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Mr. Highcock
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HEIGHT-GAIN TESTS IN THE TROPOSPHERE

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G.A. ISTED.

Air Ministry,
Great Baddow Research Station,
Nr. Chelmsford,
Essex.

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HEIGHT-GAIN TESTS IN THE TROPOSPHERE.

44/3959

Introduction.

An urgent need for prediction of ranges for V.H.F. navigational aids has been expressed by Operational Commands and an intensive research into the prediction of the meteorological conditions, upon which the range of V.H.F. waves so much depends, is being carried out.

The meteorological conditions affect the propagation in so far as they control the variation of the refractive index of the atmosphere with height above ground.

One way in which the refractive index law affects the propagation is in the nature of the height-gain relations at any given distance beyond the horizon.

It is well known that the variation of field strength with height above ground can be greatly modified when there is marked anomalous propagation associated with the formation of a sufficiently tall duct. A direct measurement of the height-gain relationship should therefore give an immediate indication of the existence of abnormal conditions, when the usual increase of field strength with height typical of pure diffraction would be modified. From the nature and degree of the modification it should be possible to assess the refractive index law and its effect on the range of V.H.F. signals received at any given height.

The height-gain relationship should therefore provide a direct and useful indication of propagation conditions.

Mr. Eckersley considered that regular aircraft flights could be made to measure the change in field strength with height at one or more distances below the horizon from a fixed transmitter, analogous to the regular flights now made to obtain meteorological data. Permission was granted by the Air Ministry for some initial experimental flights to be undertaken by 192 Squadron in order to explore the feasibility of the method and the possibility of interpreting the results in relation to range predictions.

This report will deal only with the practical work involved, the conditions under which the measurements were made and the tabulation of the data obtained.

A further report will be made by the Eckersley Group dealing with the analysis and interpretation of the data obtained.

Six experimental flights, under the direction of Mr. Eckersley, were made between January and April of this year, using a frequency of 200 Mc/s.

Equipment.

(a) Receiver.

A modified Hallicrafter S27 CA was used for all these test flights.

The major modification to be made was the insertion of a suitable signal strength measuring device.

A piston type attenuator was inserted in series with the aerial feeder. The particular attenuator available had been designed for 75 ohms and was therefore suited to one of the standard flexible concentric cables used on aircraft.

As it was hoped to measure field strength variations of the order of 80 decibels it was obviously necessary to pay great attention to the screening of the receiver.

The S.27.CA was therefore taken out of its standard box and put in a 16 S.W.G. brass box with ventilation vents of close mesh brass gauze.

The aerial input to the receiver was modified to an unbalanced circuit by means of a standard Air Ministry socket, the earth portion of the socket being directly connected to the receiver chassis.

The attenuator was fitted on a sloping panel on top of the receiver.

The preliminary laboratory tests showed that the attenuator introduced an insertion loss of 25 dBs. between aerial and receiver input.

In order to reduce this loss to a reasonable value the two electrodes of the piston were arranged to touch in the lowest attenuation position giving an insertion loss of 7 decibels which was considered reasonable; in consequence linear movement of the attenuator dial was sacrificed. To make the lower values of attenuation readable the scale was opened out by a series of gears free from back-lash and an 8" dial used for calibration.

One decibel variation at the lower end of the scale gave a dial movement from the pointer of 1/8", at the 20 dBs. position the movement opened out to ½", from then on the movement was substantially linear. By a double rotation of the dial a variation between 0 and 80 dBs. was obtained.

The method of calibrating the attenuator was simply to connect a standard signal generator to the feeder in place of the aerial and vary the generator output by the wanted amount and change the attenuator dial position to bring the receiver output back to a reference level. This calibration was cross-checked with the aid of a test signal injection box and dummy aerial.

The injection box was a very simple unit consisting of a caged portion of the inner conductor of the feeder into which the generator, terminated by a 75 ohm resistance, injected a test signal. This unit was very useful in adjusting and checking the aerial and also in checking the receiver sensitivity on the aircraft.

The diode 2nd detector of the receiver was used as a source of D.C. signal supply to a Cossor Cathode Ray Oscilloscope unit.

During the first test flight it was found that the screening of the receiver was still far from perfect. Further investigation in the laboratory showed that the metal frequency indicating dial of the receiver was responsible for most of the unwanted pick up, this was suppressed by inserting a specially designed spring washer between the dial and panel. Similar spring washers had to be fitted to most of the protruding spindles on the panel.

An appreciable amount of unwanted signal was introduced into the set by the power mains lead and the output lead to the oscilloscope. Suitable filters had to be inserted in each of these leads and the leads screened.

(b) Transmitter.

A standard CD/CHL pulse transmitter working on a frequency of 200 Mc/s. was installed at the A/M transmitting station at Stock four miles south of Chelmsford.

A 70 ft. wooden lattice tower was available on the site and a simple vertical dipole installed at the top of it. The aerial was carefully lined up and the usual checks made for standing waves on the 200 ohm balanced feeder connecting the transmitter to the aerial.

The transmitter was capable of radiating about 25 kilowatts peak power.

During the first test flight a pulse width of 4 microseconds was used with a P.R.F. of 500. An interval signal was incorporated in the modulator for the purpose of identification.

From the results of the first flight it was considered that a gain of 15 dBs. was necessary to do the tests well. It was obviously impracticable to raise the transmitter power to this extent so it was decided to widen the transmitted pulse in order to give the S.27.CA receiver a better chance to accept it. The P.R.F. was reduced to 50 to conserve the power available to the transmitting valve anodes.

Extra capacities were banked on to the anode and grid pulse forming circuits and a new modulator was made; under these new conditions a pulse width of 15 microseconds was obtainable, this increased pulse width gave an effective 12 - 13 dBs. gain at the output of the receiver.

During the second test flight it was found that due to the great number of pulse stations working on or around 200 Mc/s. with P.R.F's between 150 and 400 the 50 P.R. F. was rather difficult to find although once the C. R.O. time base had been synchronised it was easy to hold. Therefore for the third test it was decided to increase the P.R.F. as far as possible without decreasing the power output of the transmitter. The receiver to be used on the test was set up 4 miles from the transmitter and the P.R.F. increased until the received signal strength commenced to decrease, this point occurred at a P.R.F. of 200 and this condition was used for the remaining four tests.

Installation of equipment on the aircraft.

192 Squadron, R.A.F. kindly allocated a Wellington aircraft for these tests.

Supplies for the receiver and C.R.O. were obtained from a rotary converter driven by the aircraft's floating accumulators. The output from the converter was 230 volts 50 cycle A.C.

The aerial used was a $\frac{1}{4}$ wave vertical rod with a 2 feet square brass plate at the bottom end; an insulator was inserted in the centre of the plate to support the aerial.

The brass plate was bolted on to the geodetic of the aircraft and located just aft of the astro-dome. Special attention was paid to bonding the equipment to the aircraft structure.

The equipment was installed immediately beneath the aerial. The aerial was adjusted and the sensitivity of the receiver checked before each flight by means of the injection box mentioned previously.

Special Meteorological Equipment.

After the first two flights it was decided that meteorological data taken during the flight was necessary, therefore an aneroid barometer and a psychrometer were borrowed from an R.A.F. Meteorological Station.

The aneroid barometer was mounted on a sprung base-board and installed inside the aircraft near the starboard waist window.

The psychrometer was installed outside the aircraft near the starboard waist window in such a way that the dry and wet bulbs of the thermometers could be read by an operator in the waist of the aircraft.

The position of the psychrometer in respect to the slip stream of the aircraft was fully discussed with the Meteorological Station and it was their opinion that the position was satisfactory.

Method of making signal measurements.

Several methods of making signal measurements were tried in the laboratory and the one finally adopted was the method of adjusting the attenuator so that the signal just came down to set noise. Readings of the order of ± 0.5 dBs. could be repeated even with different operators. This method proved quite satisfactory in the air.

Before each flight the watches of the navigator and the special operator were synchronised. The special operator took readings each minute, and during some periods every half minute, throughout the flight and the data analysed afterwards with the aid of the navigators log.

The meteorological instruments were read at the appropriate heights.

Reliability of measurements.

There is evidence to suggest that the measurements taken are remarkable reliable.

It will for instance be noted, upon reference to the data sheets, that during the flight of the 22/4/44 three straight runs were made at 10,000 ft, the average reading for each run was 28.5, 29.2, and 28.8 dBs. respectively. Each of these values was the average of five to six readings.

The worst divergence of individual readings from the average was less than ± 2 dBs.

