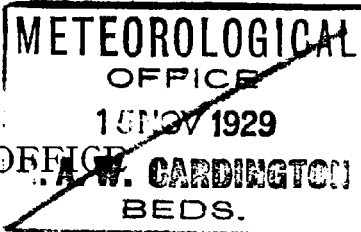


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# BUMPINESS ON THE CAIRO-BASRA AIR ROUTE

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## BUMPINESS ON THE CAIRO-BASRA AIR ROUTE

By J. Durward, M.A.

1. Copies of the "Flight Reports" made on the outward and inward journeys of the Imperial Airways machines from Cairo to Basra were made available to the Meteorological Office, Heliopolis, by kind permission of Messrs. Imperial Airways Ltd.; the following notes on bumpiness are based largely on information extracted from these reports and from personal conversation with the pilots. Data regarding bumps are purely qualitative, but it is thought that the information may be of interest in connection with the crossing of the route by occasional aircraft and by airships flying between England and India. Observations are for the period October 1927–September 1928.

2. The route has been divided as follows, corresponding to the normal landing grounds on the Cairo–Basra Air Service.

<i>Section</i>		<i>Normal Flying Time</i>		<i>Distance</i>
		G.M.T.	Local Time.	<i>Miles</i>
1	Cairo–Gaza .. ..	0400–0630	0600–0830	212
1a	Gaza–Cairo .. ..	1215–1445	1415–1645	
2	Gaza–Rutbah .. ..	0700–1115	0900–1415	365
2a	Rutbah–Gaza .. ..	0630–1130	0930–1330	
3	Rutbah–Baghdad .. ..	1200–1430	1500–1730	241
3a	Baghdad–Rutbah .. ..	0300–0545	0600–0845	
4	Baghdad–Basra .. ..	0400–0700	0700–1000	281
4a	Basra–Baghdad .. ..	1030–1400	1330–1700	
		(To April 29, 1928) 1200–1600   1500–1900 (After April, 1928)		

3. The following notes on the general character of the country will, together with the map in Fig. 1, help towards an understanding of the results found later.

Between Cairo and Gaza the air route lies for a short distance near the boundary between the cultivated area of the Nile and the sandy desert. After the Suez Canal the country consists chiefly of scrub-covered plains and sand dunes. From Gaza the route crosses the Palestine plain and then the hills separating the coastal districts from the valley of the Jordan and the Dead Sea. The Jordan valley is separated from the Iraq plain by a broad elevated tract which forms the northern portion of the great table-land of Arabia. The western escarpment rises somewhat abruptly from the valley of the Jordan and the Dead Sea, and its apparent height is increased by the fact that the Dead Sea is

1,300 ft. below sea level. For about 20 miles eastward from the western edge of the plateau the belt of country called Trans-Jordan is deeply incised by the valleys of numerous streams running towards the Jordan. Further east the plateau surface consists of rolling uplands with shallow depressions; the rocks forming the plateau are almost entirely of limestone except between Azrak and landing ground H (see Fig. 1) where the basalt or lava country is encountered.

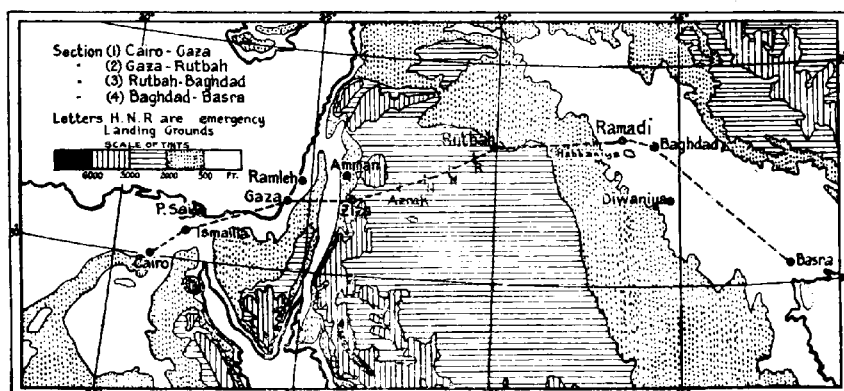


FIG. 1.—THE CAIRO-BASRA AIR ROUTE.

The river is encountered first near Ramadi. Cultivation is limited to the river banks, elsewhere on the route Ramadi to Basra the country consists almost entirely of very fine sand.

4. In the "Flight Reports" bumps are generally classified as nil, slight, moderate, severe, bad, violent. In this note all bumps reported above moderate have been considered as one class—severe.

The following table shows the frequency of the various classes of bumps along each section :—

TABLE 1.—FREQUENCY OF DIFFERENT CLASSES OF BUMPS ON CAIRO-BASRA AIR ROUTE

Section	Local time	Nil	Slight	Moderate	Severe	No. of obs.
1	0600-0830	23	3	1	1	28
1a	1415-1645	9	3	7	0	19
2	0900-1415	4	1	14	11	30
2a	0930-1330	6	4	13	3	26
3	1500-1730	7	4	9	6	26
3a	0600-0845	17	2	5	1	25
4	0700-1000	16	4	1	1	22
4a	1330-1700					
	1500-1900	8	5	7	3	23

5. Generally speaking, if bumpiness is due chiefly to the rising of air from the surface of the hot desert, one would expect the bumpiness over this route to be greatest about midday and early afternoon and to be greater in summer than in winter. On any section of the route which is traversed in the early morning bumpiness should accordingly be reported as nil or slight. Sections 1, 3a and 4 are crossed early and Table 1 shows that the percentage of bumps reported as nil or slight on these sections is very large (actually about 85 per cent.).

