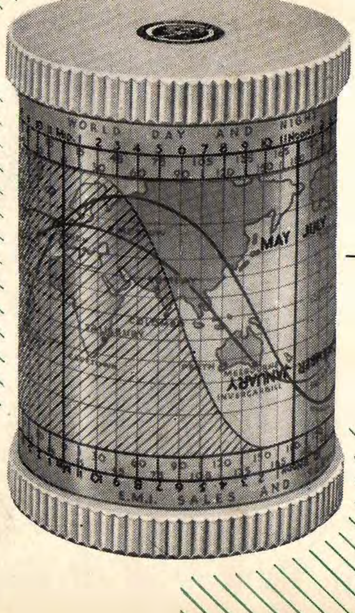

the FISK Solariscope

THE FISK SOLARISCOPE

An essential aid to all users of Short Wave Communications

DESIGNED BY

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Introduction

The " Fisk " Solariscope is a novel instrument designed to show clearly and easily the areas of daylight and darkness over the earth at all hours in each month of the year. It is particularly useful for shortwave radio communication because it shews at a glance whether daylight waves or darkness waves should be used for direct communication between any two points or whether it is necessary to have a repeater station, to receive on daylight waves and relay on darkness waves or vice versa, at an intermediate point.

For shortwave listeners and for users of radiotelephone links or radiotelegraph circuits it shews clearly the hours at which best communication may be expected between any two points on the earth. It can be used in ships to indicate the times at which shortwave communication with distant ships or land stations should be attempted and the class of wave to be employed. The Solariscope is also useful for teaching solar and geographical relationships throughout the year and it shews at a glance the relative times, or hourly time differences, between any two places on the earth.

The instrument is provided with a double Mercator projection map on which the land boundaries are repeated. The object of this is to enable great circle sailing routes or radio beam communication routes to be indicated in each of the two opposite directions around the globe. One or two sample great circles are printed on the instrument, others can be drawn on by users to suit their own requirements.

THE MAP.

Before the Solariscope is put to use, a few minutes examination of its construction and design will assist in better appreciation of the applications of the device.

It will be seen that a map of the world on Mercator's projection is mounted on the cylindrical body of the Solariscope. The fact that there are two maps in continuation need not concern us at the moment ; the convenience of this arrangement will be recognised later.

On the map are marked principal cities and lines of latitude and longitude. The latter are arranged at intervals of 15° east and west of the Greenwich meridian which, of course, is drawn through London. The interval of 15° is not a haphazard choice ; it represents a time difference of one hour between the vertical lines. Also, as the lines are 15° apart and as one degree of longitude represents approximately 60 geographical (or nautical) miles at the equator, the vertical lines may be used as a scale of distances between one country, or city, and another, the unit being 900 geographical miles (approx.) at the equator, decreasing gradually to zero at the poles.

On the Solariscope, therefore,

(1) 15° longitude represents a time difference of one hour.

(2) 15° longitude represents a distance of 900 geographical miles (approx.) at the equator.

THE TRANSPARENT SHADOW CHARTS

Now examine the transparent shadow charts which fit over, and may be moved round, the Solariscope map. Remove the top of the Solariscope and withdraw the transparent charts which will be found inside. There are three, which, together with the chart already fitted round the Solariscope, make a set of four.

These shadow charts enable

(1) The areas of daylight and darkness on the world's surface to be instantly ascertained at any time of the day or night.

(2) Comparisons of Mean-Solar Time between any two or more places in the world to be made without any calculation.

USING THE SHADOW CHARTS

Upon close examination of the shadow charts it will be seen that the names of the applicable months are marked near the top and bottom of the endless strip and the arrangement is as follows :—

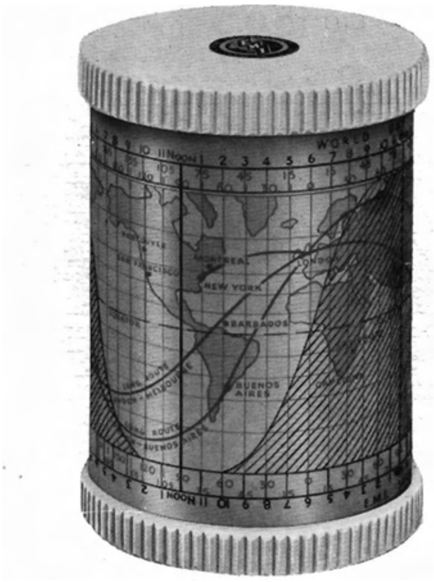
(a) March /September.
(b) April /August—February /October.
(c) May /July—November /January.
(d) June /December.

It must be noted that the designation "March / September," for example, means that that particular shadow chart is to be used either for the month of March or the month of September, and not for the period between March and September.