The averages of the three straight runs at 10,000 ft. on the 25/4/44 are equally good.

Only two straight runs at 10,000 ft. were made on the 20/4/44 and 23/4/44 but here again extremely close agreement exists.

Throughout each test the transmitter was monitored on a second receiver located on the ground four miles from the transmitter.

First Test Flight 27/1/44.

The first test flight was very much in the nature of trying out the equipment and the general conditions under which the tests were to be carried out and to find out what modifications to equipment, test conditions, and programme had to be made for future tests.

When the tests were planned it was considered possible to make the height gain tests over the 192 Squadron's airfield in Norfolk but upon investigating the ground contour along the signal path it was realised that a very high hill was directly in the signal path and only one mile from the transmitter.

The only free routes away from the transmitter were due east and west north west. The east route was ruled out owing to the proximity of enemy occupied territory. Accordingly the air-crew was briefed to fly from their base in Norfolk to Chelmsford to Buckingham at a constant height of 2,000 feet. At Buckingham the aircraft was to spiral up to 10,000 ft. and at that height to patrol between Bicester and Towcester on a steady compass bearing; the line joining these two places is at right angles to the line joining Chelmsford and Buckingham, therefore the aircraft was flying on an equidistant course from the transmitter. After the aircraft had completed the 10,000 ft. straight run it was to fly back to Bicester and run in again on the same patrol course at 9,000 ft. and maintain that height throughout that run.

After each patrol the aircraft was to descend 1,000 ft. until it reached 4,000 ft., it was then to descend in 500 feet stages down to 500 feet.

The attached track chart shows the route taken and the method of timing for correlating signal measurements.

During this test flight it was confirmed that the Norfolk - Chelmsford route was completely unsuitable for the tests planned and that the Chelmsford - Buckingham route was satisfactory.

The signal measurements between Chelmsford and Buckingham give a good idea of the attenuation along the route. Although this did not form part of the original programme it was included in each test as it was obviously of general interest.

The Height-Gain measurements and the attenuation measurements have been tabulated on an appended sheet.

It will be seen that the measurements made during the spiral climb are very erratic, due without a doubt to the polar diagram of the aerial being affected by different positions of the aircraft in respect to the transmitter and by the tilting of the aerial while banking.

The step by step straight run Height-Gain measurements were quite reliable.

It is pointed out that the measurements for the 27/1/44 test have all been corrected by + 12 dBs. (the gain obtained by increasing the pulse width after the first test) in order that they may be readily compared with the remaining five tests.

All curves have been plotted on a linear scale and are shown on a separate sheet so that they may be compared easily one with the other. All distances and heights have been converted to kilometers and metres to facilitate the analysis of the data.

Second Test Flight 29/2/44.

Necessary modifications to the equipment were made between the first and second test flights. For the second flight it was considered necessary to make the Height-Gain measurements at a greater distance in order to make sure that the aircraft went well beyond the horizon; the patrol line was therefore in the Leamington area.

It is of great interest to note that the signal on this occasion could not be found above about 6,000 ft. during the spiral climb and was picked up again during the descent at about 7,000 ft.

The discrepancy between these two heights may be explained by the fact that the rate of climb was assumed to be constant whereas it probably fell off towards the higher levels; the level at which the signal dropped out was therefore probably nearer 7,000 ft. during the aseent.

The cut-off of the signal was extremely sharp as also was the reappearance on the descent. Although no measurements were possible it is almost certain that the signal went through this violent change in about 200 - 250 feet change in altitude.

Upon analysing the meteorological report for that day it was found that wide-spread temperature inversions occurred throughout most of the day in the region of 7,000 ft. An extract from the meteorological report for this day is attached.

Test Flights 20/4/44, 22/4/44, 23/4/44, 25/4/44.

These four flights were made under the same conditions and on the same route and can therefore be reported upon collectively.

The P.R.F. had been raised from 50 to 200 for these tests in order to make the signal more easily readable amongst the numerous pulse stations on the same radio frequency.

The meteorological instruments mentioned previously were installed in the aircraft for these tests and readings were taken only as the straight run patrols during the step by step descent.

In order to save time on the flight it was thought possible to make each alternate height-gain straight run on the reciprocal compass bearing; in other words the 9,000, 7,000, 5,000 etc. feet runs were made on the reciprocal compass bearing to that on which the 10,000, 8,000, 6,000 etc. feet runs were made.

A check was made at 10,000 ft. on each flight to see if this was permissible; therefore two or three runs were made at 1,000 ft. flying in opposite directions and of course still at right angles to the line joining the patrol area and the transmitter.

On each occasion the method was perfectly satisfactory and extremely close agreement of readings was obtained as already stated.

A further modification to the programme of these tests was that when the signal was lost at the end of the attenuation run at 2,000 ft. the aircraft was to descend to 500 ft. to check whether signals could be picked up again at a lower altitude; no evidence was obtained that this was the case.

It will be noticed upon reference to the set of height-gain curves that a marked "ledge" occurs between 7,000 and 9,000 ft. on the 20th, 22nd and 23rd of April.

In all these tests it will be seen that the measurements made during the spiral climb are too erratic to be made use of.

Conclusion.

The Eckersley Group desire to express their gratitude for the whole-hearted cooperation and help of Wing Commander Willis D.S.O., D.F.C. formerly commanding 192 Squadron; Wing Commander Fernbank D.F.C. commanding 192 Squadron; Sq/Ldr. Mazdon and his Special Signals Section also of 192 Squadron; and the many Aircrews who carried out so well the very tedious flights.

Symbols used in report.

T	=	Time in B.S.T.
Kms.	=	Kilometres.
TX.	=	Transmitter.
Hm.	=	Height in metres.
Temp.	=	Temperature in degrees F.
Hum.	=	Humidity in %.
mbs.	=	Millibars.

Inclusions.

Six sheets of tabulated attenuation and height-gain readings.
One sheet of meteorological readings.
One sheet of attenuation and height gain curves.
One track chart.
One extract from the meteorlogical report 29/2/44.

GAI/JOB.

Height-Gain Tests in the Troposphere.   27/1/44.

Attenuation.

T.	Kms. from TX.	dBs.	Hm.
1327	6.2	52	600
1328	9.3	51	"
1329	12.4	56	"
1330	15.5	51	"
1331	18.6	47	"
1332	21.7	43	"
1333	24.8	43	"
1334	28.3	39	"
1335	31.8	36	"
1336	35.3	37	"
1337	38.8	33	"
1338	42.3	31	"
1339	45.8	32	"
1340	49.3	28	"
1341	53.8	28	"
1342	57.3	26	"
1343	60.8	27	"
1344	64.3	26	"
1345	68.8	24	"
1346	72.3	25	"
1347	75.8	24	"
1348	79.3	22	"
1349	83.8	22	"
1350	87.3	21	"
1351	90.8	20	"
1352	94.3	21	"
1353	97.8	19	"
1354	101.3	18	"
1355	104.8	21	"

Height-Gain.

T.	Kms. from TX.	dBs.	Hm.	
1356	104	23	600	
1357	"	27	720	
1358	"	32	840	
1359	"	32	960	
1400	"	32	1080	
1401	"	34	1200	
1402	"	31	1320	
1403	"	35	1440	Spiral
1404	"	36	1560	
1405	"	29	1680	Climb
1406	"	34	1800	
1407	"	40	1920	
1408	"	44	2040	
1409	"	41	2160	
1410	"	42	2280	
1411	"	44	2400	
1412	"	36	2520	
1413	"	32	2640	
1414	"	31	2760	
1415	"	29	2880	
1416	"	25	3000	

T1/ T2.	Kms. from TX.	Average. dBs.	Hm.	
1417 1423	114	32.4	3050	
1435 1440	"	32.3	2740	
1450 1455	"	33	2430	
1506 1513	"	31.2	2120	Straight
1523 1529	"	32	1820	Run
1539 1545	"	28.4	1520	
1555 1602	"	26.1	1220	
1611 1617	"	24.3	1070	
1627 1633	"	23.3	910	
1643 1649	"	19	760	
1650 1658	"	18.5	600	

GAI/JOB.

Height-Gain Tests in the Troposphere. 29/2/44.

Attenuation.