On the other five sections on which flights are made by day, reports show a much greater percentage of moderate or severe bumps, notably on the section Gaza-Rutbah on which bumps are reported as moderate or severe 25 times out of 30 and as severe 11 times.

Bumpiness is, however, sometimes due to particular phenomena, e.g., thunderstorms, sand storms and other cold-front phenomena. One would also expect topographical features to play an important part particularly on the section Gaza-Rutbah on account of the very irregular nature of the country in Palestine and Trans-Jordan and also on account of the basalt-covered country from Azrak to landing ground H, mention of which has already been made.

The separate sections will now be treated in somewhat greater detail.

*Section 1 : Cairo to Gaza.*—Over this section flying takes place early (at a height of 1–3,000 ft.) and bumpiness is generally reported as nil.

The exceptions were all due to the presence of cold fronts associated with well marked depressions over the eastern Mediterranean. In the immediate neighbourhood of these fronts bumpiness is generally reported as moderate, in one case as severe.

*Section 1a : Gaza to Cairo.*—Flying occurs over this section in the afternoon and the bumpiness is reported more frequently as moderate. Bumpiness would be expected to be somewhat greater in summer, but the period 1415–1645 is probably late enough in winter to be free from the worst bumps unless they are caused by other factors than purely daily turbulence. Actually of the nine reports of bumpiness nil, 7 occurred in winter.

*Sections 2 and 2a : Gaza to Rutbah and Rutbah to Gaza.*—This section is flown over (at a height of 4,000–8,000 ft. depending on weather conditions) during the morning when bumpiness would be well developed. A large percentage of bumps are reported as moderate or severe. The severe bumps are met with—(a) during thunderstorms, (b) during sand storms (though these are rare over this section), (c) over the basalt or lava country, due apparently to the excessive heating of the air over the black basalt boulders, (d) during vigorous convection. The following remarks illustrate the nature of the bumpiness :—

“In a thunderstorm machine was forced from 4,000 to 8,000 ft. in two minutes.”

" Bumps severe over lava country."

" Bumps extraordinarily bad over lava country."

" Abnormal number of large sand devils near Rutbah—veritable walls of sand up to 1,000 ft. rising in a few minutes."

" Bumps violent between landing ground N and Rutbah—rough up to the haze top at 12,000 ft., which height I reached through the medium of upward currents."

*Section 3 : Rutbah to Baghdad.*—The first portion of this route does not differ materially from the latter half of the Gaza-Rutbah section and severe bumpiness occurs 6 times in 26. The two occasions on which bumps were most severe occurred during dense sand storms in the Ramadi area.

Flying height over this section varies from 1,000 to 8,000 ft.

*Sections 4 and 4a : Baghdad to Basra and Basra to Baghdad.*—Flying from Baghdad to Basra occurs early and bumpiness is reported as nil except on one occasion in February, when it was due to the passage of an intense depression. The return journey is performed during the afternoon, and from the flying point of view this is probably the worst section of the route on account of dust and sand storms, but severe bumpiness is not reported as often as one would expect. The country is flat and sandy, and the sand being very fine is picked up by the strong NW'ly wind which blows so frequently in summer; the whole of the lower atmosphere may contain sufficient dust to render the visibility almost nil, but by climbing to a sufficient height it is generally possible to avoid the bumps. On other occasions, however, the dust rises in the vicinity of definite fronts and then the bumpiness is reported as severe. For example, on March 31 bumpiness was reported as severe and " sand was rising to unknown heights—like a yellow pall round the machine."

Whereas on June 23, with bumpiness reported as slight, the pilot reports :—

" At 9,000 ft. still in thick dust—so thick that the sun was just visible but not strong enough to cast shadows—the thickest dust I have ever met at that height. As I was leaving the area and coming into the clear air it was like passing through a cumulus cloud, and this was the appearance presented on looking back into the storm."

On June 24 " convection was so bad that dust was being picked up in sheets from the reeds of the marshes," but at 4,000 ft. bumpiness was apparently so slight as to be not worth reporting.

**6. Absence of Bumps.**—It is of interest to note that on two occasions, viz., July 29 and September 2, the " outstanding feature of the flights from Baghdad to Cairo was the remarkable absence of bumps." It would appear from the synoptic charts for these days that ill-defined warm fronts orientated roughly east to west had crossed the major portion of the route previous to the flight, so that practically the whole journey was performed in the " warm sector " in which, owing to the smaller temperature lapse rate during the day, bumpiness would be reduced to a minimum.

7. **Conclusions.**—The chief points of interest which emerge are as follows :—

- (a) Bumpiness is very slight in the early morning.
  - (b) The bumpiest portion of the route is between Gaza and Rutbah, due largely to the nature of the country.
  - (c) The bumpiness on the section Baghdad-Basra is not so severe as the reports of dust storms would lead one to imagine.
  - (d) Bumpiness has been found to extend as high as 12,000 ft.
  - (e) Two reports have indicated an involuntary rise of 4,000 ft. in about 2 minutes.
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For the information of the reader who is not accustomed to air travel, it should be added that a “bump” is a convenient term for expressing the rise or fall of an aircraft due to ascending or descending currents in the atmosphere. Bumps may be experienced when flying in any country, even in temperate latitudes, and are in no sense to be regarded as dangerous phenomena. The normal sensation is far less unpleasant than that produced in crossing the English Channel by an ordinary passenger boat on a moderately rough sea. The conclusions reached in this paper are, on the whole, reassuring from the point of view of travel by air in the hot countries of the East.

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