J. A. DELLOW

139826

3 Flight / 3 Squadron

10. I.T.W.

Navigation

Form of the Earth

For navigational purposes the earth is treated as a sphere rotating on its axis, and this axis cuts the earth at the N. & S. geographical poles.

Rad. approx. 4,000 miles – approx 25,000 miles Circumference

The Grt. circle is formed on the earth's surface by its intersection with a plane that goes through its centre.

A small circle is formed on the surface of the earth by its intersection with a plane which does not pass through its centre. A parallel of latitude is a small circle whose plane is parallel to that of the equator

Latitude is the angle at the centre of the earth between the radius to the place and the plane of the equator.

A meridian is a semi Gt. circle joining the poles.

Longitude is the angle between the plane of the prime meridian and the plane of the meridian through the place.

	LAT.	LONG.
From A	4500 N.	4500 E.
To B	2330 S.	1545 W
Ch. Lat.	6830 S.	

Graticual is the network formed by meridians of parallels on map or chart

Ch. Lat. and Ch Long.

These are set down exactly as follows

	LAT	LONG
From A	4500 N.	4500 E
To. C	2330 N.	6112 E
	2130 S.	1648

Opposite names ADD

Same names SUBTRACT

From A. 135° 25" E.

To B. 150 15° W

285° 10" W

360 00

285 40 W.

74 20 E

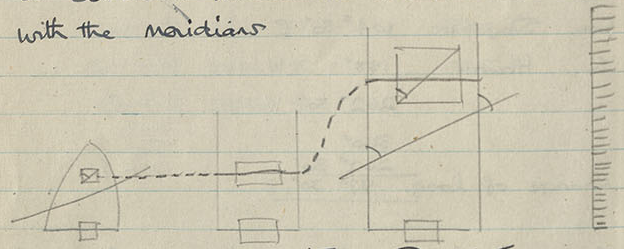
From Singapore	104° 30' E	060 E
To. Hawaii	158° W	060 W
	262° 30" W	120 10.
	360°	360°
	262° 30'	120
Change of Long.	97° 30" E	240 E

Change of Long. = The smaller angular difference between the meridian through the places - hence If Ch. Long. EXCEEDS 180°, SUBTRACT from 360° and change the name.

Gt Circle - Shortest

Rhumb line - Constant, cuts every meridian it crosses at the same angle i.e. a line of constant bearing.

Navigation in the air is almost invariably along the rhumb line rather than the Gt ○ route, although the rhumb line route is the longer. The great advantage of the rhumb line is that it may be followed by maintaining a constant true track i.e. A constant angle with the meridians



Mercator's Projection

Mercator's Projection can best be understood from the accompanying diagram.

Its main objects are

1. That all rhumb lines shall be straight lines on the chart
2. That angles of the earth's surface shall be correctly represented on the chart.

It will be realised, that the effect of representing meridians by straight ‖ lines is that any straight line cuts them at equal angles. Thus a straight line is a rhumb line.

This however means stretching the ‖s of latitude by an amount which increases towards the poles. Thus a small shape is now distorted and the angle PQR is incorrect

To overcome this in Mercators Chart the longitude scale is also increased to correspond exactly at any latitude with the latitude Scale.

Now small shapes are correct again i.e. orthomorphic & the angle PQR is correctly represented.

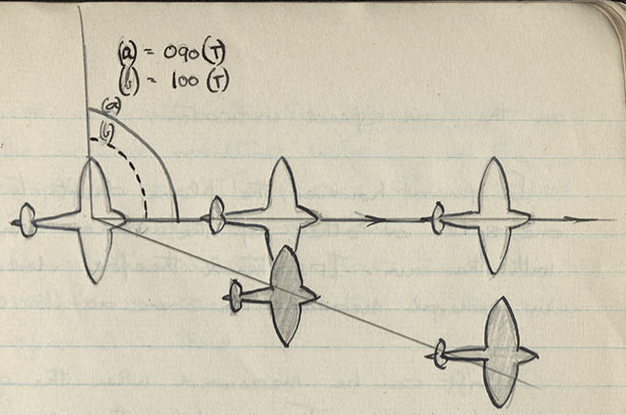
Distances (i.e Rhumb line distances not crossing more than 10° Lat. can be measured in sections of 40 miles using the scale at the mean latitude

N.B. Longitude has no connection with distance on any map but a minute of lat. is a nautical

Angles. In R.A.F angles are always measured clockwise from the N. direction (Meridian) from 0° to 360° (The only exception is drift)

All directions on the chart are measured from the true Meridian and are followed by the letter T (e.g. 175 (T))

All directions are in three figure groups e.g. 045 (T)
009 (T)



Track - is the angle measured clockwise from the meridian to the path of the aircraft over the ground.

Course - is the angle measured clockwise from the meridian to the direction in which the aircraft is pointing (heading or steering)

Drift - is the difference between course and track. It is measured Port or Starboard relative to the aircraft nose. If there were no wind, an aircraft would go the way it was heading, and its speed over the ground (G/S) would be the same as its air speed (A/S) (the air speed is the speed relative to the surrounding air, and is measured

on the air speed indicator.

In general however, the plane drifts to one side or other of the course moving with the air. It's track therefore does not in general measure the same as its course.

Drift can be measured when the ground can be seen. This enables the navigator to check the track made good.

Course + Starboard drift = Track
Course − Portside drift = Track
Velocity = Speed + Direction

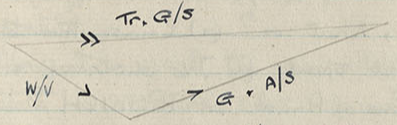
The Vector Triangle

A Vector is a quantity which can be represented by a line. A velocity calls it to this class

An aeroplane is subject to 2 velocities at once.

1. Course and Air Speed
2. Wind Speed + Wind direction = Wind Velocity

These are called the two Components
The actual resulting velocity of the aeroplane is :- Track and Ground Speed
This is called the resultant. A well known theorem states that these three vectors can be represented by the sides of a Δ – thus



Vector Scale = 1mm. = 1 Kt.

Note carefully the directions of the arrows.
The Δ contains information about 6 quantities. If any 4 are known, the Δ can be drawn and the other two found.

Case I – Knowing track A/S, W/V – to find course to steer & ground speed.

(i) Lay off the wind to Vector scale, pulling away from point of departure (or down wind)
(ii) With centre the other end of wind vector and radius air speed, cut the track. This gives

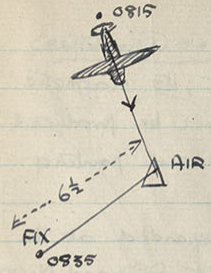
the other corner of the triangle.

(iii) Draw in and measure the course for the length cut off on the track, is the ground speed to Vector scale.

E.G.

You are Navigator of an Anson, and are detailed to fly from your base at LINCOLN to IPSWICH. You set course at 0820 hrs, using a met. wind of 260/30 M.P.H. T.A.S. to be 140 m.p.h, What is? (a) Course true to steer (b) The ground speed (c) The distance & (d) The Estimated Time of Arrival at IPSWICH?

DATA	WORKING	ANS
At 0820 LINCOLN s/c IPSWICH		(a) Co. 150° (T)
T.A.S. 140 m.p.h	Time = Dist. = 107	(b) G.S. 154 m.p.h
W/V 260/30	Speed 154	(d) Dist. 107½ miles
	= 43 mins	(e) E.T.A 0903



T.A.S. = 120 K^s.

Air distance run in 20 min. = 40 K^s

6½ wind distance blown in 20 mins.

∴ W/S = 19½ Kts.

W/V = 075°/19½ Kts.

Wind Finding by an Air Plot

1. Lay off the true course from the pt. of departure
2. Along this, mark the air distance run in statute or nautical miles during the time from setting course to fixing position.
3. Mark the end of this 'AIR', for air position, and with the time. This is where the ~~average~~ aircraft would have been, had there been no wind at all
4. Join AIR to FIX. This gives wind direction & wind distance blown since setting course (or leaving). The distance blown in 1hour can then be calculated

The Earth's Magnetic Field, Dip & Quantities

The Earth is a huge magnet, its magnetic field is similar to that which would be produced if there were a bar magnet, RED end pointing SOUTH inside the earth.

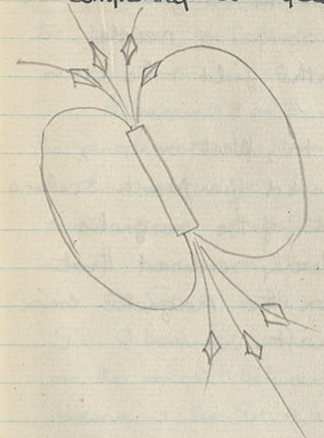
Dip:- Thus a magnet freely suspended at the centre of gravity will not only point RED end NORTH but will in general dip. In the N. hemisphere RED end dips. In the S. hemisphere blue end dips.

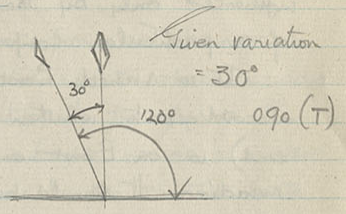
At the magnetic equator, there is no dip.

VARIATION - The axis of the earth's magnetic field does not coincide with the axis of rotation Therefore, in general, a magnet arranged to swing horizontally does not point along a geographical position meridian

Definition Variation is the angle in the horizontal plane between the true meridian at the place & the direction of a freely suspended compass needle influenced only by the earth's field. It is named EAST (or +), WEST (or −) according to whether the RED i.e. North seeking end lies on East or West of the true meridian

Variation of a place varies slowly completing a cycle in about 960 years





Deviation

Deviation & the Pilot's Compass - A compass inside an aircraft is not influenced only by the earth's magnetic field, but by fields due to permanently magnetised parts of the aircraft, soft iron" components and fields due to current bearing wires.