T.	Kms. from TX.	dBs.	Hm.
1031	0	54	600
1032	4.65	51	"
1033	9.3	53	"
1034	14.0	51	"
1035	18.6	49	"
1036	23.2	48	"
1037	27.9	45	"
1038	32.6	45	"
1039	37.2	43	"
1040	41.8	42	"
1041	46.6	41	"
1042	50.6	38	"
1043	54.6	39	"
1044	58.6	38	"
1045	62.6	33	"
1046	67.4	35	"
1047	72.2	33	"
1048	77.0	29	"
1049	81.8	28	"
1050	86.6	25	"
1051	91.4	24	"
1052	96.2	22	"
1053	101.0	19	"
1054	105.8	15	"
1055	110.6	15	"
1056	114.3	14	"
1057	118.0	15	"
1058	121.7	10	"
1059	125.4	10	"
1100	132.8	7	"
1102	136.5	–	"
1103	140.2	–	"
1104	143.9	–	"
1105	147.6	–	"

Height-Gain.

T.	Kms. from TX.	dBs.	Hm.	
1105	148	–	600	
1106	"	–	750	
1107	"	–	900	
1108	"	16	1050	
1109	"	N.R.	1200	Spiral
1110	"	16	1350	
1111	"	27	1500	
1112	"	23	1650	Climb
1113	"	22	1800	
1114	"	–	1950	
1115	"	–	2100	
1116	"	–	2250	
1117	"	–	2400	
1118	"	–	2550	
1119	"	–	2700	
1120	"	–	2850	
1121	"	–	3000	

T1/ T2.	Kms. from TX.	Average dBs.	Hm.	
1121 1127	148	–	3000	
1135 1140	"	–	2700	
1148 1153	"	–	2400	Straight
1154 1200	"	25	2250 Av.H.	Run
1201 1207	"	19	2100	
1214 1218	"	17.6	1800	
1228 1233	"	15	1500	
1234 1242	"	12.5	1350 Av.H.	
1243 1247	"	–	1200	
1255 1300	"	–	1050	
1309 1312	"	–	900	
1321 1326	"	–	750	

GAI/JOB.

Height-Gain Tests in the Troposphere. 20/4/44.

Attenuation.

T.	Kms. from TX.	dBs.	Hm.
1230	2	68	600
1231	6	41	"
1232	10.2	49	"
1233	14.4	47	"
1234	18.4	39	"
1235	22.4	37	"
1236	26.5	37	"
1237	30.6	36	"
1238	34.7	36	"
1239	38.7	34	"
1240	42.7	32	"
1241	46.8	30	"
1242	50.9	28	"
1243	55.0	27	"
1244	59.1	28	"
1245	63.1	26	"
1246	67.2	24	"
1247	71.2	24	"
1248	75.3	22	"
1249	79.4	15	"
1250	83.5	17	"
1251	87.6	17	"
1252	91.6	15	"
1253	95.7	15	"
1254	99.8	12	"
1255	103.9	10	"
1256	108.0	7	"
1258	112.0	–	"
1259	116.0	–	150
1300	120.1	–	"
1301	124.2	–	"
1302	128.3	–	"
1303	132.4	–	"
1304	136.5	–	"
1305	140.6	–	"
1306	144.7	–	"
1307	148.8	–	"
1308	152.9	–	"
1309	157.0	–	"
1310	161.0	–	"
1311	165.0	–	"
1312	169.0	–	"
1313	173.0	–	"
1314	177.0	–	"

Height-Gain.

T.	Kms. from TX.	dBs.	Hm.	
1314	177	–	150	
1315	"	–	270	
1316	"	–	390	
1317	"	–	510	
1318	"	–	630	
1319	"	–	750	
1320	"	10	870	Spiral
1321	"	11	990	
1322	"	14	1110	
1323	"	11	1200	Climb
1324	"	23	1350	
1325	"	14	1470	
1326	"	15	1590	
1327	"	15	1710	
1328	"	19	1830	
1329	"	22	1950	
1330	"	14	2070	
1331	"	15	2190	
1332	"	16	2310	
1333	"	16	2430	
1334	"	14	2550	
1335	"	13	2670	
1336	"	15	2790	
1337	"	11	2910	
1338	"	14	3000	

T1/ T2.	Kms. from TX.	Average dBs.	Hm.	
1339 1344	177	20	3000	
1345 1351	"	19	3000	
1352 1359	"	16.8	2740	Straight
1400 1406	"	17	2430	
1407 1413	"	12.5	2130	Run
1414 1418	"	11	1830	
1419 1427	"	–	1530	
1428 1433	"	–	1220	
1434 1440	"	–	1070	
1441 1447	"	–	920	
1448 1453	"	–	760	
1454 1500	"	–	600	
1501 1508	"	–	460	
1509 1515	"	–	300	
1516 1522	"	–	150	

GAI/JOB.

Height-Gain Tests in the Troposphere. 22/4/44.

Attenuation.

T.	Kms. from TX.	dBs.	Hm.
1300	4.8	53	600
1301	6.4	56	"
1302	9.6	49	"
1303	12.8	54	"
1304	16.0	47	"
1305	19.2	41	"
1306	24.6	41	"
1307	28.7	38	"
1308	32.8	38	"
1309	36.9	37	"
1310	40.1	32	"
1311	44.2	30	"
1312	49.3	27	"
1313	53.4	28	"
1314	57.4	27	"
1315	61.5	23	"
1316	65.6	19	"
1317	69.7	21	"
1318	73.8	16	"
1319	77.9	15	"
1320	82.0	13	"
1321	86.1	13	"
1322	90.2	12	"
1323	94.3	10	"
1324	98.4	8	"
1325	102.5	6	"
1326	106.6	6	"
1327	110.7	–	"
1328	114.8	–	"
1329	118.9	–	"
1330	123.0	–	"
1331	127.1	–	"
1332	131.2	–	"
1333	135.3	–	150
1334	139.1	–	"
1335	142.9	–	"
1336	146.7	–	"
1337	150.5	–	"
1338	154.3	–	"

Height-Gain.

T.	Kms. from TX.	dBs.	Hm.	
1338	154	–	150	
1339	"	–	290	
1340	"	–	435	
1341	"	–	585	
1342	"	–	720	
1343	"	10	865	
1343½	"	18	930	
1344	"	15	1000	Spiral
1344½	"	15	1020	
1345	"	17	1150	
1345½	"	21	1200	Climb
1346	"	17	1290	
1346½	"	22	1350	
1347	"	24	1460	
1347½	"	23	1500	
1348	"	21	1570	
1348½	"	24	1650	
1349	"	25	1730	
1349½	"	23	1780	
1350	"	25	1850	
1351	"	26	2000	
1352	"	22	2140	
1353	"	23	2280	
1354	"	20	2430	
1355	"	24	2570	
1356	"	23	2720	
1357	"	30	2850	
1358	"	22	3000	

T1/ T2.	Kms. from TX.	Average dBs.	Hm.	
1359 1401	154	28.5	3050	
1402 1406	"	29.2	3050	
1407 1412	"	28.8	3050	
1413 1420	"	22	2740	Straight
1421 1428	"	22	2430	Run
1429 1436	"	22	2130	
1437 1444	"	17	1830	
1445 1452	"	13	1530	
1453 1458	"	7.5	1220	
1459 1507	"	–	920	
1508 1514	"	–	600	
1515 1521	"	–	300	
1522 1526	"	–	150	

GAI/JOB.

Height-Gain Tests in the Troposphere. 23/4/44.

Attenuation.				Height-Gain.				
T.	Kms. from TX.	dBs.	Hm.	T.	Kms. from TX.	dBs.	Hm.	
1200	2	54	600	1234	147	-	150	
1201	6.3	61	"	1235	"	-	420	
1202	10.6	53	"	1235½	"	-	540	
1203	14.9	49	"	1236	"	-	660	
1204	19.2	47	"	1236½	"	-	780	Spiral
1205	23.5	45	"	1237	"	-	900	
1206	27.8	42	"	1237½	"	12	1040	
1207	32.1	38	"	1238	"	15	1140	
1208	36.4	40	"	1238½	"	16	1260	Climb
1209	40.7	39	"	1239	"	15	1380	
1210	45.0	37	"	1239½	"	15	1500	
1211	49.3	35	"	1240	"	18	1620	
1212	53.6	32	"	1240½	"	22	1740	
1213	57.9	33	"	1241	"	16	1860	
1214	62.2	30	"	1241½	"	19	1980	
1215	66.5	28	"	1242	"	26	2100	
1216	70.8	26	"	1242½	"	26	2200	
1217	75.1	27	"	1243	"	21	2340	
1218	79.4	24	"	1243½	"	29	2460	
1219	83.7	23	"	1244	"	31	2580	
1220	88.0	21	"	1244½	"	28	2700	
1221	92.3	19	"	1245	"	31	2820	
1222	96.6	19	"	1245½	"	26	2940	
1223	100.8	16	"	1246	"	22	3050	
1224	105.1	15	"					
1225	108.4	15	"	T1/ T2.	Kms. from TX.	Average dBs.	Hm.	
1226	112.7	12	"					
1227	117.0	11	"					
1228	121.3	7	"	1250 1254	147	29.6	3050	
1229	125.6	-	"					
1230	129.9	-	150	1255 1300	"	29.5	3050	
1231	134.2	-	"					
1232	138.5	-	"					
1233	142.8	-	"	1301 1307	"	24.5	2740	Straight
1234	147.1	-	"					
				1308 1313	"	24.6	2430	
				1314 1318	"	24.0	2130	Run
				1319 1325	"	22.5	1830	
				1326 1332	"	16	1530	
				1333 1338	"	14.5	1220	
				1340 1345	"	5	920	
				1346 1349	"	-	600	
				1350 1355	"	-	300	
				1356 1400	"	-	150	

GAI/JOB.