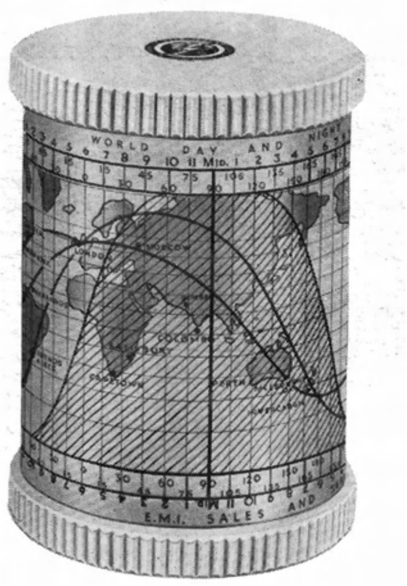
Select the chart which bears the name of the month you are now in and, after removing the top of the Solariscope, slip the chart over the outside of the map, making sure that the name of the month concerned is towards the top of the chart when it is in position. For example, if the month concerned is July, fit chart (c) so that the month names, " May /July " are in the northern hemisphere of the map. Then place the unwanted charts inside the Solariscope and replace the lid.

The Solariscope map is now covered by the transparent shadow chart ; the shaded portions on the chart represent the areas of night and the clear portions indicate where it is day. To determine the extent of these areas on the world's surface at any particular time of the day or night, proceed as explained in the following example.

Assume that the " May /July " chart is in use,



The Solariscope set up to demonstrate the example given on p. 4 (6 p.m. in London in the month of July). Note how the areas of daylight and darkness may instantly be ascertained, together with the relative Mean Times of places throughout the world.



that the time is 6 p.m. some evening in July, and that your location is London. Rotate the transparent chart until the thick vertical line connecting to the word " NOON " at the top of the chart is over London; then move the chart from right to left until the line connecting " 6 " is over London. From this it will be appreciated that the figures along the top of the transparent chart represent hours. Those between " NOON " and " MID " (midnight) reading from left to right are P.M. and those between " MID " and the next " NOON " are A.M.

Now, with the chart set for 6 p.m. in London, many interesting facts may be observed at a glance. Here is a selection.

(1) Night covers India, Australia, New Zealand, most of Africa, Russia and China.

(2) The sunset twilight belt (the left or leading edge of the shaded portion of the chart) is sweeping across Europe, Finland and the South Atlantic.

(3) The twilight belt will reach London in about an hour and a half.

(4) Dawn (the right, or trailing edge of the shaded portions of the chart) is breaking over the eastern Pacific.

(5) The night is very short in the North Polar Regions as indicated by the shadow on the chart being very narrow over these parts, extending over a period of only four hours.

(6) The South Polar Regions are in the grip of the long winter night which extends from 2 p.m. until 10 a.m.

(7) The Mean Time in any part of the world is instantly ascertained by noting the hour line at the top of the shadow chart which is above the part of the world concerned. For example, when it is 6 p.m. in London it is 10 a.m. in Vancouver and San Francisco and 4 a.m. the next day in Melbourne.

Allowance must be made during the Summer months for any operation of " Summer Time " in countries employing daylight saving. For example, 7 p.m. B.S.T. in London is 6 p.m. by the sun, or G.M.T., and the shadow chart should be set at 6 p.m. over London to ascertain the Mean Time at any other location not enjoying daylight saving when the time in London is 7 p.m. B.S.T.

How the knowledge of these facts, so quickly obtained with the aid of the Solariscope, may be applied to everyday problems is explained later, but first, it will be of interest and help if we compare the characteristics of the shadow charts with the day-to-day and seasonal variations which prevail over the globe during its yearly journey round the Sun.

AREAS OF DAYLIGHT AND DARKNESS

The areas of daylight and darkness change throughout every twenty-four hours and it is essential to know the location of these areas when considering, for example, wavelengths for short wave communications.

The times of sunrise and sunset could, of course, be ascertained by referring to tables published by meteorological and astronomical authorities ; but the time differ for every degree of longitude and to have this data available for every day of the year, and for even the chief cities of the world, would require a large volume of reference tables needing a great deal of time to find the information desired. Also, the times given in the tables could be either Greenwich Mean Time, Local Time or the Standard Time of the location being considered and mistakes can easily occur if these differences are not kept in mind.

EVOLUTION OF THE SHADOW CHARTS

The shadow charts have been designed to eliminate all this confusing investigation. The Solariscope takes no notice of the various time systems and gives the Mean-Solar Time at the location being considered i.e., the time by the Sun. By a careful plotting on the map of the world of all the times of sunrise and sunset at every few degrees of longitude, a curve of these times was obtained for one particular day of a month. Other curves for the remaining days of the month were produced and from these an average curve was struck which was representative of the month and which forms the outline for the shadow areas which indicate night on the shadow charts.