Attempts are made to compensate for these extraneous fields but there is always a small error remaining at any particular magnetic heading. This is called "Deviation"

Deviation - is the angle in the horizontal plane between the axis of a compass needle influenced only by the earth's field & the axis of a particular compass.

It is named East or +, West or −, according to whether the red (i.e North seeking end) is on East or West of the magnetic meridian. It should be clearly realised that deviation depends only on the magnetic course (or heading) of the aircraft.

FORM 316

Co.(M)	Co.(C)	
000	358	+2
045	048	−3
090	090	0
135	132	+3
180	179	+1
225	222	+3
270	269	+1
315	318	−3

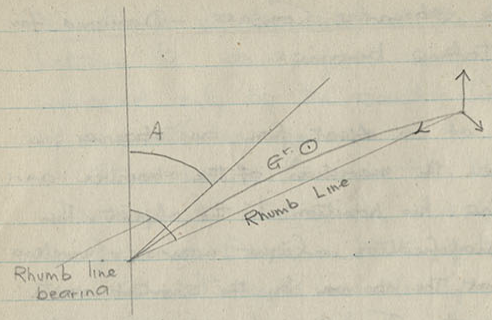
Deviation in the Observers Compass. - Designed for the purpose of taking bearings

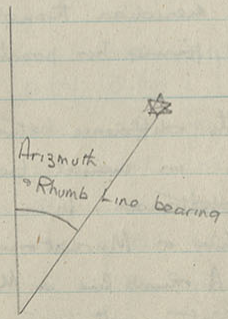
A bearing of an object from an observer, is the angle between the meridian of the observer and the line ~~adjoining~~ his position to the object. This needs some qualification. - Light waves & wireless waves arrive at the observer by the shortest route i.e. the Grt. ○ route. Thus these bearings are called Grt. ○ bearings or "Azimuth", and are defined as the angle between the meridian through the observer & the Grt. ○ route joining his position to the object.

However, there is little difference between the grt ○ and the rhumb line in visual bearings which are over short distances. These are therefore laid down as Rhumb line or Mercatorial bearings defined as follows −: A rhumb line or Mercatorial bearing is the angle between the meridian of the observer, & the rhumb line joining his position to the object.

All bearings can be refered to true Magnetic or Compass North.

MAGNETIC OR · COMPASS NORTH





Methods of Reporting Position

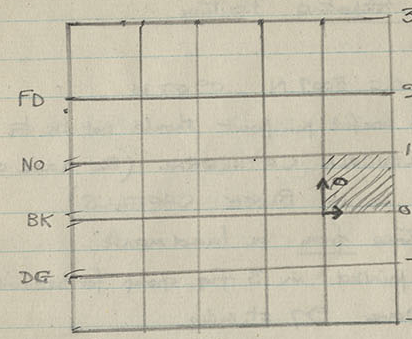
1. – By Lat. & long e.g. 5007 N 0207 W

2 – Pin pointing – (a useful pin point should not be too big)
e.g. 0815 – LINCOLN CATHEDRAL (the name of the place should be in BLOCK CAPITALS.)

3.– Bearing & distance <u>from</u> a land mark
Name of place printed in 3 fig group for bearings
e.g. 135° Dover 27 st. mdes.

<u>Note</u>– Distance is measured in nautical or statute miles by arrangement

4. – R.A.F graticule co-ordinate reference system.
Each degree of long. & lat is known by a pair of letters. In reporting a position, the letters for the S.W. corner of the degree rect. angle in which the position is situated are given – Latitude first. Then follows minutes – Northwards first then Eastwards from this corner.



NB The minutes to the nearest whole minute & made up to a 4 fig. group.

5. RN. Graticule co-ordinate reference system. The degrees are lettered as before – the position is then reported as a bearing & a distance in nautical miles from the nearest corner.

The bearing to the nearest degree as a 3 fig. group & is set down first, then the letters Lat. first and lastly the distance in nautical miles

e.g. 140 NOBO 17

Maps and Charts in use in the R.A.F.

1. Mercator Plotting Chart 1:1,000,000 (also 1:500,000) MERCATOR
2. Topographical Maps 1:500,000 INTERNATIONAL
   1:250,000 MODIFIED POLYKONIC
   1:1,000,000
3. . . ¼" to a mile Ordnance Survey – CASSINI
4. Target Maps –
5. Gnomonic Charts – GNOMONIC
6. Admiralty Charts – MERCATOR
7. Charts of Magnetic Variation & Magnetic Dip " etc.

Maps used on 'ops' – No 1, & a No ½ million

For elementary flying i.e. when below 2,000' use No 3. Ord. Survey.

Details of Topographical Maps.

Variation – may be shown as follows

(i) Isogranules every ½ degree

(ii) Diagram statements in the margin giving variation in the centre of the sheet.

(iii) Diagrams with statements at different places on the map.

(iv) A second compass rose showing magnetic direction inside the one showing true.

Topographical Maps (continued)

½ million uses No. 1 & sometimes No. 2.
¼ million . . 2
¼ inch . . 3

Methods of Showing Relief

i. Contours - lines on a map joining those places with the same height above same datum level

ii Spot heights - The ht. above mean sea level of local high pts. marked in metres OR ft. It is important to know what the units are on any particular map or chart. (Metres x 3.3 gives ft. with a margin of safety).

iii. Layer tinting - The tinting of the spaces between contours usually with the darker shades on the higher ground.

iv. Hachuring - The high ground roughly defined by short lines following the downward slopes.

v. Hill Shading - The printing in brown to give the effect of shadows on the one side of the high ground

The ½ million uses nos 1, 2, 3,
¼ inch . . 1, 2, 3,
¼ million has no layers tinting uses 1. 2

Scale

1. Representative Fraction or natural scale is the ratio of any unit on the map to the length it represents on the ground in the same unit

e.g. 1 centimetre on map - 500,000 centimetres = 5 Kms on ground
OR 1 inch . . = 500,000 inches on ground

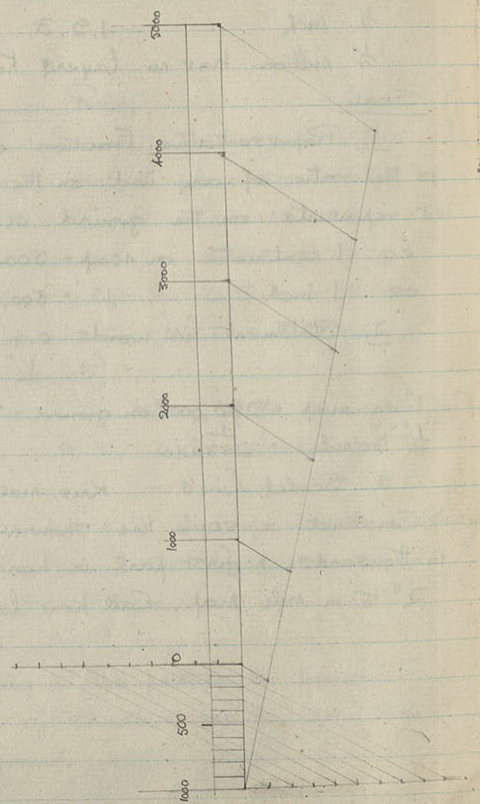
2. Statement in words e.g. 10 miles to the inch
¼" to the mile.

1" on map = 250,000" on ground = $\frac{250,000}{63360}$
¼" to mile = $\frac{1}{253240}$

3. Scales Lines - Kms. metres & cms.

Construct a scale line showing 5,000 yards in thousands & first part in hundreds for the 2" to a mile map. - Call - how long

Construct a scale line showing 5,000 yards in thousands and first part in hundreds for the 2" to a mile map?



Conventional Signs

30 Land aerodrome (Hts in ft. above mean sea level)

30 Landing Ground (. . . . .)

Seaplane Station (Centre of Circle)

. Mooring Area or Anchorage (Centre of Stock

CROYDON Airport (i.e with Customs Facilities)

30 Airship Base (Hts in ft above mean Sea Level)

Mooring Mast for Airships (Centre of Base)

Hangar . . . . .

Golf Course

R.C. Race Course

GJD Radio electric Station – Call Sign

(a) Other than aeronautical, but which may be of use to aircraft

T (b) Aeronautical (Communications with Aircraft)

M (c) Sending meteorological information at fixed times

N (d) Navigational radiobeacon (Non directional

D Track Indicating

A Landing approach radiobeacon

R. Goniometric

~~Geometric~~,

Obstruction to air navigation of a ht. above 60 metres (200'). The ht. above sea level will be given when the ht. of the obstacle exceeds 90 metres (300')

(a) Unlighted obstruction 

(b) Lighted 

Danger

Prohibited

X (a white cross in centre of area in ground)