Height-Gain Tests in the Troposphere. 25/4/44.

Attenuation.

T.	Kms. from TX.	dBs.	Hm.
1559½	4.75	64	600
1600	9.5	50	"
1601	14.2	61	"
1602	19.0	46	"
1603	23.8	47	"
1604	28.5	45	"
1605	33.2	42	"
1606	38.0	41	"
1607	42.7	42	"
1608	47.5	36	"
1609	52.2	37	"
1610	57.0	32	"
1611	61.8	26	"
1612	66.5	23	"
1613	71.2	25	"
1614	76.0	25	"
1615	79.4	19	"
1616	82.9	21	"
1617	86.3	19	"
1618	89.8	18	"
1619	93.3	16	"
1620	96.7	11	"
1621	100.2	10	"
1622	103.6	9	"
1623	107.1	11	"
1624	110.6	6	"
1625	114.0	6	"
1626	117.5	–	150
1627	121.2	–	"
1628	124.9	–	"
1629	128.6	–	"
1630	132.3	–	"
1631	136.0	–	"
1632	139.7	–	"

Height-Gain.

T.	Kms. from TX.	dBs.	Hm.	
1632	140	–	150	
1633	"	–	400	
1634	"	–	650	
1635	"	–	900	Spiral
1636	"	7	1140	
1636½	"	10	1260	
1637	"	11	1400	
1637½	"	13	1530	
1638	"	14	1650	Climb
1638½	"	12	1760	
1639	"	15	1900	
1639½	"	15	2010	
1640	"	20	2140	
1640½	"	15	2260	
1641	"	19	2400	
1641½	"	15	2500	
1642	"	21	2640	
1642½	"	20	2700	
1643	"	23	2890	
1643½	"	22	3050	

T1/ T2.	Kms. from TX.	Average dBs.	Hm.	
1644 1648	140	24.8	3050	
1649 1657	"	24.3	3050	
1658 1702	"	25.4	3050	Straight
1703 1712	"	22.3	2740	Run
1713 1718	"	18.0	2430	
1719 1725	"	16.0	2130	
1726 1733	"	13.5	1830	
1734 1740	"	11.5	1530	
1741 1746	"	–	1220	
1747 1753	"	–	920	
1754 1759	"	–	600	
1800 1807	"	–	300	
1808 1815	"	–	150	
1816 1822	"	–	150	

GAI/JOB.

Height-Gain Tests in the Troposphere.

Meteorological Data.

27/1/44.					29/2/44.					
Hm.	Temp.	Hum.	Pres.	T.	Hm.	Temp.	Hum.	Pres.	T.	
3050	27°F.	64%	700 mbs.	1500	3050	6	40	677	1300	
2740	29	60	727	"	2740	8	44	705	"	
2430	32	56	756	"	2430	9	53	734	"	
2130	33	55	785	"	2130	11	58	764	"	
1830	37	58	815	"	1830	14	59	795	"	Spiral
1530	37	70	846	"	1530	16	63	827	"	
1220	41	74	879	"	1220	19	67	860	"	
920	45	77	913	"	920	23	68	894	"	
600	48	81	947	"	600	28	70	929	"	
300	47	81	992	"	300	33	69	964	"	Climb
150	-	-	-	"	150	-	-	-	"	

20/4/44.					22/4/44.				
Hm.	Temp.	Hum.	Pres.	T.	Hm.	Temp.	Hum.	Pres.	T.
3050	21	46	694	1430	3050	29	88	706	1450
2740	23	53	724	"	2740	-	-	-	"
2430	25	60	752	"	2430	35	15	762	"
2130	26	66	782	"	2130	37	15	792	"
1830	28	71	813	"	1830	38	19	824	"
1530	30	76	845	"	1530	42	57	855	"
1220	34	76	878	"	1220	45	39	888	"
920	39	74	913	"	920	49	30	916	"
600	45	71	946	"	600	51	59	956	"
300	47	69	967	"	300	57	82	990	"
150	-	-	-	"	150	59	-	1002	"

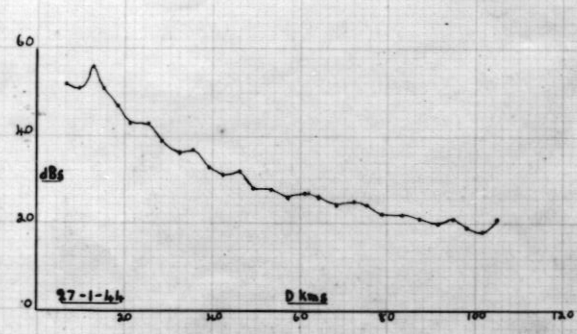
23/4/44.					25/4/44.					
Hm.	Temp.	Hum.	Pres.	T.	Hm.	Temp.	Hum.	Pres.	T.	
3050	31	55	705	1330	3050	25	64	688	1730	
2740	33	57	730	"	2740	26	63	724	"	
2430	36	42	758	"	2430	27	62	755	"	
2130	37	57	783	"	2130	28	60	788	"	
1830	41	73	815	"	1830	32	60	809	"	
1530	44	84	848	"	1530	34.5	65	848	"	
1220	47	73	878	"	1220	37	65	873	"	
920	44	93	906	"	920	40	66	910	"	Straight
600	48	85	937	"	600	45.5	64	944	"	
300	-	-	-	"	300	50.5	62	977	"	
150	-	-	-	"	150	53	61	996	"	Run

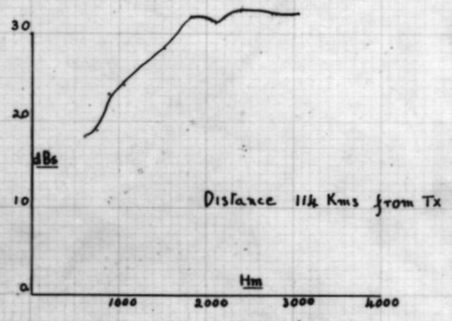
Note:- The data for the 27/1/44 and 29/2/44 was supplied by the Meteorological Office.
The data for the 20/4/44, 22/4/44, 23/4/44 and the 25/4/44 was obtained from meteorological instruments on the aircraft.

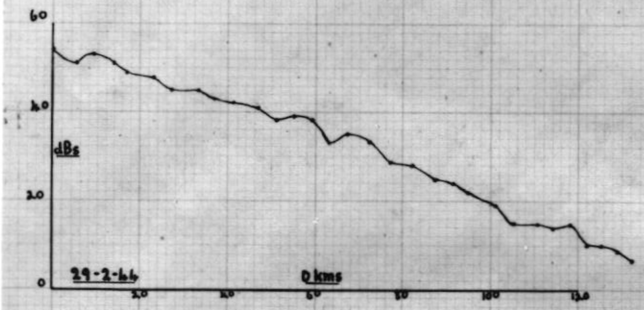
GAI/JOB.

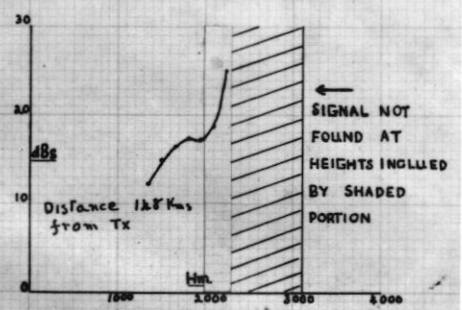
HEIGHT-GAIN TESTS IN THE TROPOSPHERE.