An examination of the four shadow charts will illustrate the points mentioned above and it will be seen that all seasonal variations are covered.

Take first, for example, the Summer Solstice for the Northern Hemisphere which is covered by the June shadow chart. When this is on the Solariscope with the name of the month, June, over the Northern Hemisphere and the " NOON" time-line over London, daylight extends over a very considerable part of the Northern Hemisphere while only a small portion of the Hemisphere is in darkness, as indicated by the shadow area on the chart. The shadow area does not extend to the Northern Polar Regions where the midnight sun during midsummer fails to dip behind the Northern horizon.

The Southern Hemisphere, on the other hand, is experiencing winter conditions with short days and long nights as shown by the clear and shaded portions of the shadow chart respectively. By revolving the shadow chart round the Solariscope while looking at Australia, for example, it is at once apparent how long the night is as the sunset (left) edge of the area of darkness reaches Melbourne at 4.30 p.m. while dawn does not break until 7.30 a.m. the next morning, as shown by the dawn (right) edge of the area of darkness on the shadow chart.

Now the conditions for the Winter Solstice in the Northern Hemisphere are the exact reverse of those described for the Summer Solstice, and this is immediately perceived when the June shadow chart is removed from the Solariscope, turned upside down and replaced. The Northern Hemisphere has now a large percentage of its surface covered by the shadow area of the shadow chart; daylight prevails over the North Atlantic, Europe, North Africa, Scandinavia and part of Russia. Iceland, even at noon, is practically in the twilight belt while the Arctic is in perpetual night, as can be seen from the fact that the daylight, or clear, area of the shadow chart stops short of the Northern Polar Regions.

The Antarctic, however, is enjoying its season of the midnight sun and it is summer in the Southern Hemisphere.

When the July shadow chart is fitted round the Solariscope, with the noon time-line over London, it is at once apparent that, in the Northern Hemisphere, the days are beginning to draw in, as denoted by the shorter distance separating the two areas of darkness and the times of sunrise and sunset shown at the top of the shadow chart. The Arctic is experiencing a short night of four hours but the Antarctic is emerging from its long winter night and is enjoying four hours of daylight and the winter days are lengthening in the Southern Hemisphere.

The Solar conditions for July, which is one month past the Summer Solstice, are similar for the month preceding the Summer Solstice so that the one shadow chart is applicable to the months of May and July.

If the shadow chart is now refitted to the Solariscope upside down, the Solar conditions for one month after and one month before the Winter Solstice are shown and the same chart is, therefore, applicable to the months of November and January. Compared with the Winter Solstice conditions, as shown by the December chart, the nights are a little shorter. This is indicated by a smaller area of darkness (shaded portion of the shadow chart) and the times of sunrise and sunset, and the Arctic has four hours of daylight. The reverse conditions prevail in the Southern Hemisphere.

In a similar way, the shadow chart for August shows the Solar conditions two months after the Summer Solstice in the Northern Hemisphere and as these will be similar to those existing two months before the Summer Solstice, the same chart serves for the month of April. Reversing the chart on the Solariscope gives the conditions two months before and two months after the Winter Solstice, so that the same shadow chart also covers the months of October and February.

This brings us to the Vernal and Autumnal equinoxes which are covered by the shadow chart for March and September. When this chart is fitted to the Solariscope it will be seen that solar conditions create equal areas of daylight and darkness. The sun is over the equator and days and nights are of equal duration in both hemispheres.

COMPARISONS OF MEAN TIME

The second important feature of the shadow charts is that they are divided into vertical zones or belts by lines along the upper and lower edges which are separated from each other by a distance of 15° of longitude. As 15° represents a difference in time of one hour, the lines on the shadow charts are designated by hours, with a thick line denoting the hours of noon and midnight.

An explanation of Mean and Standard Time may be helpful at this point.

Mean Time, or Mean-Solar Time is, for all practical purposes, the time by the sun at a given locality. Actually the sun is not uniform in its movements and the True, or Apparent Times, are averaged to give a consistent Mean Time. The use of Mean Time when referring to time by the sun is now practically universal; for example, the term Greenwich Mean Time is used referring to the time by the sun at Greenwich.

However, Mean Time is different for every place east and west of any particular location and, as has already been stated, there is one hour's difference in time by the sun for every 15° of longitude. In these days when most towns are linked by communications of various kinds, it would be very confusing if every town or village worked to its own Mean-Solar Time and, for general convenience, time is usually standardised over an area or zone. For example, two important cities may be 15° apart longitudinally and their local or mean time by the sun would differ by one hour, but for convenience in communications and travel they could be incorporated in a time zone so that the time is standardised throughout the zone. This time would be called the Standard Time for that zone.