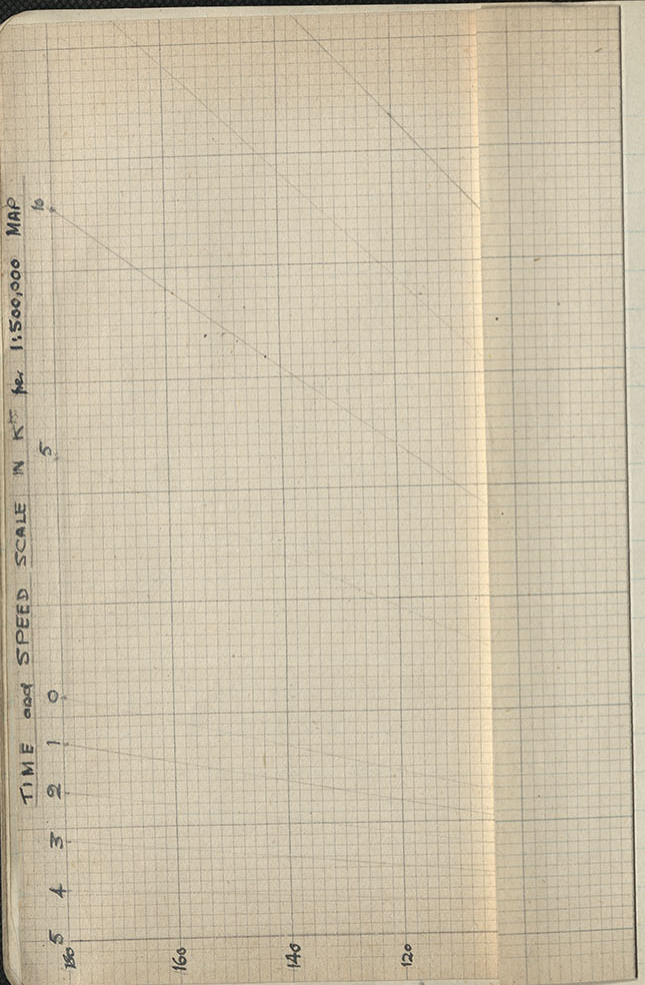
→→→ One way compulsory route

←→ Two way -

-→-→-→ recommended route

→←→

	MERCATOR	I.M.P. CASSINI	GNOMONIC
Meridians	Equidist. ‖ st. lines at 90° to parallels	St. or almost st. lines converging to near pole	St. lines
Parallels	St. Lines ‖ to equator not equidist.	Concave to near pole	Concave to near pole
Gt. Circles	Convex to near pole	for pract. purposes St. lines	Gt. Cs are exact st. lines
Rhumb lines	Straight	Slightly concave to near pole	Concave to near pole
Angles	True	True	True only from pt. of tangency
Shapes	Small shapes are well represented	for prac. purposes orthomorphic	Distortion increases rapidly with dist. from pt. of tangency
Areas	Area increases with dist. from the equator	for practical purposes Correctly related	Areas increase rapidly with dist. from pt. of tangency
Scale	Increases with distance from equator	Scale - same all over for practical purposes	Scale increases with distance from pt. of tangency



Time & Speed Scale

Constructed for chosen range of ground speeds for a given map. (usually ½ million). They can be used for the following purposes.

i. To check ground speed – know map distance covered in a certain time.

ii. To discover the distance on the map that will be covered in a certain time at a given ground speed

iii. To discover the E.T.A at a pt. on the map knowing the ground speed

N.B. The time speed scale obviates the necessity of interpreting a map distance in inches or having to calculate when finding the unknown quantity.

MAP READING

A soldier interprets a map from the ground, sees a small area at a time & seeks to recognise features which are often small.

A seaman reads his chart by using the conventional signs and information regarding depths, currents etc.

An airman must be able to do all this but reading a map from the air means in general

i. Recognising general features (Mountains Coastlines etc) Since detail is of little use.

ii. Recognising places and objects by noting their relationship with neighbouring features

iii. Recognising places and objects by noting their relationship with neighbouring features.

Landmarks

(a) Water is characteristic shape of small lakes makes them excellent landmarks & coastline is easy to recognise

(ii) Railways - good in England - Too many on central the continent.

Distinctive features - They are fairly straight & their angle to the track is usually quite definite

(iii) Woods (iv) Roads - Main roads are often tarred & are not always so conspicuous as some secondary roads. The straight concrete motor roads on the continent are quite good.

(v) Towns - Often recognisable by the disposition of railway station or churches - Different colour

(vi) Golf courses - Fairly good if not too high. Emergency Landing grounds

(vii) Very large Private house

(viii) Schools

{(i) Lightships Large buoys Lighthouses Cliffs Distinctive colour}

1st Class pin points - They are small, well known and always marked.

2. Map reading at Night

Useful land marks - (i) Lakes rivers & coasts (ii) Woods & Forests (iii) Railways & roads from the light of trains or cars (Degree of visibility varies much more than during the day & the shadows cast by the moon often hide roads alter outlines & look like woods themselves.

The Pilot's Compass

The main parts are -:

i. The Compass or Magnet system which indicates compass North in the aircraft

ii. The Lubber line which is parallel to, or coincident with the longitudinal axis of the aircraft Against this, the compass course of the aircraft is read

iii The Grid ring with grid wires carries the graduations of the compass rose; on this the course is read

Reading Course.

i. Unlock grid ring, set "red on red", relock

ii. Read the compass course against the lubber line

Setting Course or Altering Course.

i. Apply deviation to the magnetic course ~~read~~ received

ii. Unlock grid ring, turn it, bring the desired compass course against the lubber line & relock

iii. Turn the aircraft to bring "red on red".

Turning Error

Turns either way when steering "North"

i. The effect on the compass — It turns with the aircraft.

2. Result — Turns are underindicated

(a) Turns more slowly than the aircraft
Too small a turn indicated

(b) Turns at the same rate as the aircraft
— No turns indicated

(c) Turns more quickly than the aircraft. A turn the wrong way indicated (Northerly turning error)

(d) Compass Course Sluggish

3. The Correction

(a) Stop short of the desired course as indicated wait for the magnet system to recover, & make minor adjustments to the heading. [Turns either way when steering "South".

i. Effect on the compass — It turns the opposite way to the aircraft

ii. Turns are overindicated

iii Correction — Overshoot the desired turn as indicated

Compass Course Lively

Southerly	Northerly
Opposite way	Same way
Lively	Sluggish
Overdistant	Stops short

In the Southern hemisphere, the effects described for Northerly courses now apply to Southerly & vice versa

Acceleration Error

1. Effect on the Compass

Westerly deviation when heading West
Easterly . . . East

2. Result - Apparent turn to the North in both cases which persists as long as the acceleration persists

Retardation - Error

Effect on the Compass

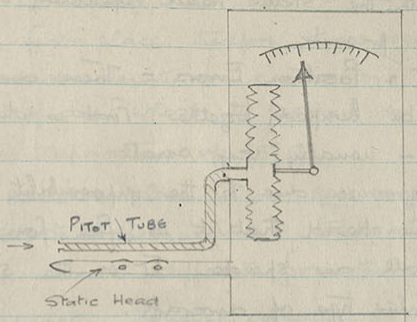
1. Westerly deviations on Easterly courses
Easterly . . Westerly .

2. Result - Apparent turn to the South in every case which persists so long as retardation persists

The effects are a maximum at E. & W. and only sink to zero on due Compass N. & Compass S. The effects are completely reversed in the Southern hemisphere

[i.e. Accelerations give an apparent turn to South
Retardations . . . . . North]

The Air Speed Indicator



If an open ended tube, closed at the other end, with a pressure gauge, has the open end facing the air stream, then the pressure which is in excess of that of the still air will be built up in the tube, and registered by the gauge.

This pressure difference increases with increased velocity relative to the tube. Therefore, if the gauge is calibrated in units of speed it is an "Air Speed Indic.

It is necessary that the pressure outside the capsule of the instrument shall be the same as that from which the PITOT tube starts building up. i.e Should be atmospheric press. Whatever the height of the instrument

Leaving the instrument open to the cockpit is not sufficient since this pressure is very variable

and often lower than that of the surrounding still air. The outside of the capsule communicates therefore with the static head specially designed to give this pressure

Instrument & Position Errors - These are permanent and can be lumped together. First is due to faulty calibration - usually very small

Position error is due to the impossibility of so placing the pressure head that it is free from turbulent air at all air speeds. It is the same for any particular type of aircraft.

The instrument error correction is usually obtained from a table showing I.A.S. & corresponding values of C.A.S at various speeds. The correction is applied to I.A.S. to obtain C.A.S & it must be noted that the sign must be reversed to get I.A.S from C.A.S.

Example.

C.A.S. & T.A.S.

Pressure built up in the Pitot head depends not only on Air Speed, but also on air density.

In the first place therefore it is necessary to choose a standard density for calibration. This is the density of air whose pressure is 1013.2 mbs. and a temperature of 15° C.

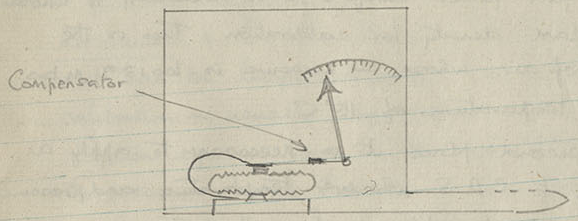
In the second place it is necessary to apply a correction to C.A.S. whenever temperature and pressure give a density different from the standard.

In practise, however, average conditions are assumed and the drop in density with increase in height which results yields a simple correction factor as follows —:

$$T.A.S. = CAS \times \frac{(57+x)}{57.}$$

{x = altitude in 1000's of ft.}

The Altimeter



Atmospheric press. decreases with an increase of ht. The altimeter is a modified form of aneroid barometer which responds to the decrease of pressure but is calibrated in "feet" or "metres" and not in units of pressure.

In order that the altimeter may be subject to the correct pressure of the surrounding still air the outside of the capsule communicates only with the static head.

Lag - If an aircraft loses or gains ht. quickly the reading of the altimeter lags behind the true ht. The difference between the true and indicated ht gradually decreases and a minute or two later, may record correctly.

Due to imperfect elasticity of metal capsule & spring.

This fault has been almost eliminated in the later types.

Horizontal Pressure change and zero setting - In order to compensate for changes in ground pressure from day to day, the zero of the instrument is made adjustable. There are two ways of setting the altimeter before setting a flight.