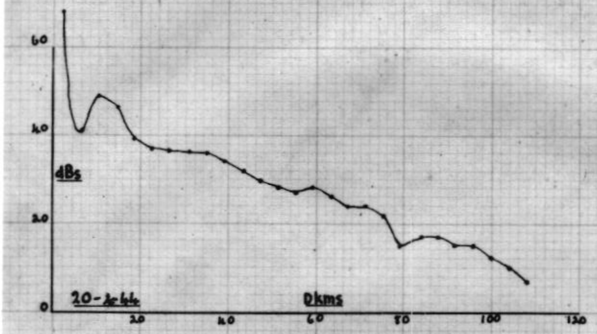
ATTENUATION CURVES. | HEIGHT GAIN CURVES.

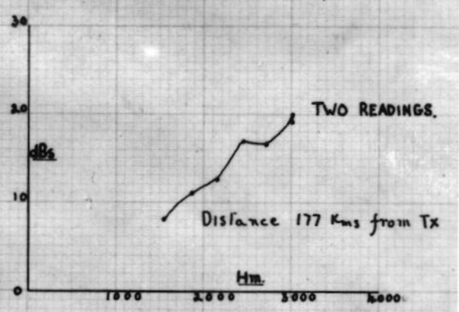


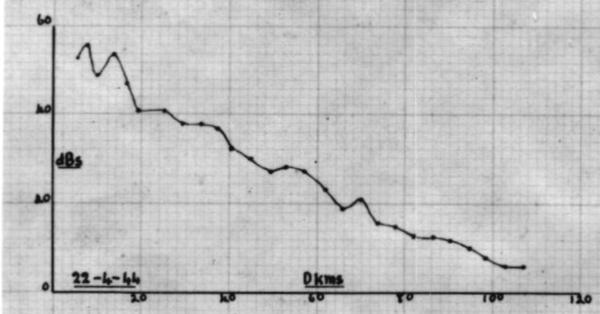


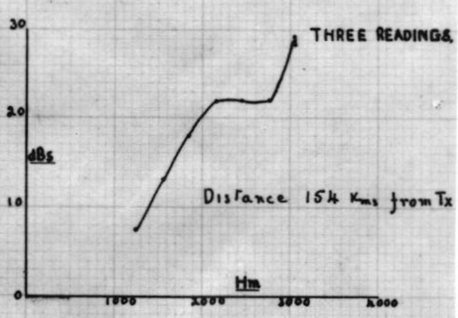


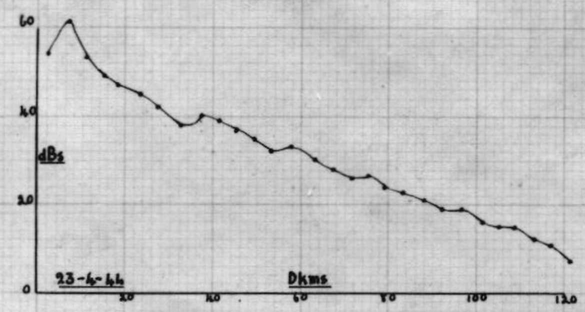


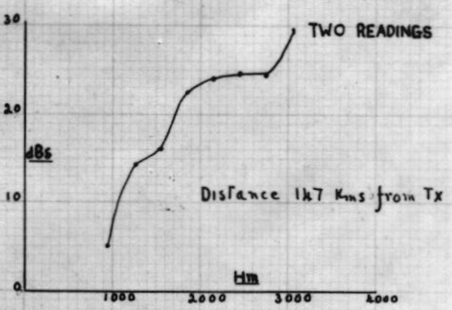


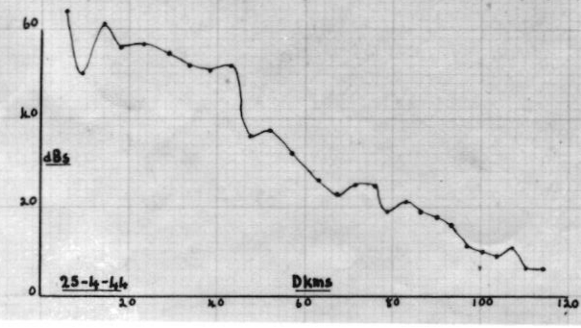


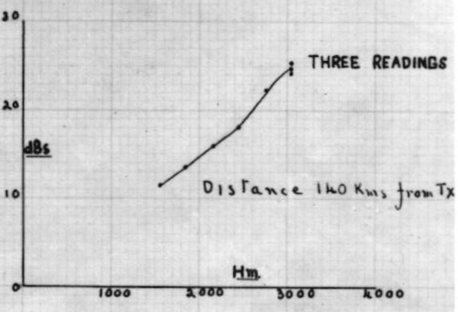


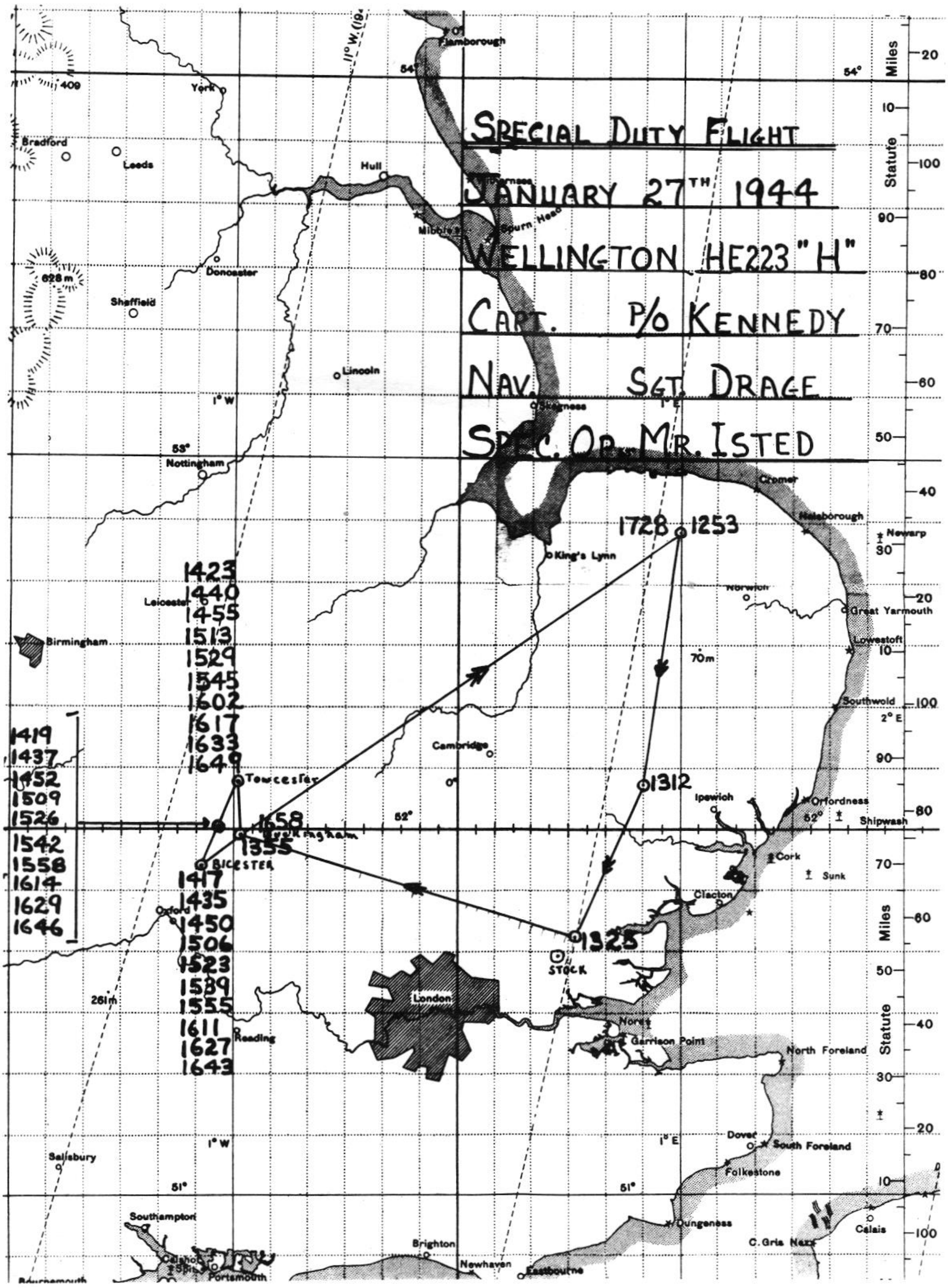











SPECIAL DUTY FLIGHT
JANUARY 27TH 1944
WELLINGTON HE223 "H"
CAPT. P/O KENNEDY
NAV. SGT. DRAGE
SPEC. OP. MR. ISTED
1728 1253
1312
1325
STOCK
1355
1358
Towcester
Bicester
1423
1440
1455
1513
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1602
1617
1633
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1452
1509
1526
1542
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1450
1506
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1611
1627
1643
Flamborough
York
Bradford
Leeds
Hull
Doncaster
Sheffield
Lincoln
Nottingham
Leicester
Birmingham
King's Lynn
Cromer
Norwich
Great Yarmouth
Lowestoft
Southwold
Cambridge
Ipswich
Orfordness
Shipwash
Cork
Sunk
Clacton
Oxford
Reading
London
Nore
Garrison Point
North Foreland
Dover
South Foreland
Folkestone
Dungeness
C. Gris Nez
Calais
Salisbury
Southampton
Portsmouth
Brighton
Newhaven
Eastbourne
Statute Miles

READINGS OF RADIO—SOUNDINGS OF TEMPERATURE, HUMIDITY AND WIND (Heights above M.S.L.)