In some continents the 15° longitudes are made the boundaries of time zones and the time is changed by one hour as a traveller proceeds across the boundary from one zone to the next. For example, the U.S.A. and Canada are covered by five zones and the times are described as *Atlantic Time*—Newfoundland; *Eastern Time*—New York and Washington; *Central Time*—Chicago and St. Louis; *Mountain Time*—Denver; *Pacific Time*—San Francisco and Los Angeles.

Under the zoning arrangement two towns may be only a mile or two apart but, if they are in adjacent zones, their Standard Time will differ by one hour. Conversely, two towns just within the outer boundaries of two adjacent time zones and, therefore, nearly 30° apart, will also have a Standard Time difference of one hour. This will explain what may appear to be discrepancies when calculating time by longitude and comparing it with times announced during transmissions while listening to long distance short wave stations.

For reference, other zones of Standard Time are as follows:—

Greenwich Mean Time is used over a wide area including England, Scotland, Belgium, France, Holland, Portugal and Spain.

Mid-Europe Time (which is one hour in advance of G.M.T.) rules in Austria, Hungary, Denmark, Germany, Italy, Switzerland, Norway and Sweden.

Eastern Europe Time (two hours in advance of G.M.T.) is used in Bulgaria, Greece, Rumania, Turkey and also in Egypt and South Africa.

Eastward, the Standard Times recognised are

	Hours in advance of G.M.T.
Mauritius	4
India	5½
Burma	6½
Straits Settlement	7
Western Australia, Hong Kong, Borneo	8

Japan	9
South Australia	9½
Eastern Australia	10
New Zealand	11½

Westward, Iceland is one hour behind G.M.T.

APPLICATIONS OF THE SOLARISCOPE.

Short Wave Communications. The varying conditions of short wave communications are due primarily to Solar influences. To establish reliable contact between two distant stations it is essential to know the Solar conditions prevailing over the communication route. Areas of darkness and daylight can be covered only by transmissions of certain frequencies. The extent of the areas will also affect the choice of frequency but the Solariscope presents the prevailing conditions all over the world at a glance for any hour of the day or night and at any season of the year. Present conditions may be verified or the frequencies best suited for future schedules may be chosen by observing the conditions shown by the shadow chart covering the month during which the future schedule is to be worked.

As an example of the use of the Solariscope for this object, let us assume that a receiving station wishes to listen-in to a distant short wave station. The Solariscope will show whether reception is possible.

By setting the applicable shadow chart so that the appropriate time-line is over the receiver location, the essential information required is immediately available.

(1) Is the transmitting station in daylight or darkness ?

(2) Is the path between the transmitting and receiving stations all daylight, all darkness, or is it part light and part dark and how much of each ?

(3) What is the approximate distance separating the stations as estimated by lines of longitude ?

(4) (*a*) Does the time at the transmitter location correspond to any known transmitting schedule ?

(b) Conversely, if the local time of the transmitting schedule in known, what will be the time at the receiver location during which the transmissions may be received ? This is ascertained by rotating the shadow chart so that the time-line corresponding to the local time at the transmitter is over its location. The time at the receiver location may then be read from the chart. This is useful in planning programme listening ahead to see whether the receiving time will be convenient.

With the above data available from the Solariscope, the frequency band most likely to give good signals may be chosen in the light of the characteristics of short wave communication well known to radio engineers and operators.

For those who may not be aware of the propagation characteristics of the various frequency bands used in short wave communications, a table is provided at the end of this book giving details of the frequency bands, their allocations to various communication purposes and their propagation characteristics.

IN NAVIGATION COLLEGES

In all colleges and training establishments where navigation is on the curriculum, no better method of introducing the rudiments of the subject can be devised than by examples worked out with the aid of the Solariscope. By moving the shadow chart over the map it is easily demonstrated that at any place on the meridian 15° east of Greenwich, the time is one hour later than at Greenwich because the sun has risen one hour earlier. At any place 15° west of Greenwich the time is an hour earlier because the sun is an hour later in rising. Knowing this, a navigator can locate his position as to longitude in any part of the world. He only requires a watch or chronometer, maintained at Greenwich time, to compare with the time when the sun passes over his meridian. On taking observations with his sextant, if he finds that his noon time is exactly two hours later than at Greenwich, then he knows that he is exactly 30° west of the Greenwich meridian i.e., in the middle of the Atlantic.

IN RADIO COLLEGES

The application of the Solariscope to the elucidation of problems connected with Short Wave Communications, together with simple navigational problems for those student-operators taking a combined course as is often necessary for air crews, will prove of real assistance to instructors and pupils alike. The simplicity of the Solariscope and its easy manipulation, help to take some of the " terrors " out of the theory of the subjects and to fix the essential facts more firmly in the mind of the student.