(a) To read zero (Set) - the altimeter then records the ht. above the aerodrome

(b) Set the altimeter to read aerodrome ht. - it then records ht. above Mean Sea Level.

There is another case to consider.

Suppose an aircraft having set the altimeter correctly before starting off, flies into a district where the ground pressure is lower. It will read too high. The error will be the same at all heights so that the altimeter can be corrected if the ground pressure at the new district is known.

Why does Isothermal Alt over under indicate when air temp below it is less than 50° F.

Since the air below it is colder, than the standard it will be denser. In rising from the ground through this dense atmosphere the aircraft will be putting below it a bigger weight of air than under standard conditions. Therefore the aircraft will experience a bigger drop in pressure causing it to read too high.

Meteorology

Pressure The pressure the atmosphere exerts is due to the weight of a blanket of air 7 to 11 miles high The pressure will decrease with increase of height as the weight of the over lying air diminishes. An average rate of decrease for the 1st 1000' is 1m.b.a decrease per 30 feet rise.

The value of the atmospheric pressure at sea level, varies from day to day between 1050 m.b.s & 955 m.b.s in England. Distribution of this pressure is plotted on the weather chart in the form of isobars.

An isobar, is a line drawn on the weather chart joining places with the same M.S.L. atmospheric pressure

Types of Pressure Distribution – Isobars form definite patterns each with its own kind of weather.

i. The depression or LOW – A series of roughly concentric isobars with the lowest pressure in the middle

ii. Secondary depression

A small depression within the main depression.

iii. An anticyclone or HIGH – A series of roughly concentric isobars with the highest pressure in the middle.

iv. A trough of Low pressure – is shown by the isobars extending outwards from a depression in the form of a V. – (i.e. is known as V shaped).

V. Ridge or wedge of High Pressure is shown by a bulge in a High Pressure system, usually between two 'Lows'

Vi. A Col or Saddle – is an area of fairly normal pressure between two high and two low pressures.

Temparature – The rays of the sun pass through the air without warming it appreciably, but are absorbed by the top layer of the earth's surface which therefore does become warm.

The air in contact with the warm earth is heated. This is followed by convection in the air up to 1000 to 2000 feet so that the air in turn is warm.

A second factor is the fact that some of the long wave radiation from the warm is absorbed by the air (more is absorbed when the air is humid than when it is dry).

In both ~~factors~~ cases the earth is the direct source of heat for the air. Therefore the temparature of the

air decreases with its distance from the earth. The average rate of decrease or "Lapse Rate" is 3° Fahrenheit per 1000 ft.

Stable and Unstable Conditions.

When air rises, it expands owing to decrease in pressure. The expansion causes "adiabatic" cooling. Air above its dewpoint cools 5.4° F. for every 1000 ft. it rises. This is called "the dry adiabatic lapse rate".

If the normal lapse rate is smaller than the adiabatic lapse rate, then rising hot air soon becomes as cool as it's surroundings and then it stops rising.

These are known as "stable conditions"

If the normal lapse rate is greater than the adiabatic lapse rate, then the conditions are "unstable".

Rapid up currents of air rise to great heights accompanied often by thunderclouds.

Inversion - On a calm clear night after a hot day, the earth cools rapidly by radiation leaving the upper layers of air warmer than those in contact with the cold earth. The temperature of the air ∴ increases with height. This is called "an inversion"

An inversion provides exceptionally stable conditions. Another kind of inversion due to adiabatic heating of the air by subsidence sometimes occurs in the centre of a "high". This occurs between 4,000 & 9000 feet.

Winds.

The winds at about 2,000 feet are free of the drag of the earth's surface. These upper winds blow along the isobars in a direction given by Buys Ballot's Law which states that with the observer's back to the wind, the L.P. is on his left hand (This becomes right hand in the Southern hemisphere).

The speed of the upper wind may be fairly accurately gauged by the closeness of the isobars i.e. The pressure gradient

Hence the upper wind is sometimes called "the gradient wind". A geostrophic scale, placed over the weather map, enables the speed of the gradient wind to be read off directly.

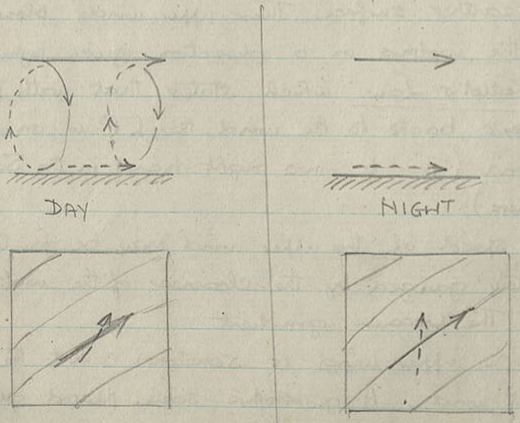
"WINDS" (Continued).

The surface wind is affected by the frictional drag of the earth's surface. This results

(a) In a decrease of speed decrease smaller over the sea)

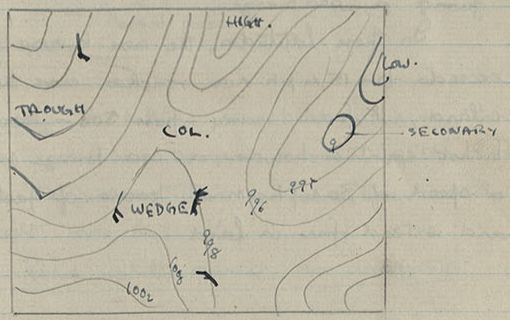
(b) An alteration in direction, the surface wind is inclined across the isobars towards the lower pressure. Thus on descending from 2,000 feet. a pilot will experience a backing and a lulling of the wind.

DIURNAL VARIATION



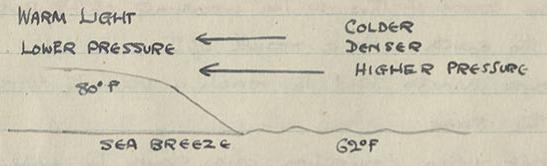
During the day mixing of the surface air with the upper air occurs due to convection currents. The prime cause of this is the warming of the surface air by the earth. As a result of this, the upper and lower winds tend to reach a velocity more nearly the same.

At night when convection dies down, the upper and surface winds ~~tend~~ return to their original velocities. Thus at night the surface wind tends to back, and lull - the upper wind to veer & freshen



LOCAL WINDS

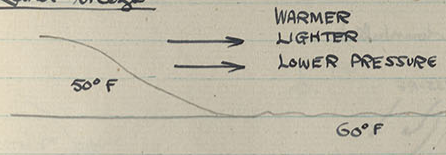
Land & sea breezes.



During the day, the land becomes warmer than the sea & the air above it becomes warmer ∴ less dense, giving a lower pressure over the land than over the sea. Thus air moves from sea to land giving a sea breeze.

In these latitudes, the sea breeze seldom exceeds 10 - 15 m.p.h. nor reaches more than 10 miles inland. It fades away from 500 - 1000 feet in height In hot countries however, a sea breeze may reach a speed of 30 m.p.h nearly 1000's of feet in height and extend far in land.

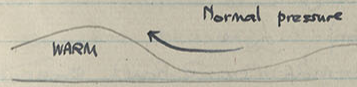
Land breeze



At night when the sea is warmer than the land, the high pressure is over the land and the land breeze flows towards the sea. This is seldom as strong as the sea breeze.

"ANABATIC" {or Uphill}

Warm, light & lower pressure



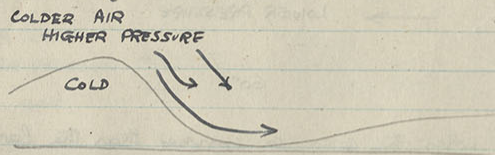
During the day the hilltops may become warmer than the valley. The air above becomes warmer, lighter and consequently the pressure there is lower than at the same height over the valley.

The air flows uphill giving an 'anabatic'

P.T.O.

'LOCAL WINDS' continued

Katabatic (or downhill)



At night, the reverse happens. The exposed hilltops become very cold. The pressure there is greater than over the valley and a downhill wind results

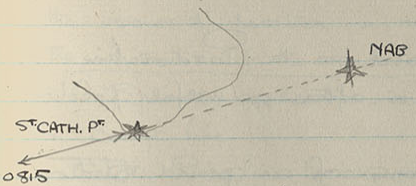
EWD

Position Line

A line drawn on map or chart somewhere along which the aircraft is known to be at the time stated against the line

To obtain i. By Transit Bearing - Two suitable land marks are seen to be in line at the same time. They are said to be "in transit". The aircraft is somewhere on a line extending through them. The statement in the log reads eg. ST CATHERINE LIGHT HOUSE Ø NAB TOWER 0815 hrs.

A Position Line — 0815 ST CATHERINE'S PT Ø NAB PT



Position line is laid down with a single arrow at either end, and this procedure is used for any position line laid down at the time of the observations

ii. With the 02 Compass

When an object is sighted with the 02 compass, the compass bearing is first obtained. Deviation obtained from Form 316A. against the magnetic course of the aircraft, is applied; then Variation for the district. This gives the true bearing by laying off its reciprocal from the land mark the position line is obtained.

Possible error 2° either way

iii. By Astro-Compass.

This is essentially a bearing plate when the true course on it is set against the lubber line, the plate indicates true directions. When, by means of a sighting device a

bearing of an object is obtained, it is a true bearing

iv. Coastline used as a Position line.

A suitable coastline is often a useful position line.

