field: altitude and wind.

The wave-generating terrain along the promising cross-country routes is generally 2500 – 4000' MSL. Assuming the kind of wave conditions that could make long flights feasible, typical flight altitudes will be 8000 – 17000' MSL; the altitude of the valleys and flat areas among and east of the mountains (where landings might happen) are typically 300 – 1200' MSL. Winds at typical flight altitudes on days when wave cross-country flights are possible will necessarily be significant: 25 - 35 knots on a moderate day, up to perhaps 70 knots on a strong day.

This combination of altitude and wind has an interesting (and profound) effect on where a sailplane can glide to a landing: Upwind, it's unwise to assume that a 40:1 glider can achieve better than about 2:1; downwind, 50:1 may be conservative.

The nature of wave lift and sink is important to note here. Heading upwind, it nearly always takes a long time to pass through the cycles of lift and sink; conservative planning requires allowing for extended wave sink, which may exceed 10 knots (on a strong day, 30 knots down has been measured). Safe planning thus requires being very pessimistic about upwind glide performance.

Heading downwind, if bands of lift and sink are present they will be passed quickly, so it is reasonable to assume that a glider will average zero sink. A strong tailwind will thus produce an impressively shallow glide angle. The necessary conclusion is that safety fields must be located downwind of the intended flight track: a wind within about 40 degrees of a pure tailwind is a strong ally.

Here are some reasonable assumptions: we'll want to arrive at a landable field 1000' above the ground (say 2000' MSL), to evaluate the surface and fly an orthodox landing pattern. We'd like to be able to persist in looking for wave lift down to about 6000' MSL (2000 – 3000' above the wave-generating terrain), and still have no worse than a 30:1 glide downwind to the nearest field. With 4000' to burn, fields must thus be located within 120,000' (roughly 23 miles) of the intended flight track.

In most of northern New England, this turns out to be an easy standard to meet. Field-scouting expeditions in 2004 turned up an adequate number of useful fields within 15 miles of the likely wave flight tracks. The more populated areas in the flat terrain east of the likely flight tracks are 25 to as much as 50 miles away, but even these are well within reach of a pilot with the discipline to abandon a wave flight with sufficient altitude.

Appendix A presents a list of fields that may be of use during wave cross-country flights. Note that some of these require annual scouting.

Flight considerations

Several points distinctive of wave cross-country flying are worth noting here. An important one is that, while it's well worth looking for long bands of usable wave lift, these are not essential. It would suffice to have a number of reliable localized wave lift sources, and to use a climb and glide technique. It would be important that during the glides, the average air be about neutral – long bouts with wave sink are likely to be a big problem (and to indicate that the nature of the wave needs more study, for a line of sink implies that lift should also be available nearby).

Using "point sources" for wave lift implies making transitions between wave systems (which can also to apply to a flight that uses long stretches of wave lift). When these transitions are upwind, it's desirable to do them in a weak section of the wave. Pilots routinely seek out the strongest part of a wave for their climbs, but then often attempt an upwind transition in that same area, where the loss in height during the transition is likely to be greatest.

A point mentioned above needs emphasis: in wave flying, you must look downwind for landable fields: a field that's upwind may be out of safe reach even when very close. This is an obvious large adjustment from the typical thermal cross-country mindset.

Safe flying in mountains requires the discipline of having a safe field in reach at all times, and of starting a retreat when there is still sufficient altitude to reach it. This will likely be harder in wave cross-country flying because it will sometimes happen that the retreat must start under what seem like benign circumstances: still well above the highest terrain, and perhaps with promising-looking clouds ahead and in reach. An additional point is that once a pilot heads downwind he has typically given up any realistic chance of saving the flight, which may make him more willing to press on lower than is safe.

It makes sense to spend a lot of time and effort studying the safe landing options along all contemplated flight route. It also makes sense to allow for the possibility that a flight may not end at a safe field. The following equipment should be along on every serious wave cross-country flight:

- An ELT (emergency locator transmitter) with fresh batteries
- Clothing warm enough to survive a winter night
- Emergency food (e.g. peanut butter)

- A handheld radio with fresh batteries

Appendix A - Field notes

The following list shows fields that may be of use during wave cross-country flights. (Fields with an asterisk are those needing special attention). All these fields (and their latitude, longitude and elevation) are included in a waypoint database suitable for downloading to a Flight Recorder.

Bethel (aka Colonel Dyke) – This airfield, located just northwest of the town of Bethel ME, has a single paved runway (14-32) whose dimensions are 3800'x75'. (Not visited.)

Berlin – This airfield, located in the town of Milan (7 miles north of Berlin NH), has a single paved runway (18-36) whose dimensions are 5200'x100'; it slopes uphill to the north. (Visited Oct 2004.)

***Bradley** – This small airfield, located near the town of Woodstock NH, has a single grass runway oriented roughly north-south. The runway is difficult to spot and the approaches (through trees) are difficult. The grass bordering the runway may not be cut back far enough to allow a safe glider landing. Inspection essential. (Visited May 2002.)

Bristol (aka Newfound Valley) – This airfield, located a mile west of the town of Bristol NH, has a single paved runway (03-21) whose dimensions are 1900'x40'. (Visited May 2003.)