IN THE SCHOOL

A short lesson based on the explanations given in this book with demonstrations will impress on the children in an interesting way facts concerning longitude, time differences, seasonal changes, etc.

Quite young children may be allowed to work out easy time problems, such as " What is the time in Capetown when it is noon in London ? " or " If it is 6 p.m. in Bombay, what time is it in Montreal ? " Such simple exercises familiarise the children with the general physical geography of the world and time differences, and cultivate their intelligence by teaching them to manipulate simple calculating devices.

IN THE OFFICE

Foreign times and seasonal conditions at any particular time of the year are frequent problems confronting exporters, importers, brokers and many other business houses where oversea markets and foreign financial transactions feature in the day's work. With a Solariscope handy, the business man can instantly ascertain seasonal and daily conditions in any part of the world. Market opening and closing times can be checked against foreign market times.

Office hours in an overseas firm may be compared with local time to find out what time is best to put through a radio 'phone call. Without going too deeply into the characteristics of short wave long distance reception, it may be mentioned that, due to Solar influences, communication between two points on the earth's surface is generally more reliable when the direct route between the two points is in complete darkness or complete daylight. The shadow chart provides this information at a glance, together with the times during which one or other of the conditions exist. Communication is possible at other times by the choice of suitable wavelengths if the geographical conditions are satisfactory while, on the other hand, magnetic storms may completely upset communications even under what should be ideal conditions. Callers may therefore have to be guided by the post office technician's report on conditions prevailing at the time of the required call.

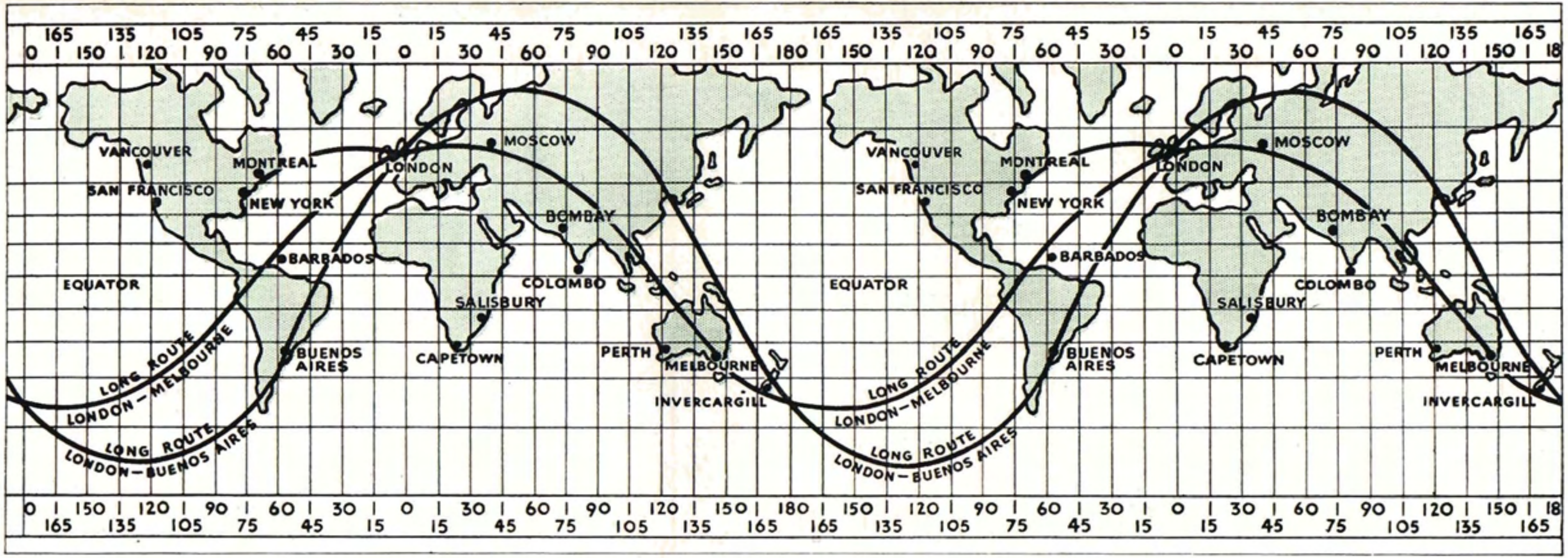
IN THE HOME

All the applications mentioned above are as useful in the home as they are at school. Where lessons have been taught without the aid of the Solariscope, the presence of one in the home will elucidate (or help the parent to elucidate) the half-learnt facts and give the child a fresh interest in the subject. It will help with homework and the child should be allowed to take the Solariscope to school so that she, or he, can show the teacher and the other children how it has helped the child in its studies.