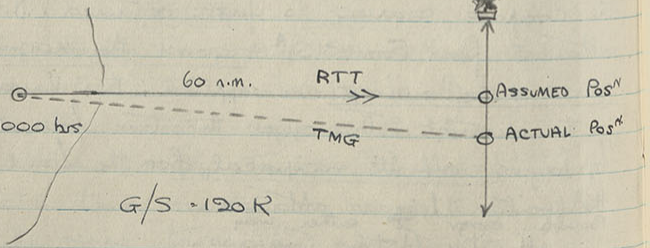
v. By loop bearing of a ground station

vi. Bearing of the aircraft's transmission by D/F (goniometric) ground station

vii. Position lines obtained from Celestial Bodies

Use of Position Lines

i. Single Position line to check g/s.

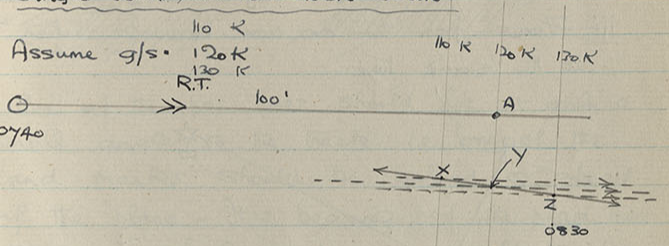


A Posn. line approx 90° to track may be used to check g/s. The error in g/s introduced by measuring the distance to the assumed position is negligible under ordinary conditions.

This is obvious from the diagram where the distance to the assumed position is nearly the same as to the distance of the unknown actual position

A Special application is commonly the use of the coast line

Single Posn. line to check Path



Y = Assumed position

X, Z } possible positions

AY = "Wander" from correct position

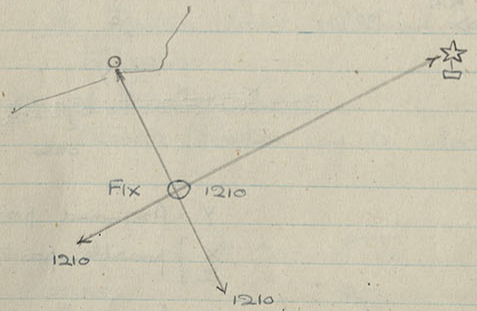
Position line usually from celestial bodies at glancing angle to the track is obtained.

Assuming g/s distance from the last fix is marked by a small line at right angles to the R.T.T. A line drawn ∥ to R.T.T.

through the intersection of the position line and the short line just drawn is taken as the corrected path.

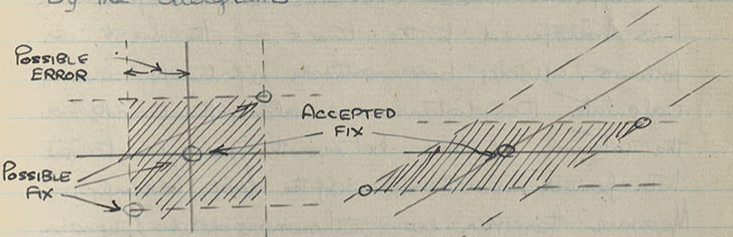
As the diagram shows error due to wrong g/s is small if the position line makes a small angle with the track.

iii. Fixes from two or more bearings taken at the same time



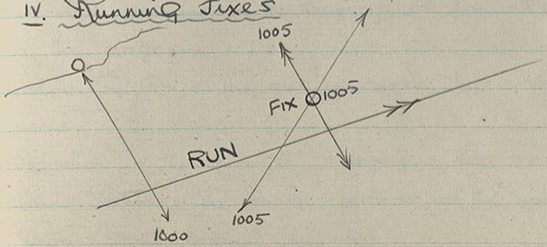
Two position lines referring to the same time fix the position of the aircraft. The fix is laid down exactly as shown in the diagram

The lines should cross at an angle as closely approaching 90° as possible in the case of a fix using two lines - anything less than 30° is of no value. The dependance of accuracy of angle of intersection is illustrated by the diagrams



One of the pos. lines should lie at only a small angle to the track i.e. one of the land marks should be behind or ahead of the plane - If its bearing of the plane then alters very slowly and as a result the fix can be timed from the other bearing without much error

iv. Running Fixes



In this case the two or more bearings are taken at different times and the earlier position lines transferred to the time of the last as follows. Using best estimate of track and g/s calculate the distance run along the track during the interval of time between the bearing to be transferred, and the time of the last bearing. Measure this run as shown and lay down a transferred position line parallel to the old one. It carries two arrows at either end and the new time against it. The fix is then obtained as shown. Unless the run is a very long one errors in track and g/s of normal magnitude size do not greatly affect the fix.

ARMAMENTS

VICKERS GAS OPERATED GUN ·303 MARK IV.

General Descript"–

Wt complete with sights & deflector 20½ lbs
. without . . 19½ lbs

Overall length with Flash Eliminator = 40"
. of Barrel = 30"

Rifling — Left hand / No. grooves ·5
Bore ·303" / Rate of fire approx 950 rounds p. min.
Capacity of Magazines = 60 & 100 rounds
Wt . 60 r. mag. when empty = 4 lbs
. . . . full = 7½ lbs
. . 100 . . empty = 5½ lbs
. . . . full = 11 lbs approx

Sights used = 50 m.p.h. relative speed sight & reflector sight
Muzzle Velocity = 2440 ft. p. sec.
Control of fire – The gun is automatic in the sense that sustained pressure on the trigger will fire all the rounds in the magazine.
Cooling System – The gun is cooled by air flow over the barrel
Operation – The gun is magazine fed & gas operated
Moving Portions – The moving portions of the gun are the piston and breech block

SEQUENCE of STRIPPING.

1. Remove magazine if fitted.
2. See the gun is unloaded.
3. Remove sights & deflector bag.
4. Press out body retaining pins and remove body extension.
5. Remove return springs and rod.
6. Pull cocking handle sharply to rear, remove piston & breech block and return cocking handle forward.
7. Remove deflector.
8. Remove gun pivot, nut & bolt and remove barrel strap.
9. Separate body from barrel group.
10. Remove gas cylinder.
11. Remove Flash Eliminator.
12. Remove gas plug.
13. Barrel.
14. Strip Breech Block and clean

TO LOAD THE GUN.

(a) Put safety catch to "safe"

(b) Pull cocking handle to rear to cock gun and return cocking handle forward.

(c) Place loaded magazine, rear catch first in position on the gun and give an upward pull to ensure security.

(d) Set the safety catch to "~~safe~~" "fire".

The gun is now ready to fire.

TO UNLOAD THE GUN.

Safety catch to 'Safe'

(a) With palm of the hand press forward the rear magazine catch lever, and with fingers of the same hand grasp the leather handle and lift the magazine rear end first from the gun

(b) If the breech block is held to the rear, press the trigger, cock and fire the gun again.

(c) If the breech block is in the forward position then to Fire cock and fire the gun.

The gun is now unloaded.

Mechanism

Release of the Sear

When the trigger is pressed the trigger rod moves forward compressing the trigger rod spring. The fork end of the trigger rod bears against the base of the sear, rotating it on its axis depressing the nose of the sear & compressing the sear spring.

Meanwhile the lugs on the trigger rod have moved forward, allowing the sear catch spring to rotate the sear catch, and the arms of the catch engage over the step of the sear, retaining the sear in a depressed position.

The piston and breech block are now forced forward by the compressed return springs

Feeding of the round from Magazine to Chamber

As the breech block moves forward, the feed piece strikes the base of the round held in the lips of the magazine: The round is forced out of the magazine and the bullet guide deflects the bullet downwards and as it enters the chamber the base of the cartridge is forced downwards on to the face of the breech block when it is engaged by the extractor.

The final forward movement of the breech block forces the bullet fully home into the chamber.

Locking of the Breech Block – When the breech block reaches the end of its forward movement, the piston continues to move forward and the lower inclined surface on the piston bears against the corresponding surface on the breech block, thus forcing the rear of the breech block upwards in front of the locking shoulder in the body. The final movement of the piston causes the horizontal flat at the rear of the piston to retain the breech block in a locked position.

Firing of the Cartridge – During the final movement of the piston, the front of the piston projection strikes the rear of the firing pin forcing the nose of the firing pin through the firing pin hole in the face of the breech block, thus striking the cap of the cartridge held in the chamber

Action of the Gases – When the cartridge is fired, the gases formed force the bullet along the barrel. and when the bullet is clear of the gas vent, a portion of the gases escape through the gas vent into the gas block & the gas plug port deflects them on to the head of the piston, forcing it to the rear and compressing the return springs.

Unlocking the Breech Block

During the initial backward movement of the piston the horizontal flat on the piston ensures that the breech block remains locked until the bullet has left the barrel. On further movement of the piston, the upper inclined surface bears against the corresponding surface inside and at the rear of the breech block, thus forcing the rear of the breech block down out of engagement with the locking shoulder in the body.

The piston now continues its backward movement carrying with it the breech block until it is arrested by the buffer in the body extension, the buffer spring absorbing the impact.

Extraction & Ejection – As the breech block moves to the rear, the extractor withdraws the empty case held in the chamber. On further backward movement, the ejector cam on the left side of the breech block strikes the tail of the ejector, rotating it on its trunnions, and forcing the nose of the ejector into the ejector slot at the front of the breech block, thus forcing the empty case off the face of the breech block through the ejector opening into the deflector bag.

Engagement of the Sear

When the trigger is released, the trigger rod spring returns the trigger and trigger rod back to their normal positions. The lugs on the trigger rod bear against the sear catch rotating it to the rear thus disengaging the arms of the catch from the step on the sear. The sear spring forces the sear upwards and the sear engages the bent of the piston as it commences its forward movement. The shock of this engagement is absorbed by the sear lever buffer spring.

