The sea-breeze at Lasham

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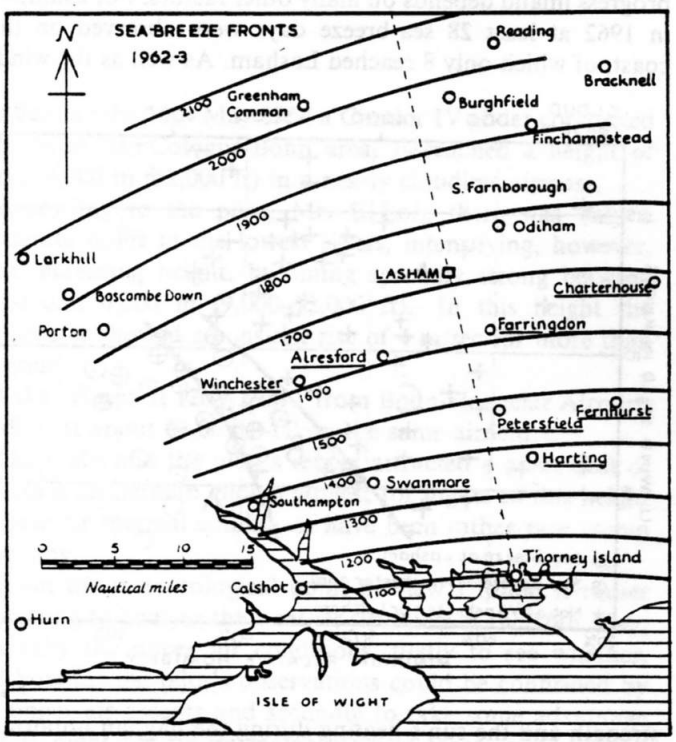
Fig. 1



1. Tracking the fronts

During the summers of 1962-3-4 a special series of observations has been made, based on the Lasham Gliding Centre, to try and find out more about the behaviour and structure of the sea-breeze front as it travels across Hampshire.

There is nearly always a rise in dewpoint at the passage of the seabreeze front (1), so nine pairs of thermographs and hygrographs were set up, enabling dewpoints to be calculated on likely days. Using discontinuities in these dewpoint records and Met. Office records it was possible to track the movements of the fronts inland in some detail.

Fig. 1 shows the position of the stations and the average isochrones for the 16 fronts which reached Lasham in 1962-3 from mid-April to mid-August. The fronts in 1964 formed a similar pattern.

Most of the fronts showed a gradual increase in speed of advance inland from 3 knots or less near the coast to 7 or 8 knots in the later stages. Several were detectable as far as Greenham Common and Reading, 20 miles beyond Lasham.

Although the average isochrones have necessarily appeared as smooth curves, individual fronts could often be seen to be advancing at different rates in different sections.

As well as the haze and clouds which mark these fronts (2), swifts have also served as markers of the rising air. On 13 May 1961 and 26 May 1963, I was able to make soaring flights along the sea-breeze front at about 2000 feet by following groups of swifts apparently catching their insect food in the lift.

2. Soaring Conditions

Soaring has been carried out near the front, both on occasions (a) when it was almost stationary, and (b) when it was moving inland at a speed comparable with the sea-breeze itself.

(a) On 3rd June 1962, the task in the National Gliding Championships was a 300 km triangle, and the first turning point was at Cerne Abbas, only 12 miles from the South Coast. From 1200–1300 GMT the sea-breeze front was in the neighbourhood of this turning point. The wind inland was NE about 12 knots, and to the south of the line it was SE, 8 knots. All pilots reported masses of confused cloud, and many had difficulty with low cloud obscuring the turning point. The base of the cumulus to the north was about 4500 feet; at the front which was marked by intermittent patches of low streamer cloud, the base was about 2500 feet, with some patches even lower. It was cloudless well to the south of the frontal area. The best lift anyone found was 5 knots, by circling in and out of the cloud on the landward side. The average of 12 reports gave 2½ knots, so the air was rising at about 4 knots (2 m/sec).