LARKHILL 0000 G.M.T.

Pressure M.S.L. 1002 mb; Surf. 985 mb; Freezing: Surface

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	04.4	29	89	360 10	
1000	0.5				
950	13.8	26	94	20 18	A
900	27.7	21	86	40 21	-
850	42.3	16	79	40 22	-
800	57.6	10	80	30 22	-
750	73.7	5	72	20 19	-
700	90.6	-4	63	20 21	-
650	109	-6	51	20 31	-
600	128	-9	38	30 41	-
550	149	-11	24	30 50	-
500	171	-20	51	30 57	-
450	196	-25	56	30 63	-
400	223	-40	37	30 64	-
350	252	-53	-	30 61	-
300	285	-65	-	20 61	-
250	323	-75	-	20 63	-
200	369	-68	-	10 22	B
170	-	-69	-	10 31	
150	429	-67	-	10 28	-
130	-	-66	-	10 19	
110	-	-73	-	350 20	
100	513	-69	-	340 25	
90		-68	-	320 20	
80		-71	-	310 19	
70		-69	-	290 29	

Inversion: 700mb -4° to 680mb -8°

Tropopause: Type I 280mb -76° 32,800ft.

LARKHILL 0600 G.M.T.

Pressure M.S.L. 1003.1 mb; Surf. 986 mb; Freezing: Surface

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	04.4	23	98	360 6	
1000	0.8				
950	14.1	27	96	360 21	B
900	28.0	21	88	10 18	A
850	42.6	15	96	20 12	A
800	57.8	9	84	20 19	-
750	73.8	4	67	20 23	-
700	90.8	-2	65	20 26	-
650	108	-1	44	20 32	-
600	128	-2	27	20 40	-
550	149	-9	37	20 46	-
500	172	-17	49	20 56	-
450	197	-25	51	20 57	-
400	224	-35	63	30 61	-
350	254	-48	-	30 58	-
300	287	-61	-	20 58	-
250	326	-74	-	20 52	B
200	371	-66	-	360 23	-
170	-	-65	-	350 28	
150	432	-65	-	340 21	-
130	-	-66	-	310 17	
110	-	-68	-	320 28	
100	516	-69	-	310 33	
90		-70	-	300 27	
80		-72	-	300 27	

Inversion: 986mb 23° to 960mb 25°; 700mb -2° to 670mb 1°; 630mb -3° to 600mb -2°

Tropopause: Type II 260mb -74° 31,800ft.

LARKHILL 1200 G.M.T.

Pressure M.S.L. 1004.1 mb; Surf. 988 mb; Freezing 960 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	04.4	37	73	330 10	
1000	01.1				-
950	14.6	31	83	310 14	A
900	28.6	23	83	330 15	-
850	43.2	17	76	350 15	-
800	58.5	12	59	360 14	-
750	74.7	6	57	10 14	-
700	91.8	6	49	20 20	-
650	110	3	43	20 27	-
600	130	0	62	20 36	-
550	151	-6	51	20 32	-
500	174	-15	100	20 30	-
450	199	-24	100	10 33	-
400	225	-36	100	20 32	B
350	255	-48		30 41	-
300	289	-62		20 41	
250	326	-77		10 38	
200	372	-72		360 27	
170		[illegible]		350 25	
150	432	-67		360 22	C
130		-68		340 25	
110		-70		310 24	
100	517	-68		290 27	
90		-67		280 29	
80		-69		270 40	
70		-67		290 33	
60		-64		290 30	

Isothermal: 750-700mb 6°

Tropopause: Type II 240mb -80° 33,700ft.

LARKHILL 1800 G.M.T.

Pressure M.S.L. 1004 mb; Surf. 988 mb; Freezing 940 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	04.6	34	80	270 5	
1000	01.0				
950	14.5	33	85	280 21	A
900	28.6	26	95	300 18	-
850	43.3	20	100	330 16	-
800	58.8	18	100	360 18	-
750	75.1	12	92	360 21	-
700	92.5	14	68	360 23	-
650	111	8	60	360 26	-
600	129	0	66	360 26	-
550	151	-8	72	10 30	-
500	173	-19	83	10 30	-
450	198	-30	86	360 30	-
400	224	-42	-	360 30	-
350	253	-57	-	360 29	-
300	286	-67	-	10 28	-
250	324	-82	-	360 29	-
200	369	-81	-	340 33	-
170	-	-71	-	310 34	
150	427	-73	-	310 33	B
130	-	-76	-	310 33	
110	-	-77	-	290 33	
100	510	-73	-	280 47	
90		-73	-	280 42	
80		-73	-	270 43	
70		-76	-	270 45	
60		-75	-	260 40	

Inversion: 988mb 34° to 970mb 35°; 830mb 31° to 800mb 18°; 750mb 12° to 700mb 14°. Isothermal: 800-750mb 18°

Tropopause: Type I 246mb -83° 33,000ft.

LIVERPOOL 0000 G.M.T.

Pressure M.S.L. 1004.2 mb; Surf. 1002 mb; Freezing: Surface

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	00.6	30	83	Calm	
1000	01.1				
950	14.4	28	70	360 11	B
900	28.4	22	60	360 11	A
850	43.0	15	67	350 11	-
800	58.2	10	71	360 12	-
750	74.3	4	68	360 11	B
700	91.3	1	59	360 18	-
650	108	3	74	360 22	-
600	128	-1	66	10 27	-
550	150	-8	87	20 33	B
500	173	-17	87	20 38	-
450	198	-27	86	20 37	B
400	224	-40		20 43	-
350	254	-52		20 46	-
300	287	-66		20 47	-
250	324	-86		20 47	-
200	369	-79		20 33	-
170	-	-73		340 17	
150	428	-73		340 20	C
130	-	-76		340 29	
110	-	-78		330 21	
100	511	-74		300 19	B
90		-77		290 28	
80		-78		310 32	
70		-77		310 32	
60		-78		310 32	

Inversion: 1002mb 30° to 980mb 32°; 720mb -2° to 700mb 1°

Tropopause: Type II 250mb -86° 32,400ft.

LIVERPOOL 0600 G.M.T.

Pressure M.S.L. 1002.2 mb; Surf. 1000 mb; Freezing: Surface

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	00.6	27	86	Calm	
1000	0.6				
950	13.8	30	78	250 17	C
900	27.9	26	78	360 17	-
850	42.5	17	81	290 15	-
800	57.9	19	80	330 16	B
750	73.9	3	86	360 21	-
700	91.0	8	70	360 22	-
650	109	5	79	360 24	-
600	129	2	71	360 30	-
550	150	-9	82	360 30	-
500	173	-15	86	360 30	-
450	197	-27	91	360 34	-
400	224	-39	89	10 36	-
350	254	-51	-	10 32	-
300	287	-63	-	360 32	-
250	326	-81	-	360 27	-
200	370	-80	-	350 26	-
170	-	-72	-	320 26	
150	428	-76	-	310 27	C
130	-	-74	-	310 34	
110	-	-77	-	300 38	
100	511	-77	-	290 33	-
90		-76	-	280 35	
80		-73	-	280 31	

Inversion: 1000mb 27° to 970mb 31°; 760mb 1° 720mb 10°

Tropopause: Type I 220mb -87° 35,200ft.

LIVERPOOL 1200 G.M.T.