◇ ◇ ◇

To load 100 round Magazine – Test for tension

(a) Release the retainer and movable lip

(b) Rotate the spacer plate until the follower is visible against the cartridge body guide

(c) Place the first cartridge (keeping the cartridge as parallel to the bottom plate as possible) in the first space, rotate the spacer plate till the next space appears, and repeat with remaining cartridge until the magazine is full

(d) Replace the movable lip (e) Place magazine on winding plate, and with winding handle assembled turn the handle to maximum (i.e approx 4½ turns)

and replace the retainer.

To Unload 100 round Magazine

(a) Place magazine on winding plate

(b) With the winding handle assembled release the retainer and ease all spring tension

(c) Remove magazine from winding plate, release movable lip and rotate the spacer plate, expelling all cartridges from the magazine

(d) Replace movable lip and retainer.

To load 60 round Magazine. - Test for tension

(a) Withdraw retaining pin & remove the driver

(b) Rotate the spacer plate until the follower is visible against the cartridge body guide

(c) Slide the first cartridge, case first into the lip, keeping the cartridge as parallel to the bottom plate as possible

(d) Turn the spacer plate until the next space appears and repeat with remaining cartridges as for (c) until no further rotation of the spacer plate is possible.

(e) Insert the driver and turn anti clockwise.

To engage spring anchorage - (f) Place magazine on winding plate and with winding handle turn the driver the maximum amount (i.e about 3½ turns) and insert the retaining pin

To Unload 60 round Magazine - Test for tension

(a) Place magazine on winding plate

(b) With the winding handle assembled remove the retaining pin and ease all spring tension

(c) Remove driver and spacer plate and empty magazine

(d) Reassemble magazine

◇

Points before Firing

(a) Remove all oil from gas affected parts i.e. barrel, piston head, gas block, gas cylinder and flash eliminator.

(b) Oil breech block, piston way, & trigger mechanism with suitable lubricant for temperature conditions

(c) Check gun for correct assembly

(d) Examine sights for serviceability

(e) " axis pins for looseness

(f) " split pins & ensure that they are serviceable & correctly fitted. They must protrude at least a $\frac{1}{16}$", the split ends open & bent over

(g) See that the magazines are properly loaded

◇

Gun Sights

Elementary Theory of the Ring Sight

Definitions – Muzzle Velocity is the velocity imparted to a projectile by the charge (propellant). It is usually measured in ft. per sec.

Line of Sight – is the st. line from the firers eye through the sights to the pt. aimed at.

Fixed guns – are those which are mounted rigidly on the aircraft. The gun is fixed so that it fires straight forward along the line of flight of the aircraft. In order to lay the gun it is necessary to manoeuvre the aircraft until it is flying in the direction the gunner wishes to fire

Free guns – are those which are so mounted on the aircraft that the line of fire relative to gunners aircraft may be varied at the will of the gunner.

Own Speed is the speed of the aircraft carrying the gun(s)

Target Speed – is the speed of the aircraft to be fired at

Angle of Deflection – is the angle between the line of sight and the axis of the barrel.

Deflection – is the dist. moved by the target during the time of flight of the bullet.

The point of intersection – is the place where the bullet and target meet

Trajectory – is the actual path of the bullet

Cone of fire – is that portion of space which contains the trajectories of all bullets fired

Point of Harmonisation – is that pt. at which the line of sight intersects the trajectory under certain specified conditions

NAVIGATION (CONTINUED).

Air Plot

T.A.S. 120 K.

Diagram (1)

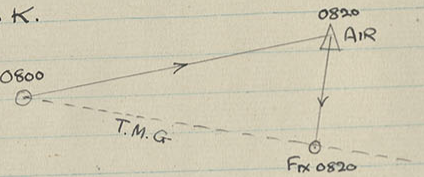


Diagram (2)

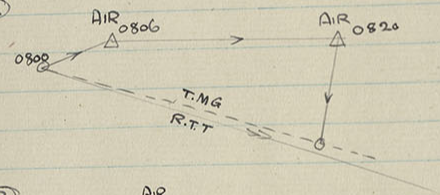
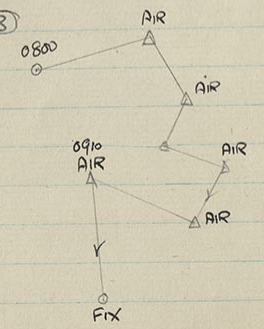


Diagram (3)



Air Plot consists of plotting on the chart a journey which the plane would have made if there had been no wind blowing i.e. using Course & Air speed in place of the actual track and ground speed. An air position, (marked * "AIR" with the correct time against it) is the point the aircraft would have reached at the time stated if no wind had been blowing.

By joining an air position to the ground position at the same time the wind effect since the beginning of the air plot can be found. This wind effect is quite independent of the Courses flown or the Speeds used, and depends only on the time concerned.

An air plot is usually begun afresh at each reliable fix to avoid accumulation of errors. It gives the mean wind velocity for the area covered and the result must therefore be used with discretion

D.R. position by AIR PLOT

Diagram ④

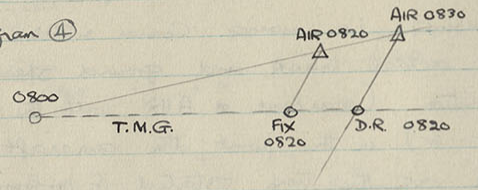
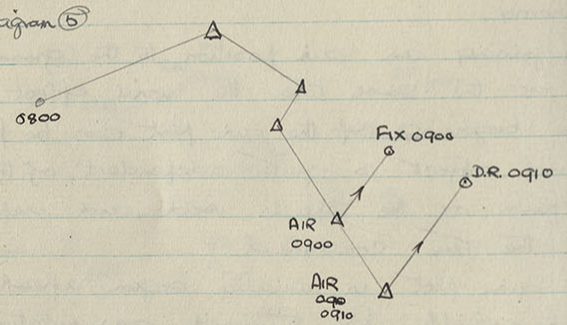


Diagram ⑤



If a navigator knows his air position and the W/V. then he always knows where he is.

Thus the general method of finding a D.R. position is to find the air position first. and then add on the wind effect for the time since the air plot began. The diagrams show how this is applied by a navigator working to alter course ten minutes after obtaining a FIX and W/V.

Alternative methods are available when a steady course has been steered from the fix

(a) The intersection of the wind effect line and T. M. G. give D.R. position without calculating the wind effect

(b) Since ground speed is often required it is often convenient merely to plot along T.M.G using ground speed

Neither of these can be used if the course has been altered.

3. - Course Wind.

(a) By Plotting. The drift on two or more courses having been measured by drift recorder or other instrument results are plotted as follows — i. Lay off courses from the centre of a compass rose so that they converge to the centre. This is conveniently done by laying them from the centre outwards across their reciprocals on the compass rose

ii. Cut these off to represent air speed to a Vector Scale. With compasses an arc radius T.A.S. described about the Compass rose as centre will cut off the air speed.

iii. From the outer ends of these lines draw in the tracks by measuring the correct drift in each case. The intersection of these tracks (a cocked hat usually with three tracks) is joined to the centre. This is the wind vector and blows from course to track. Its direction may be measured on the compass rose.

By Doulton Computer

I. Set T.A.S. II Set 1st course (True) against lubber line and draw a line to denote the track the correct no. of degrees to port or starboard of the course

iii. Repeat number ii in the other two courses. iv A fine joining the intersection of the track to the centre is the wind vector ~~Turn~~ To read the wind bring the intersection down below the centre on the course line. Wind direction is against the lubber line. Wind speed on the red vector scale

NOTE i. A good intersection demands large changes of course. ii. The pilot should be informed so that he may keep T.A.S. and course steady iii. If the courses are specially steered they are usually chosen 60° on either side of the main course for a definite time - say three minutes. In keeping the air plot the three drift wind may then be omitted The main course then plotted three minutes short

◇

Log Keeping

Purposes for which a log is kept as follows -:

i. As a means of preparing for a flight

ii. . . record . what happens during a flight This record not only includes courses, speeds & times, and fixes but also observations of the weather experienced and messages and signals sent and received.

After a flight, much may be learnt from a analysis of the plot and the log.

Amongst the rules for log keeping the following

are especially important —:

i. Official abreviations only

ii. No. alterations

iii. Place names in Capitals

iv Tracks, Courses & Bearings in three figs with (T) (M) or (C)

v. All found W/Vs on a separate line as follows —:

W/V 320/12 AIR PLOT

vi. Messages to Base at the beginning of a fresh line with a serial number i.e. underlined

M.T.B 2

vii. E.T.A's at the end of the line and underlined

i.e. E.T.A 1243 hrs

NAVIGATION LOG Form 441

Squadron Aeroplane No

Date

Captain .....

Pilot .....

Navigator .....

Route & Orders Routine patrol BASE (5130N 0120W) SP - BEACHY H^D - BASE. M.T.B's each hour & at each turning pt. To be airborn 0700 B.S.T. IAS 157 m.p.h.

Page (2) Weather forecast :—

Depression centred over N. Sea
Secondary off Isle of WIGHT
Dispersed cumulus at 2,000 ft. clearing later
ICE — 10,000 ft.
Visibility 10 – 15 miles

STAGE From :— To :—	H^T 1000	H^T 2000	H^T 10000
BASE	275/120	300/25	300/30
ST. POINT			
ST. POINT	"	"	"
BEACHY H^D.			
BEACHY H^D	"	"	"
BASE			

FROM :— TO :—	MPH TAS	Tr.	St. m. Dist.	H^T. H^T.	G.(T)	Var	G.(M)	G/S	Time	E.T.A	A.T.A
BASE	180	233°	127 m.	8000'	242	11W	253	167	46		
ST. POINT											
ST. POINT	150	079	175 m		072	11W	083	202	52		
BEACHY H^D.											
BEACHY H^D	180	302	80½		301	11W	312	187 +31 =	32		
BASE											

MEMORANDA

IAS = 157 m.p.h.
T.A.S. 180 m.p.h.