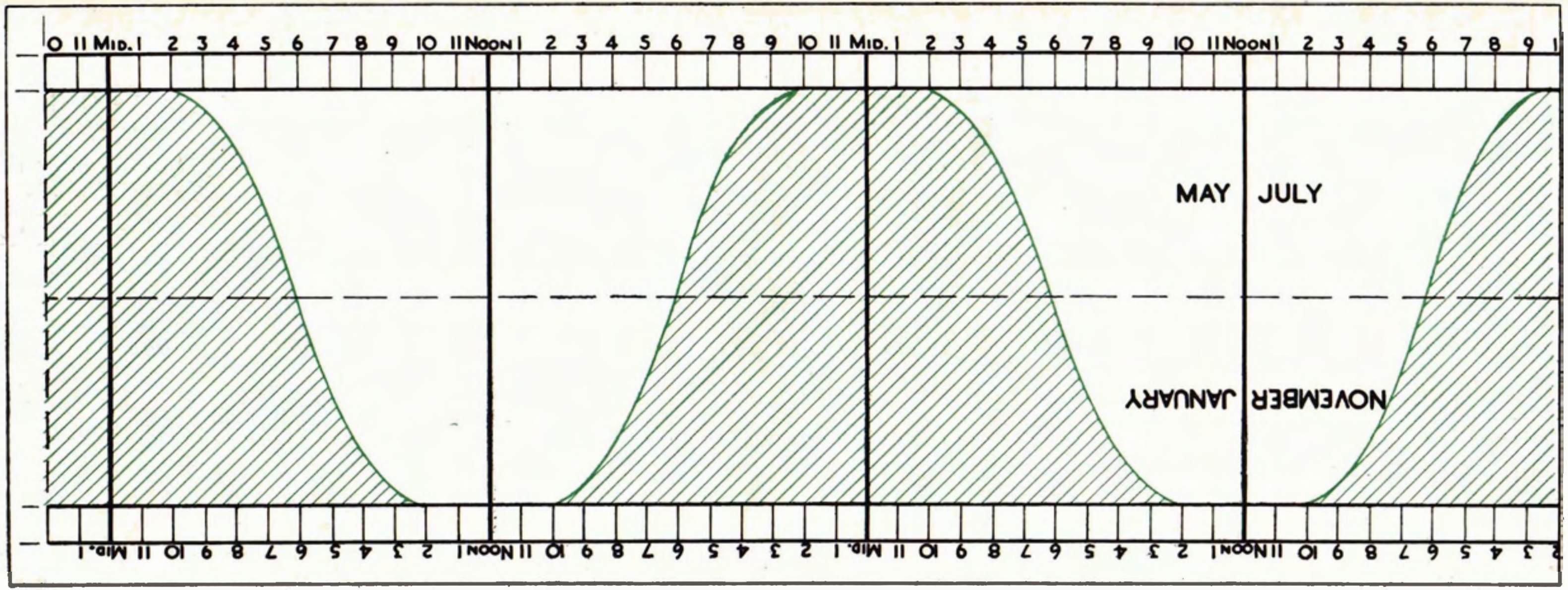
For the adults of the family many of the questions set for children as exercises come up for solution as everyday problems and the Solariscope may be employed to give immediate assistance.

A more pleasant application is the use of the various charts for determining approximate times of sunset and sunrise when planning holidays ahead and comparing these times in England with those in foreign countries if a tour abroad is contemplated.

The foregoing examples of the applications of the Solariscope have illustrated its very wide range of uses and will help you to obtain the utmost use from your Solariscope. Space prevents us enlarging on these, but sufficient, we are sure, has been said to establish that the Solariscope really does merit a place in every home, office, school and college.



The double Mercator projection map of the Solariscope which enables great circle routes to be indicated in each of the two opposite directions around the globe. Some examples are given on the map ; others may be added to suit individual requirements.



An extended representation of the May/July—November/January shadow chart which may be used for any of the months printed on it.

GAZETTEER

This Gazetteer is a compilation of the principal cities and towns from which short wave transmissions of programme value emanated before the war. Doubtless, most of the stations will be back on the air again soon; many are operating already. It is not possible to include all these names on the Solariscope map but the latitude and longitude given in this list against the town name will enable the approximate position of the station to be fixed.