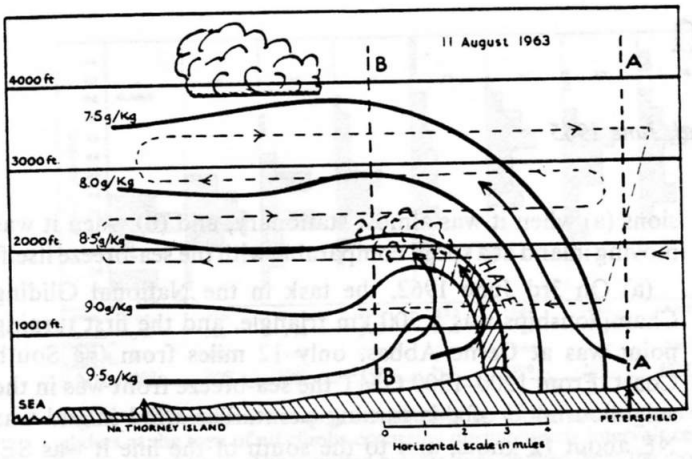
Near Cerne the front as a whole was not moving fast, but pilots reported local advances. At one time bars of cloud were visible, with cumulus-like lumps embedded in them, both the tops and the bases of this cloud were lower than those of the inland cloud.

15 miles east of Cerne, curtain clouds were visible, and N. Goodhart rejoined the front 3 miles north of Blandford at about 2800 feet and circled in a narrow band of lift of 4 knots in and out of the cloud. On reaching 4000 feet he was able to fly straight at 60 knots for eight miles with little loss of height. The patches of cloud marking the front were by then getting less frequent, so he headed more northerly towards occasional cu, still visible there. Most pilots needed to fly north nearly as far as Salisbury to find lift, and there was little cloud from there to Lasham. The last pilot flew past Lasham at 1610 GMT, 20 minutes before the sea-breeze arrived there.

Lift was found at another almost stationary front on 5 August 1962. This front remained for over half an hour across Lasham airfield; it also just reached S. Farnborough, where there were at first some interesting reversals of wind direction, with associated dewpoint changes. At Lasham several pilots investigated the rising air, which they found in narrow strips parallel to broken sections of low "curtain cloud". There were downcurrents to the north and the south of this line. Air was rising at about 4 knots, and climbs were made to 4000 feet; winds to north of the front were WNW, 10 knots, and to the south were SW, 15 knots.

(b) The front passed Lasham at 1730 hours on 8 June 1962, travelling steadily at about 6 knots. This was a day of light NE winds. Two pilots found severe turbulence at 900 feet above ground north of Winchester, and made climbs to 2000 feet into a line of steady lift. North of Lasham there was a large area of lift; no clouds at all at that time of day.

Another large area of lift associated with a comparatively fastmoving front was found on 11 June 1963; this extended over an area two miles wide in which height could be maintained at 2000 feet.



Moisture lines in section N-S of sea-breeze front

Fig. 2

3. Cross-section Flight

A flight was made through a sea-breeze front on 11 Aug. 1963 in an Auster aircraft, fitted with an electrical psychrometer. The track was the line from Lasham to Thorney Island on the coast, at right angles to the front. Traverses were made at five different heights up to 3500 feet.

Fig. 2 shows isopleths of humidity mixing ratio, and the two types of cloud visible. There was solid line of cumulus cloud, with base just below 4000 feet in a line parallel to the coast and some isolated wisps at about 2000 feet. There was also a line of haze stretching up to the wisps from the ground.

Fig. 3 shows the temperature at Sections AA ("land-air") and BB ("sea-air") and the 1140 ascent at Crawley. North of the front the wind was 280°, 10–15 knots and to the south, it was 240°, 15 knots.

On this occasion it was not possible to measure the strength of the upcurrents, but it does seem likely from the diagram that the solid line of cloud was formed by the ascent of land-air, and that the wisps and haze were at the front of the sea-air which was being swept upwards and back towards the sea.