TIME (G.M.T)	R.T.T.	Dist. Run	C.(T)	C.(M)	OBSERVATION
					Watches synchronised
0755					W/T GO airborn & climbing
0800					
0808			242°	253°	BASE S/C ST. PT. L^TH. H^T. 8000ft. vis. 10 mls
					TAS 180 : CAS = 158 IAS : 157 Temp. 40°
					G/S : 166 Dist. : 12½ Time 46 E.T.A. 0854
0810					M.T.B. 1.
0812					Drift 10° P C.S.B.S.
0820					D.R. MW ML 0303 (lettered co-ordinate)
0825					D.R. 023° PORTLAND L^TH. 30½ st.m
0836					Crossed coast D.R. 0241 N 50 41½ N (lat + long)
					Dist. run 7¼ mls G/S 158 E.T.A. 0843
0838					Drift 10° P C.S.B.S
					Visibility improving - 20 miles. Cloud dispersing
0849		Fix.			BERRY H^D L^TH. ~ TMG. 237° G/S
					W/V 296/23 Air plot
					A/C S^T.P. steering by Sight
0856			074°		S^T.P. S/C BEACHY H^D
0940					M.T.B. 2
					Ordered to search for rubber dinghy
					reported at 296 Capd. 22 n.m.

Signed

TIME	OBSERVATION
0911	a/c
0921	D.R. position s/c for dinghy
	Le Havre l^t. bears

R.A.F
LAW

Air Force Act became law in 1917 – provided for formation of the R.A.F and is durable for one year only.

Objects of R.A.F Law

1. To provide for maintenance of discipline among troops for which purpose, acts and omissions, which in civil life are mere breaches of contract e.g. Desertion or Disobedience to orders must, if committed by airmen even in time of peace, be made punishable offences, whilst in war every act or omission which impairs a man's fighting efficiency must be dealt with severely.

2. To provide for administrative matters such as Terms of service enlistment discharge and billeting

Privileges

1. An airman's service equipment, cannot be touched for outside debts up to £30. An airman cannot be placed under stoppages for private debts.

Privileges continued

Officers & airmen when on duty are exempt from paying tolls.

Rates on property must still be paid on active service.

All Officers & men over 21 are entitled to be placed on the list of absent voters i.e. Record vote by post or proxy.

Correct title of the R.A.F is —:

"The Imperial Air forces of the Crown" — consist of Commissioned & enlisted personnel who have undertaken service.

Branches

R.A.F reserve — comprises of reserve of Air force Officers

R.A.F.V.R. — Wartime Air force

A.A.F — Auxiliary " "

Special Reserve — men in technical branches with special qualifications

Crown

Sec. of State for Air (He is President of the Air Council) | Chief of Air Staff

The Air Council —:

Comprises of:

i Permanent Under Sec. of State for Air (A Civil Servant)

ii Parliamentary Under Secs of State for Air

iii Air member for personnel

iv " " " supply & organisation

v " " " training

Commands

Eight in number — Home

1. Fighter 2. Bomber 3. Coastal 4. Balloon
5. Flying Training 6. Technical Training 7. Maintenance
8. Army Co-operation

Abroad

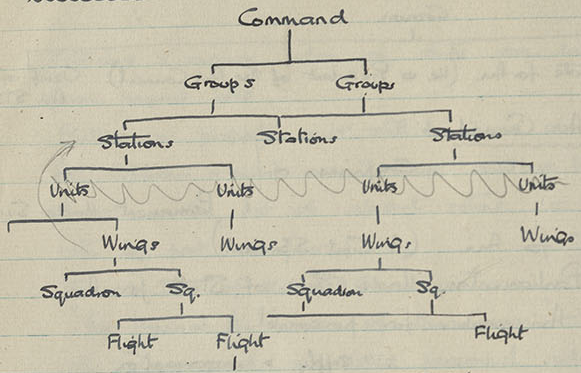
R.A.F Middle East includes units in Egypt, Sudan Transjordan & Palestine.

R.A.F — Mediterranean — H.Q. Malta — includes all units co-operating with R.N. in Mediterranean.

British forces in Iraq

R.A.F — India, Aden, Far East — H.Q. Singapore

Commands at Home



50 Men approx per Flight.

Commanding Officer has 4 Officers to assist him they are —: (a) Senior Administrative Officer

(b) Assistant - C.O.'s personal assistant in control of Orderly room & deals with correspondence & issues D.R.O.'s. S.P. Accounts Martial.

(c) Accounting Officer

(d) Equipment Officer

A Flying Wing is divided into Squadrons
In Fighter Stations 4 sets of 3 machines
" Bomber Stations 3 " 5 machines

Senior N.C.O. is the Flt. Sergeant who is responsible for discipline.

A Warrant Officer holds a warrant from the King but not a Commission & is therefore not saluted.

The three lowest ranks in the R.A.F

Sergeant

Corporal

{ L.A.C. / A.C.1 / A.C.2 } - Aircraftmen.

Discipline - i. Acquaintance with Regulations

ii D.R.O.'s (Daily Routine Orders)

iii. Station Standing Orders

iv. Air Ministry Orders

(a) Standing Orders

(b) Temporary Orders & Notices

K.R.'s / Paragraph 1070 - Acquaintanceship with K.R.'s and ale standing regulations from Air Council etc & as far as possible in force these regulations "Officers must also conform to established customs and practices of the service.

ii. All airmen must acquaint themselves with K.R.'s A.C.I. local instructions on Stations etc.

iii. Such orders and detail of duties are posted up in barracks.

IGNORANCE IS NO EXCUSE.

Paragraph 1072 – i. Officers & airmen must not disclose any information re-official matters to anyone outside the service & must take great care to prevent this happening

ii. Officers & airmen are forbidden to communicate any information which might directly or indirectly help the enemy except (a) when authorised to do so or (b) when it is his duty to the state to do so.

iii. Forbidden to publish in any form or communicate to the press, any service information, or his own personal views on any subject without authority.

He is held responsible for all statements to relatives or friends which may subsequently be published in the press – Must not discuss in public anything re orders, regulations or instructions (Except Air Vice Marshall Unemployed)

iv. Any information of professional or technical type acquired by the officer or airman during his service is the property of the Air Council.

v. Officers or airmen (except Air Marshals unemployed) may not write any book or any service matters without special authority. This also applies to broadcasts and lectures.

How permission is obtained – The matter to be published should be in proof form in duplicate and is submitted to Air Ministry through the usual channels – C.O. to Wing to Group etc. / at least 14 days before approval is required – Proof must be accompanied by C.O. stating that he has no objection to application being made.

The Air Ministry, if they approve, keep one copy, and return the other. After that, no alterations may be made without further permission, except those of slight Editorial nature.

When the published article appears, no mention must be made of the fact that sanction has been given.

Paragraph 1073 All information to the press originates from Air Ministry, except in Overseas Commands

Non Technical & Non Official information may be made to the press by anyone. If such information is objectionable or reflects discredit on the service then the C.O. must take disciplinary action against the person giving it.

Para. 1078. An officer of any rank will adopt towards his subordinates such methods of command & treatment as will not only ensure for authority, but also for the feelings of self respect, respect and personal honour which are essential to efficiency. He does not reprove W.O's or N.Cos in public

Para 1077 - An officer is responsible always for maintenance of good order and discipline. He must give the utmost support to his C.O., & it is his duty to notice, repress and instantly report any negligence, or impropriety of conduct on the part of any airman on or off duty.

Para. 1070 - Provisional K.R.R.S.

All officers must learn & enforce as far as possible A.F. Acts, K.R's & A.C.I & see other instructions issued from time to time & conform to traditions & customs of the service.

Every airman is responsible for acquainting himself with K.R's, A.C.I's station orders etc. All such orders to be posted in barracks.

Para 1073. - All information re. service matters to released by the Air Ministry, except abroad where various commands give it. (see previous)

Para. 1093. Smoking forbidden

Para. 1094 - Forbids gambling in barracks

Para. 1095 - Forbids alcohol in barracks.

Para. 1096 - An officer on full pay or an airman is forbidden (without special Air Ministry) sanction) to act as Director to any Private Co. or to assist it in any way. Forbidden to act as agent for, or accept any paid post of any sort with a firm.

He is forbidden to engage in trade himself, or to except any continuous civil employment for profit.

He may accept casual employment, provided that (i) he does not replace anyone on strike

(ii) he does not accept less than is usual as a wage for that work.

Para 1102 Concealment of Venereal Disease.

It is a crime to conceal the fact that you have V.D. Punishable under Sec. 11 of the A.F.A.

Para 1103 - Witnesses in Private Law Suits.

Applications for R.A.F personnel to give evidence in private law suits are reported at once to the Air Ministry if the matters connected with service duty(ies) are involved, so that they may consider the matter as to whether they shall claim privilege or not, on (for instance) grounds of secrecy.

Expert Witness - No member of the R.A.F. may appear as expert witness, except in exceptional circumstances i.e. matters in which

he has become expert in the Service. Requests that he should appear, should be declined and if requests are pressed reported to the Air Ministry

Para. 1138. —:

The Powers of a C.O. - Every charge against an airman must be investigated by the C.O. within 48 hrs. The airman is charged, i.e. He is paraded before the C.O, the charge read & witnesses brought against him. He may Cross-question the witnesses, on oath if he wishes The C.O has 4 alternatives re. the case

i. It may be dismissed

ii. Dispose of it summarily

iii. He may refer the matter to the proper R.A.F. authority for advice.

iv. Adjourn the case and have the evidence taken down in writing.