Pressure M.S.L. 1001.2 mb; Surf. 999 mb; Freezing 920 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	[illegible]	40	68	230 5	
1000	0.3				
950	13.9	34	70	250 16	C
900	28.0	29	69	270 16	-
850	42.8	22	96	280 16	B
800	58.4	21	94	310 16	-
750	74.8	15	86	330 19	A
700	92.2	12	58	350 24	B
650	111	9	47	360 28	-
600	131	1	58	340 28	A
550	152	-8	64	330 30	-
500	175	-17	70	350 26	-
450	199	-28	75	360 29	B
400	226	-40	80	360 28	
350	256	-53	-	350 25	C
300	288	-67		360 21	
250	326	-79		360 24	
200	371	-76		330 27	B
170	-	-72		320 66	
150	431	-70		320 25	A
130	-	-72		310 26	
110	-	-69		290 31	
100	514	-70		280 39	
90		-71		280 45	
80		-69		280 42	
70		-64		280 42	
60		-60		270 36	

Inversion: 710mb 10° to 680mb 13°. Isothermal: 810-800mb 21°

Tropopause: Type I 230mb -82° 34,400ft.

LIVERPOOL 1800 G.M.T.

Pressure M.S.L. 999.2 mb; Surf. 997 mb; Freezing 900 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	00.6	40	86	260 10	
1000	-0.2				
950	13.4	37	88	280 21	B
900	27.7	32	90	280 24	A
850	42.5	26	94	280 24	-
800	58.1	21	96	290 25	-
750	74.7	21	90	300 26	-
700	92.3	15	78	310 26	-
650	111	9	89	310 28	-
600	131	2	94	310 31	-
550	152	-6	97	310 31	-
500	175	-16	100	310 29	-
450	199	-28	100	300 29	-
400	226	-42	-	300 27	-
350	-	-48 (380mb)	-	300 27	-

Inversion: 770mb 20° to 760mb 21°. Isothermal: 790-770mb 20°; 760-750mb 21°

Tropopause: Not reached

DOWNHAM MARKET 0000 G.M.T.

Pressure M.S.L. 1001.5 mb; Surf. 997 mb; Freezing 960 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	01.2	36	83	Calm	
1000	0.4				
950	13.8	31	75	50 18	B
900	27.8	24	86	50 19	A
850	42.5	17	86	40 19	-
800	57.8	11	80	20 21	-
750	73.9	6	62	10 20	-
700	90.9	-1	56	20 19	-
650	109	-9	46	30 19	-
600	128	-8	31	30 28	-
550	149	-15	31	30 39	B
500	171	-16	29	30 57	A
450	196	-25	31	30 63	B
400	223	-38	33	30 80	-
350	253	-50	-	40 60	A
300	286	-62	-	40 60	-
250	324	-72	-	350 55	-
200	370	-75	-	30 33	-
170	-	-71	-	10 21	
150	429	-70	-	360 20	-
130	-	-69	-	10 18	
110	-	-71	-	360 22	
100	513	-71	-	350 24	-
90		-73	-	360 21	
80		-75	-	340 18	
70		-76	-	340 17	
60		-75	-	330 22	

Isothermal: 997-990mb 33°; 500-490mb -16°. Inversion: 650mb -8° to 620mb -6°

Tropopause: Type I 245mb -73° 33,000ft.

DOWNHAM MARKET 0600 G.M.T.

Pressure M.S.L. 1000.5 mb; Surf. 996 mb; Freezing: Surface

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	01.2	28	92	Calm	A
1000	0.1				
950	13.3	28	97	30 10	-
900	27.3	23	89	30 13	-
850	41.9	17	102	20 15	-
800	57.2	10	109	10 15	-
750	73.3	3	87	360 12	-
700	90.3	2	94	10 11	-
650	108	-4	30	30 18	-
600	128	-6	30	30 24	-
550	149	-9	31	30 39	-
500	171	-17	56	30 58	-
450	196	-28	39	30 59	-
400	223	-41	-	30 60	-
350	252	-53	-	30 53	
300	285	-67	-	30 42	-
250	323	-77	-	30 42	-
200	368	-73	-	360 24	
170	-	-68	-		

Inversion: 996mb 28° to 970mb 30°; 750mb 3° to 730mb 4°. Isothermal: 600-580mb -6°

Tropopause: Type I 260mb -77° 31,500ft.

DOWNHAM MARKET 1200 G.M.T.

Pressure M.S.L. 1001.5 mb; Surf. 997 mb; Freezing 980 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	01.0	37	57	320 5	
1000	0.4				
950	13.8	27	61	310 7	A
900	27.8	21	43	320 9	-
850	42.3	15	36	320 10	-
800	57.6	10	24	320 10	-
750	73.7	8	23	340 8	-
700	90.8	6	21	360 14	-
650	109	1	23	360 18	-
600	129	-4	30	10 24	-
550	150	-9	39	20 28	-
500	172	-18	54	30 26	-
450	197	-27	63	10 26	-
400	224	-39	68	10 37	-
350	253	-52		20 35	-
300	286	-67		20 30	-
250	323	-81		10 32	-
200	369	-78		360 24	-
170	-	-73		310 19	
150	428	-71		300 17	B
130	-	-70		300 19	
110	-	-75		300 23	
100	511	-72		300 18	
90		-70		280 23	
80		-73		260 32	
70		-71		260 34	
60		-60			

Inversion: 770mb 7° to 730mb 9°

Tropopause: Type II 250mb -81° 32,300ft.

DOWNHAM MARKET 1800 G.M.T.

Pressure M.S.L. 1000.5 mb; Surf. 996 mb; Freezing 960 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	01.2	37	67	260 5	
1000	0.1				
950	13.6	32	60	270 14	B
900	27.7	27	75	280 18	A
850	42.4	21	83	300 20	-
800	58.0	20	78	340 19	-
750	74.3	12	86	350 10	-
700	91.6	11	66	340 20	-
650	110	7	55	340 24	-
600	130	0	55	340 23	-
550	151	-8	68	360 23	-
500	174	-19	75	360 24	-
450	198	-20	78	350 26	-
400	225	-40		340 26	-
350	254	-64		350 24	-
300	287	-64		360 26	-
250	325	-78		360 28	-
200	370	-78		340 29	B
170	-	-71		310 31	
150	429	-72		300 22	-
130	-	-72		290 37	
110	-	-74		290 34	
100	513	-74		290 37	-
90		-76		290 40	
80		-77			

Inversion: 820mb 18° to 800mb 20°; 710mb 10° to 700mb 11°

Tropopause: Type I 220mb -83° 35,600ft.

LERWICK 0000 G.M.T.

Pressure M.S.L. 987.2 mb; Surf. 977 mb; Freezing 900 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	02.7	37	100	220 30	
1000	-03.4				
950	10.1	36	98	240 36	B
900	24.4	32	97	240 37	A
850	39.3	26	99	250 42	-
800	54.9	22	98	250 42	-
750	71.4	18	75	260 34	-
700	88.9	14	66	270 33	-
650	107	10	63	270 33	-
600	127	4	40	280 28	-
550	149	-3	36	280 28	-
500	172	-14	37	280 28	-
450	197	-24	57	280 30	-
400	223	-35	76	290 31	B
350	253	-45	-	290 41	-
300	287	-59	-	290 60	-
250	325	-73	-	280 47	-
200	370	-87	-	280 33	C
170	-	-84	-	280 27	
150	427	-83	-	280 25	-
130	-	-81	-	280 25	
110	-	-81	-	290 38	
100	509	-78	-	280 47	-
90		-76	-	280 52	
80		-78	-	290 33	

Tropopause: Type I 190mb -80° 38,400ft.

LERWICK 0600 G.M.T.

Pressure M.S.L. 983.2 mb; Surf. 973 mb; Freezing 870 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	02.7	40	80	260 20	-
1000	-04.6				
950	09.4	41	75	260 30	B
900	23.4	36	67	260 32	-
850	38.4	20	66	280 41	A
800	54.1	20	78	280 44	-
750	70.5	14	77	270 46	-
700	87.9	12	56	260 44	-
650	106	5	55	260 43	-
600	126	-3	66	260 46	-
550	147	-8	65	270 48	-
500	170	-17	54	270 40	-
450	194	-27	54	270 48	-
400	221	-39	72	270 64	B
350	251	-55	-	270 67	-
300	283	-71	-	270 68	-
250	320	-86	-	270 70	-
200	365	-84	-	270 66	-
170	-	-84	-	270 59	
150	422	-84	-	270 51	-
130	-	-87	-	270 40	
110		-89	-	260 46	
100		-82	-	260 54	

Inversion: 973mb 40° to 950mb 41°. Isothermal: 950-940mb 41°; 730-700 mb 12°

Tropopause: Type I 240mb -89° 34,100ft.