	Lat.	Long.
Azores Is., Atlantic Oc.	37.44N	25.40W
Bandoeng, Java	6.55S	107.40E
Barranquilla, Colombia	10.50N	74.48W
Belgrade, Yugoslavia ..	44.49N	20.29E
Bogota, Colombia	4.36N	74.15W
Bombay, India........	18.54N	72.54E
Boston, Massachusetts.	42.20N	71.3W
Bound Brook, New Jersey	As for New Jersey	
Budapest, Hungary....	47.30N	19.2E
Buenos Aires, Argentine	34.35S	58.20W
Calcutta, India	22.34N	80.24E
Calgary, Alberta	51.2N	114.2W
Cali, Colombia	3.25N	76.40W
Caracas, Venezuela....	10.30N	66.53W
Chicago, Illinois	42.0N	87.37W
Cincinnati, Ohio	39.7N	84.30W
Daventry, England	52.16N	1.10W
Eindhoven, Holland ..	51.26N	5.28E
Georgetown, Br. Guiana	6.46N	58.8W
Guayaquil, Ecuador ..	2.10S	79.56W
Halifax, Nova Scotia ..	44.38N	63.35W
Havana, Cuba........	23.8N	82.22W
Hong Kong, China....	22.16N	114.19E
Johannesburg, Transvaal	26.13S	28.7E
Khabarovsk, U.S.S.R...	48.40N	135.5E

	Lat.	Long.
Lisbon, Portugal	38.42N	9.8W
Madrid, Spain	40.24N	3.41W
Manizales, Colombia ..	5.5N	75.36W
Maracaibo, L., Venezuela	9.20N	71.30W
Medellin, Colombia ..	6.2N	75.49W
Melbourne, Victoria ..	37.48S	145.2E
Mexico City, Mexico ..	19.26N	99.1W
Miami, Florida	35.46N	100.35W
Moscow, U.S.S.R.	55.45N	37.34E
Nairobi, Kenya	1.15S	36.49E
New Jersey, U.S.A. ..	40.0N	74.30W
New York, New York	41.6N	74.0W
Panama, Panama	9.0N	79.35W

	Lat.	Long.
Parede, Portugal	As for Lisbon	
Paris, France	48.50N	2.20W
Penang, Malaya	5.25N	100.15E
Pernambuco, Brazil ..	8.0S	35.53W
Philadelphia, Pennsylvania	39.57N	75.10W
Pittsburgh, Pennsylvania	40.26N	79.57W
Ponta Delgada, Azores	As for Azores	
Quito, Ecuador	0.14S	78.50W
Reykjavik, Iceland	64.10N	22.0W
Rio De Janeiro, Brazil..	22.55S	43.12W
Rome, Italy	41.54N	12.28E
San Jose, Costa Rica ..	9.58N	84.2W

	Lat.	Long.
Schenectady, N.Y.	As for New York	
Singapore, Malaya	1.17N	103.51E
Soerabaja, Java	7.13S	112.40E
Sofia, Bulgaria........	42.42N	23.19E
Sydney, New S. Wales..	33.52S	151.12E
Tokio, Japan	35.40N	138.45E
Trujillo Santo Domingo	18.30N	69.51W
Valencia, Venezuela ..	10.9N	68.12W
Vatican City, Italy	41.54N	12.29E
Vienna, Austria	48.12N	16.22E
Warsaw, Poland	52.12N	21.0E
Wayne, New Jersey....	As for New Jersey	
Winnipeg, Manitoba ..	49.55N	97.6W

TABLE 1

An abbreviated list of waveband allocations in the short wave range with the extent of each band given in metres and kilocycles. The bands were in use in the U.S.A. and British Isles before the war and most of them still function according to the allocation detailed. The first column in this table gives the wavelength in metres commonly mentioned when referring to the band spread given in the second column. For example, an amateur working on 82 m. would be said to be operating on the 80 m. band.

Waveband	BAND SPREAD	ALLOCATION	CHARACTERISTICS OF WAVEBAND AND GENERAL REMARKS
160 m.	171.2—146.34 m. 1,750—2,050 kc.	Amateur.	This band, situated just below the medium wave band, is used chiefly for working over distances up to 400-500 miles by night and is suitable for use within the British Isles. Much longer distances have been worked under good conditions, but not regularly.
	146.18—120 m. 2,052—2,500 kc.	Police, ship—harbour, government.	—
	119.81—85.78 m. 2,504—3,497.5 kc.	Aviation, coastal harbour, government.	—
80 m.	85.71—75 m. 3,500—4,000 kc.	Amateur	The 80 m. band is useful not only for " domestic " communications of medium distance such as between British Isles and European contacts, but allows long distance communications during the winter months. Atmospheric interference limits the usefulness of both 160 m. and 80 m. bands during summer.
	74.91—50.00 m. 4.005—6,000 kc.	Aviation, government.	