4. A Sea-breeze "Index"

A method of forecasting the sea-breeze at Thorney Island on the coast has been described on the basis of the forecasted

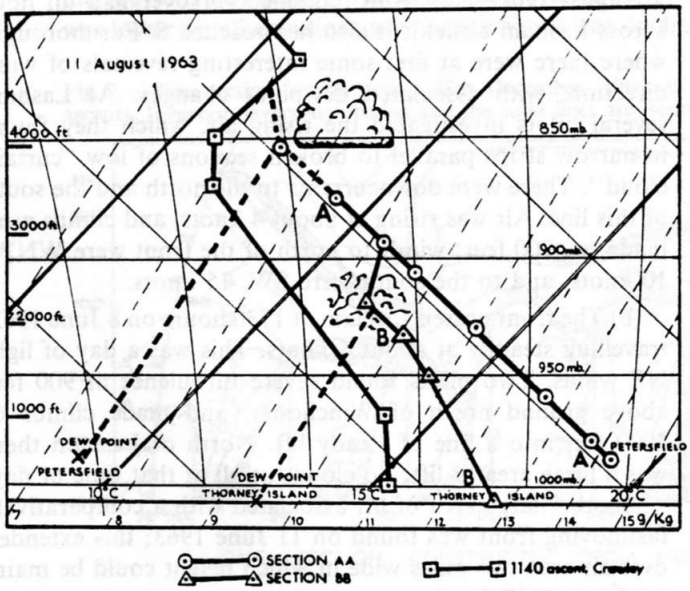


Fig. 3

3000 feet wind and the expected excess of the land temperature over that of the sea (3). A sea-breeze at Thorney Island can be said to be a necessary condition for one at Lasham (except on the rarer occasions when it comes across London). Extension of the same principle to Lasham, i. e. with less winds at 3000 feet and greater temperature excesses has shown no consistent results. Whether the sea-breeze will progress inland depends on many other factors. For example, in 1962 at least 28 sea-breeze days were observed on the coast, of which only 8 reached Lasham. As well as the wind-

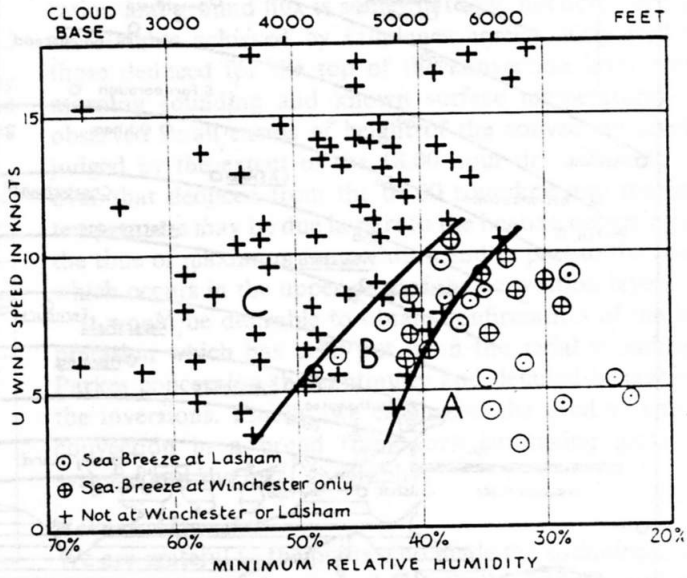


Fig. 4

strength and the sun's heating during the day, an important factor is naturally the depth of convection. Tephigrams for Lasham on sea-breeze days show an average inversion height of 4000 feet on NE days and 6000 feet on W days.

The most effective "index" for a sea-breeze arrival at Lasham so far has turned out to be the lowest value of the relative humidity reached during the day. Fig. 4 shows points plotted for days with a reasonable amount of sunshine, when soaring was possible at Lasham. The offshore wind U has been plotted as the average of 5 Met. Office stations at 1200 GMT and relative humidity as the average from 5 hygrograms, including Lasham. The sea-breeze appears most likely for winds less than 10 knots and when the relative humidity falls below 40%.

A low relative humidity may be expected to be related to heating from the sun and also depth of convection, and this index turns out to be a very easy one to work in practice. On a good thermal day there is a simple relationship between the relative humidity at any time and the height of the convective cloudbase, so a practical rule-of-thumb for glider pilots is "on a good thermal day, when the wind is less than 10 knots, a sea-breeze front is likely to reach Lasham if cloud-base is at 5000 feet or higher".

5. Time-lapse film

About 150 feet of 16 mm time-lapse colour film shows cloud-forms at the sea-breeze front on days in 1962-3.

References

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(2) *Wallington, C. E., 1959:* The structure of the sea-breeze front as revealed by gliding flights. *Weather*. Vol. 14, p. 263.

(3) *Watts, A. J., 1955:* Sea breeze at Thorney Island. *Met. Mag.* London. Vol. 84, p. 42.

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