DeanMemorial – This airfield, located 3 miles northeast of the town of Haverhill NH, has a single paved runway (01-19), 2500' long'. (Visited Sep 2003.)

EaglesNest – This residential airfield is a good-quality grass strip about 2500' long, oriented roughly southeast-northwest. (Not visited.)

EastAndover (aka Farrington) – This is a grass airfield near East Andover ME. It does not appear on current charts, but appears to be fully landable. The runway runs NW-SE. Annual inspection desirable. (Visited 11 Oct 2004.)

Errol – This is a good-quality dirt/grass strip, 3600' long, oriented east-west. (Visited 15 Oct 2004.)

***FarmingtonFld** – There is a huge farm field just east of Route 4, about 2 miles north of Farmington ME. The field is at least 3500' long, and 800' wide. Annual inspection very desirable. (Visited 10 Oct 2004.)

Franconia – This is a grass strip, 2300' long, oriented north-south; home to the Franconia Soaring Club. There is a low fence across the south end of the runway. (Visited Oct 2004.)

GadaboutGaddis – This airfield, located 2 miles south of the town of Bingham ME, has a single grass runway oriented southeast-northwest-southeast, about 2000' long. (Not visited.)

Greenville – This airfield, located 2 miles east of Greenville ME, has two paved runways: 14-32 is 4000'x75'; 03-21 is 3000'x75'. (Not visited.)

Fryeburg (aka Eastern Slopes) – This airfield, located 3 miles southeast of Fryeburg ME, has a single paved runway (14-32) whose dimensions are 4200'x75'. (Visited Oct 2002.)

Jackman (aka Newton) – This airfield, located just west of the town of Jackman ME, has a single paved runway (13-31) whose dimensions are 2900'x60'; the asphalt is reported to be in poor condition. (Not visited.)

Lindbergh (aka Raymonds) –This is a grass airfield near Philips ME. It is smooth grass, with the runway oriented NW-SE. Annual inspection not essential. (Visited 10 Oct 2004.)

***MillerQuinn** – This is "rough" airstrip just north of Wentworth Location NH. It lies on Dartmouth Grant land, behind a locked gate just off Dead Diamond road. It is about 3000' x 75', with rather long grass. Its landability will be controlled by how recently the grass has been cut. Walking about 300 yards south leads to a building with a pay phone. Annual inspection essential. (Visited 15 Oct 2004.)

Moultonboro – This airfield, located a mile northeast of Moultonboro NH, has a single paved runway (02-20) whose dimensions are 3600'x50'. (Visited Jun 2003.)

NewportNH (aka Parlin) – This airfield, located 2 miles northwest of Newport NH, has two runways: 18-36 (paved) is 3400'x50'; 03-21 (grass) is 1900'x80'. (Not visited.)

Norridgewock (aka Central Maine) – This airfield, located 4 miles west of Norridgewock ME, has two paved runways: 03-21 is 4000'x100'; 15-33 is 4000'x100'. (Not visited.)

Plymouth – This airfield, located 3 miles northwest of the town of Plymouth NH, has a single grass runway oriented northwest- southeast, about 2400' long'. (Visited Jun 2003.)

Rangeley (aka Bean) – This airfield, located just north of the town of Rangeley ME, has a single paved runway (14-32) whose dimensions are 3200'x75'. (Not visited.)

***RumfordSeaplane** – This is an uncharted grass airstrip on the north side of the Androscoggin River, south of Route 2 and west of Rumford ME. This is just across the river from the old Rumford airfield, which appears on old but not on current charts (current status unknown). The new airfield is short, but fully acceptable for glider landings. In 2004, it had a seaplane parked on it. Annual inspection desirable. (Visited 10 Oct 2004.)

Sugarloaf – This airfield, located just north of the town of Carrabassett ME, has a single paved runway (17-35) whose dimensions are 2800'x75'. (Not visited.)

Swans – This airfield, located a 3 miles southeast of the town of Dixfield ME, has a single grass runway oriented northwest-southeast, about 1800' long. (Not visited.)

Thomas – This airfield, located a mile south of the town of Roxbury ME, has a single grass runway oriented north-south, about 1800' long. (Not visited.)

TwinMountain – This airfield, located a mile south of the town of Twin Mountain NH, has a single paved runway (09-27) whose dimensions are 2600'x60'. The runway is effectively wider for a reasonably short distance at the east end. (Visited October 2003.)

***WebbLake** – There is a reasonably large farm field at the north end of Webb Lake, in Maine. Wires run along the east-west road that lies south of this field. There appears to be a section of the field further north that runs east-west. It also looks to be possible to land to the north, approaching over the lake and landing on grass just south of the road. Annual inspection very desirable. (Visited 10 Oct 2004.)

Windsock – This residential airfield, located south of Ossipee, has a single wise grass runway about 4000' long. (Visited July 2003.)

Whitefield – This airfield, located 3 miles east of the town of Whitefield NH, has a single paved runway (10-28) whose dimensions are 3500'x75'. (Visited October 2003.)

Appendix B - Maps

These files contain annotated maps covering the proposed wave XC routes:
`MapNorth.jpg` `MapNortheast.jpg` `MapSouth.jpg`