Waveband	BAND SPREAD	ALLOCATION	CHARACTERISTICS OF WAVEBAND AND GENERAL REMARKS
49 m.	50.00—48.78 m. 6,000—6,150 kc.	International Broadcast.	Transmissions on the 49 m. band are most reliable when received from a distance of 300 miles or more, although good reception at distances greater than 1,500 miles can be expected only when a large portion of the signal path lies in darkness.
	48.39—42.92 m. 6,200—6,990 kc.	Coastal telegraph and phone, government.	
40 m.	42.86—41.10 m. 7,000—7,200 kc.	Amateur.	The band is useful mainly at nights for contacts over very long distances and during the day for ranges of several hundred miles. The 40 m. band is a busy and rather congested band due to the skip effect which often permits the reception of European and American long distance signals during the same period. This makes the use of a highly selective receiver essential in order to read distant signals through comparatively local traffic.
	41.07—31.61 m. 7,305—9,490 kc.	Aviation, ship and coastal telegraph, government.	
31 m.	31.58—30.96 m. 9.500—9,690 kc.	International Broadcast.	Stations on this band afford greatest reliability of service to receivers situated at a distance exceeding 800 miles. Good reception from distant stations in this band is possible both day and night.
	30.90—27.27 m. 9,710—11,000 kc.	Aviation, government.	
	27.25—25.67 m. 11,010—11,685 kc.	Ship and coastal telegraph, aviation, government.	—
25 m.	25.64—25.23 m. 11,700—11,890 kc.	International Broadcast.	Reception from stations operating in the 25 m. band is most common when a span of 1,000 miles or more separates the receiver and transmitter. Such transmissions over a distance of less than 2,000 miles will be received best during daylight hours. The more distant stations, however, can still be heard well after nightfall under good conditions.
	25.19—21.44 m. 11,910—13,990 kc.	Aviation, government, ship and coastal telegraph.	

Waveband	BAND SPREAD	ALLOCATION	CHARACTERISTICS OF WAVEBAND AND GENERAL REMARKS
20 m.	21.43—20.83 m. 14,000—14,400 kc.	Amateur.	The most effective band for general long distance work during daylight. Atlantic coast American Stations can usually be worked from the British Isles at most hours of the day but the Central and Pacific zone American stations may be received during peak periods which occur in the early morning in summer or immediately before sunset at other seasons of the year. The 20 m. band is subject at times to sudden changes in transmitting conditions.
	20.82—19.89 m. 14,410—15,085 kc.	Fixed (point-to-point only).	
19 m.	19.87—19.54 m. 15,100—15,350 kc.	International Broadcast.	In the 19 m. band, stations situated at a distance of 1,500 miles or greater will be found most satisfactory. Signals in this band will generally be heard during daylight hours, rarely after nightfall or when any appreciable portion of the transmission path is in darkness.
	19.54—16.91 m. 15,355—17,740 kc.	Ship and coastal telegraph, aviation, government.	
16 m.	16.90—16.82 m. 17.750—17,840 kc.	International Broadcast.	The 16 m., 13 m., 11 m. bands are useful only when the reception path lies entirely through daylight and over long distances of 2,000 miles or more. Transmissions in these bands cannot generally be received after sunset.
	16.80—13.99 m. 17,860—21.440 kc.	Aviation, government.	
13 m.	13.99—13.86 m. 21,450—21,650 kc.	International Broadcast.	
	13.86—12.94 m. 21,650—23,175 kc.	Coastal and ship telegraph, government.	
	12.93—12.00 m. 23,200—25,000 kc.	Aviation, government.	

Waveband	BAND SPREAD	ALLOCATION	CHARACTERISTICS OF WAVEBAND AND GENERAL REMARKS
11 m.	11.99—11.12 m. 25,025—26,975 kc.	International Broadcast.	See 16 m. band.
10 m.	10.71—10.00 m. 28,000—30,000 kc.	Amateur.	The 10 m. band has often equalled the 20 m. for long distance traffic during winter months. Summer conditions are not so favourable and long distance working is generally only possible over north-south routes. During cycles of good conditions (the last period was 1935 to 1938) European stations may be worked all through the year. Although its remarkable long distance characteristics make the band attractive, it has the disadvantage of unreliability due to seasonal effects and even more sudden changes in transmitting conditions than the 20 m. band.
	10.00—7.14 m. 30,000—42,000 kc.	Police, relay broadcast, government.	
7 m.	7.23—6.67 m. 41,500—45,000 kc.	Television (G.B.)	The characteristics of wavelengths of 7 m. and below are problematical. They are certainly useful for contacts of from 10-50 miles at almost any time and season. With improved equipment, aerials, etc., it is being established that communication is possible over much greater distances during certain periods. Occasional " sky-wave " reception over several thousand miles has been reported but such work must still be regarded as exceptional and rather in the nature of " freak " results.
	7.14—6.00 m. 42,000—50,000 kc.	Broadcast and educational (F.M., U.S.A.).	
6 m.	6.00—5.36 m. 50,000—56,000 kc.	Television (U.S.A.)	
5 m.	5.36—5.00 m. 56,000—60,000 kc.	Amateur.	

All the shadow charts not in immediate use may be kept safe and sound within the Solariscope. The shadow chart round the Solariscope may easily and quickly be changed when the lid is removed.