LERWICK 1200 G.M.T.

Pressure M.S.L. 984.2 mb; Surf. 974 mb; Freezing 930 mb

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	02.7	37	72	300 15	
1000	-04.2				
950	09.3	34	78	310 18	B
900	23.5	27	93	310 18	-
850	38.2	20	80	300 20	-
800	53.6	15	74	300 28	-
750	69.9	10	87	280 48	-
700	87.0	3	91	260 63	-
650	105	-4	86	260 40	-
600	125	-5	83	270 63	-
550	146	-8	23	270 77	-
500	168	-12	23	270 86	-
450	193	-25	19	270 88	-
400	220	-40		270 85	-
350	249	-51		270 77	C
300	283	-65		260 80	-
250	320	-79		260 81	
200	366	-77		260 8	
170	-	-76			
150	424	-77			
130		-83		270 43	
110		-80		270 33	
100		-82		270 35	
90		-87		270 40	
80		-89		260 46	
70		-92		260 54	
60		-94			

Inversion: 630mb -6° to 610mb -4°

Tropopause: Type II 260mb -75° 31,400ft.

LERWICK 1800 G.M.T.

Pressure M.S.L. 988.2 mb; Surf. 978 mb; Freezing: Surface

Pressure mb	Height ft/100	Temp °F	Hum %	Wind Dir. Vel. knots	T
Surf.	02.7	30	76	310 5	
1000	03.1				
950	10.2	29	69	310 15	B
900	24.2	23	71	310 16	-
850	38.9	17	75	300 26	-
800	54.2	12		-	-
750	70.3	7	86	280 30	A
700	87.3	0	95	260 35	B
650	106	-7	100	260 43	-
600	125	-16	100	260 59	A
550	145	-21	100	260 56	-
500	167	-23	98	270 69	-
450	191	-29	85	270 89	-
400	218	-40	75	270 82	-
350	248	-51	-	260 103	B
300	281	-62	-	270 96	-
250	318	-71	-	270 85	-
200	365	-71	-	270 81	-
170	-	-71	-	270 64	
150	428	-73	-	270 61	C
130	-	-77	-	270 42	
110	-	-75	-		
100	508	-77	-		
90		-78	-		
80		-75	-		
70		-80	-		

Inversion: 978mb 30° to 970mb 32°; 570mb -22° to 540mb -20°; 520mb -23° to 510mb -22°

Tropopause: Type II 270mb -71° 30,400ft.

PENZANCE 0000 G.M.T.

Pressure M.S.L. 1003.6 mb; Surf. 1001 mb; Freezing 960 mb

Pressure mb	Height ft/100	Temp °F	Hum %
Surf.	00.6	37	72
1000	0.9	37	72
950	14.4	30	73
900	28.4	24	76
850	43.0	18	81
800	58.3	10	88
750	74.4	4	84
700	91.5	5	81
650	110	2	80
600	130	1	74
550	151	-7	77
500	173	-15	77
450	198	-24	78
400	225	-37	78
350	255	-51	-
300	288	-64	-
250	326	-77	-
200	371	-77	-
170	-	-65	-
150	431	-69	-
130	-	-	-
110	-	-73	-
100	514	-71	-

Inversion: 730mb 1° to 700mb 5°. Isothermal: 620-600mb 1°

Tropopause: I 240mb -70° 33,600ft

PENZANCE 0600 G.M.T.

Pressure M.S.L. 1004.4 mb; Surf. 1002 mb; Freezing 980 mb

Pressure mb	Height ft/100	Temp °F	Hum %
Surf.	00.6	35	64
1000	01.2	35	64
950	14.6	28	70
900	28.6	22	73
850	43.2	16	77
800	58.4	9	79
750	74.5	7	68
700	91.6	6	59
650	110	5	61
600	129	-1	77
550	151	-8	86
500	173	-16	87
450	198	-26	89
400	225	-35	83
350	255	-49	-
300	288	-63	-
250	326	-77	-
200	371	-80	-
170	-	-77	-
150	430	-71	-
130	-	-68	-
110	-	-	-
100	514	-73	-

Isothermal: 1002-1000mb 35°. Inversion: 700mb 6° 670 " 7°

Tropopause: II 230mb -82° 34,400ft

PENZANCE 1100 G.M.T.

Pressure M.S.L. 1005.7 mb; Surf. 1003 mb; Freezing 930 mb

Pressure mb	Height ft/100	Temp °F	Hum %
Surf.	00.6	43	54
1000	01.5	43	54
950	15.1	36	60
900	29.3	27	70
850	44.0	19	79
800	59.3	11	91
750	75.6	16	86
700	93.0	9	80
650	111	7	79
600	131	3	72
550	153	-5	63
500	175	-15	65
450	200	-21	69
400	227	-35	74
350	257	-49	-
300	290	-63	-
250	328	-74	-
200	374	-74	-
150	433	-69	-
100	518	-66	-

Inversion: 770mb 9° to 760mb 16°; 680mb 6° to 620mb 8°. Isothermal: 760-740mb 16°; 1003-1000mb 43°; 790-770mb 9°

Tropopause: III 250mb 74° 32,800ft

PENZANCE 1700 G.M.T.

Pressure M.S.L. 1005.4 mb; Surf. 1003 mb; Freezing: Surface and 950

Pressure mb	Height ft/100	Temp °F	Hum %
Surf.	00.6	35	85
1000	01.4	26	100
950	14.8	26	98
900	28.9	29	100
850	43.7	22	100
800	59.3	19	100
750	75.6	12	100
700	93.0	16	97
650	112	10	94
600	132	2	90
550	153	-6	85
500	176	-17	92
450	200	-28	100
400	227	-42	-
350	256	-63	
300	283	-64	
250	327	-77	
200	372	-81	
150	431	-74	
100	514	-76	

Inversion: 1000mb 25° 980mb 39°; 850mb 22° 840mb 23°. Isothermal: 1003-1000mb 35°; 730-700mb 16°

Tropopause: II 250mb -77° 32,700ft

VALENTIA 0000 G.M.T.

Pressure M.S.L. 1008.6 mb; Surf. 1007 mb; Freezing 950 mb

Pressure mb	Height ft/100	Temp °F	Hum %
Surf.	00.3	30	74
1000	02.2	31	
950	15.6	32	66
900	29.7	27	73
850	44.6	21	81
800	59.8	14	86
750	76.2	16	51
700	93.7	15	65
650	112	9	41
600	132	3	24
550	153	-4	25
500	177	-12	23
450	201	-22	21
400	228	-35	35
350	258	-49	-
300	291	-62	-
250	329	-76	-
200	376	-82	-
170	-	-68	-
150	433	-70	-
130	-	-69	-

Inversion: 1007mb 30° 980mb 35°; 790mb 13° 730mb 16°. Isothermal: 750-740mb 16°

Tropopause: I 216mb -85° 36,200ft

VALENTIA 1200 G.M.T.

Pressure M.S.L. 1003.3 mb; Surf. 1002 mb; Freezing 870 mb

Pressure mb	Height ft/100	Temp °F	Hum %
Surf.	00.3	47	90
1000	0.9	46	
950	14.6	40	87
900	29.0	35	83
850	43.9	30	91
800	59.7	26	89
750	76.4	26	16
700	94.2	20	32
650	113	13	41
600	133	5	44
550	154	-4	49
500	177	-14	51
450	202	-26	54
400	229	-39	56
350	258	-52	-
300	291	-66	-
250	329	-76	-
200	374	-79	
150	433	-73	-
100	516	-73	-

Inversion: 940mb 36° 920mb 37°; 810mb 25° 780mb 29°

Tropopause: II 280mb -80° 34,900ft

~~LEUCHARS~~ WITTERING 0700 G.M.T.

Pressure M.S.L. 999.6 mb; Surf. 988 mb; Freezing 980 mb

Pressure mb	Height ft/100	Temp °F	Hum %
Surf.	00.4	33	75
1000	-0.1		
950	13.4	29	-
900	27.3	28	-
850	42.3	25	-
800	57.0	20	-
750	74.3	15	-
700	91.7	14	-
650	110	9	-
600	130	3	-
550	151	-5	-
500	174	-15	-
450	199	-25	-
400	226	-38	-
350	253	-52	-
300	289	-64	-
250	326	-77	-
200	371	-81	-
150	430	-73	-
100	—	-76	

No humidities reported except at surface. Isothermal: 740-700mb 14°. Inversion: 950mb 29° 930 " 31°

Tropopause: Not reached