N° ii may be dealt with under Sec. 40-44 Air Force Act consisting of a list of sundry offences with their punishments.

Sentence of Detention - up to & including 7 days are awarded in hours - After that in days

Under (ii) Summary Punishment

1. Detention up to 28 days Para 1138 K.R.

The O.C. cannot give more than the above when dealing with a first offence absence without leave of no more than 7 days he cannot give more than 168 hrs. detention.

If the C.O. is of the rank of Flt. Lieut. or below, again he cannot give detention of more than 168 hrs. except in cases of absence without leave of more than 7 days. when he can award detention equal to the no. of days absent up to 28 days.

A man is reckoned to have deserted if absent for more than 21 days.

ii Fines for drunkeness - not exceeding two pounds

iii. Deductions from pay

iv. On active service, field punishment up to 28 days

v. " " forfeiture of pay up to 28 days

In all the above cases, the accused has the right to a court martial, & must be given the choice, otherwise the punishment is null & void

Minor Punishments - In the following cases there is no choice of a court-martial, except in the case of an automatic deduction of pay.

(i) Up to 14 days C.C. for A/C's or apprentices
(ii) For apprentices - extra duties up to 14 days.
(iii) A/C's only - extra guards or pickets, not exceeding three in number and must be for offences connected with guards or pickets
(iv) N.C.O's only - Reprimand or severe reprimand
(v) N.C.O's, A/C's & apprentices - admonition

The Powers of an O.C. detachment

(i) If he is of rank of, or above Squadron Leader, he has the full powers of a C.O.
(ii) If he is of, or below the rank of Flight Lieut. there are certain restrictions
(a) He can only give detention up to 168 hrs.

Powers of a Subordinate Commander.

The C.O. is authorised to give discretionary powers to sub commanders, to dispose of offences which he himself would dispose of.
Subordinate Commanders have powers of minor punishment

Squadron Leader or above

(i) 14 days C.C. etc. as in Minor Punishments as in para 1138

Flt. Lieut or below

(i) N.C.O. below rank of Sergeant, reprimand or admonition
(ii) A/C's (a) 7 days C.C
(b) Extra guard or pickets not exceeding 3 days.
(iii) Apprentices (a) 7 days CC.
(b) Extra duties up to 7 days
(c) Admonition

He must be allowed free communication with his witnesses or friends, or legal officer or adviser, & must be given a copy of the charge in order to prepare his defence

The above relates to the rights of a man awaiting court martial.
An officer, must if possible be tried by his equals.
In no case may a Flt. Lieut or below, sit on a court martial trying Squadron Leaders or upwards

Section 4 to 44 Air Force Act.

Sec. 4.

Crimes punishable by Death - connected with treachery & assisting the enemy "holding correspondence with or aiding the enemy, supplying arms to the enemy or treacherously showing the white flag harbouring or protecting an enemy, not as prisoner of war, or voluntarily serving the enemy having been made prisoner, or treacherously aids or causes damage to R.A.F aircraft (Baling out unnecessarily)

Crimes not punishable by death - Sec. 5th

I. To taken prisoner from want of due precaution or disobedience of orders, or wilful neglect of duty, or having been taken prisoner, fails to rejoin the service when given the chance to escape

II Without due authority holds correspondence with, or sends a flag of truce to the enemy

III Spreading reports calculated to create unnecessary alarm or despondency

IV. Negligently causes or aids the destruction of R.A.F aircraft.

V. Misbehaves, or induces others to show cowardice in front of the enemy

(Penal Servitude as the penalty for the above)

Sec. 6

Crimes which are punishable more severely on active service than at other times.

I. Striking a sentry } If on active service
II Sleeping on guard } penal servitude
In peace time { A/c's imprisonment Officers - Cashiered

Sec. 7. Punishable by death

I. Mutiny - Causing or conspiring to cause mutiny or sedition

II Endeavouring to seduce anyone from H.M. allegiance.

III Failing to attempt to prevent mutiny if engaged in one

IV Failing to inform the C.O. of any intended mutiny

Sec. 8. I Striking or threatening a superior officer while both officer & man are on duty

II. If he strikes or threatens, or uses insubordinate language to a superior officer not in the

execution of his duty.
Punishable by Penal Servitude (in wartime)
A/C.s imprisoned - officers cashiered (in peacetime)

Sec. 9. i. Disobedience of orders by wilful defiance of authority to a superior officers instructions.

ii. Disobedience Not necessarily wilful defiance
Punishment - A/C.s imprisoned / Officers cashiered (in peacetime)
Penal Servitude (in wartime)

Sec. 10 - i. Insubordination - Being mixed in a scrap Failing to obey the orders of any officer superior or otherwise & strikes said officer when told to stop

ii. Strikes anyone civil or otherwise if in the custody of said person.

iii. Resists an escort who is in charge of that person.

iv Being an airman breaks out of barracks camp or quarters
Punishment - Officers cashiered
A/C.s imprisoned

Disobedience

Sec. 11
i. Failing to obey, local or standing orders
Punishment - Officers cashiered Airman imprisoned

Sec. 12. Desertion i Desertion - Deserts the service or attempts to desert, or persuaded others similarly
Punishment: (a) Penal Servitude in wartime
(b) Imprisonment Penal Servitude in wartime

Sec. 13 - i Attempting to re-enlist in the Air Force or any other service, without having first obtained a discharge.
Punishment. Imprisonment (ii) Penal Servitude

Sec 14 See Desertion

Sec 15 - Absence without leave
i. Absence
ii. Failing to appear at a selected rendezvous, parade post etc or being out of bounds
Punishment - Officers desertion - cashiered
Airman imprisoned

Sec. 16 - Scandalous conduct of an officer
i Behave in a manner unbecoming to an officer & a gentlemen
Punishment - CASHIERED

Sec. 17 - Fraud or embezzlement by a person in charge of property

Penal Servitude.

Sec. 18 - Disgraceful Conduct

i. Malingering, feigning or producing disease or infirmity

ii. Wilfully maiming or injuring himself or any other person thus rendering that person unfit for service

iii Misconduct or wilfully disobeys (whether in hospital or not) thus rendering oneself open to further disease or infirmary

iv Stealing embezzling or receiving stolen property of a comrade, or public property of any sort

v. Any offence of a fraudulent nature, or any other misconduct or misbehaviour

Imprisonment

Sec. 19 Drunkeness - on or off duty

Airman - imprisonment - Officer cashiered

Sec. 20 - PERMITTING PERSONS IN CUSTODY TO ESCAPE i. Guard Commander

ii Any person who allows anyone whom he is supposed to guard, to escape

If done wilfully - Penal Servitude

Negligently - Imprisonment

Sec. 21 Unlawful arrest or Keeping in Custody

Illegally - Officers cashiered

Airmen imprisoned

SEC 22 - Escaping from prison or attempting to

Officers cashiered / Airmen imprisoned

Sec. 23 - Corrupt dealings re-supplies

Imprisonment

Sec 24 - Deficiencies & Damage to Equipment

i. Pawning, selling or stealing equipment, arms clothing etc.

ii. Loses by neglect any of the above equipment

iii. Pawns or sells any decoration granted to you.

iv. Wilfully injures any service property

v. Illtreats any animal in the service

Imprisonment

Sec. 25 - Falsifying Official Documents

i. Making false or fraudulent statements, or omitting anything with intent to defraud.

ii. Alters, steals or suppresses or damages

Sec 28 (continued)

any document with intent to injure any person

iii. Making false declarations

Imprisonment

Sec. 26 Signing in Blank – i.e. signing any document which is blank

Officers cashiered / A.C.s imprisoned

Sec 27. Making false accusation

i Accuses a person falsely ii Complaining about a person falsely thus affecting that person's character. iii Suppresses facts

Imprisonment

Sec. 28. Court Martial Offences

i. Failing to appear as witness at a court martial when ordered to.

ii Refusing to take the oath, or make a solemn declaration when required to.

iii. Failing to produced any document required.

iv. Refusing to answer any question legally put to him, unless the question incriminates him

v. Contempt of court by using insubordinate language or interrupting the proceedings.

Officer cashiered / Airmen imprisoned.

Sec. 29 - False Evidence – Imprisonment

Sec. 30 – Billeting Offences

i Illtreating the owner, or making disturbances

ii Officer who refuses to inspect billets when genuine complaints are made.

iii Wilfully demanding billets when they are not required

iv. Taking money in order to prevent billets being used.

Officers cashiered / Airmen imprisoned.

Sec 31 - Unlawfully demands of or takes over any vehicle or aircraft

Officers cashiered / A.C.s imprisoned

Sec 32 – Re-enlisting having already been discharged with disgrace & failing to declare the facts – Imprisonment.

Sec. 33 – Wilfully giving false answers to an attestation paper on enlistment. – Imprisonment.

Sec 34 (i) Any person concerned with a man's enlistment, when knowing that the man's enlisting fraudulently. (ii) Offends against any enlistment order.

Imprisonment

Sec 35 – Traiterous words – Officers cashiered
Airmen imprisoned

Sec. 36 - Disclosing information re forces or movement of same - Officers Cashiered / Airmen imprisoned

Sec. 37. Striking or ill-treating an a/c. or receiving his pay (not handing it over)
Applies to Officers & N.C.O.s only
Officer - cashiered / N.C.O.s prison.

Sec 38. Duelling or Promoting same, or attempting suicide. Officer cashiered. A/C prison.

Sec. 39. Refusal to hand over to civil authorities any officer or man guilty of civil offence
Officers cashiered - A/C. Prison.

Sec 39A - Damaging wilfully, or by neglect, or loses or steals any aircraft, or part of same, or being interned negligently or otherwise, thus losing the aircraft - Penal Servitude.

Sec. 40 - Any act conduct, or neglect or disorder to the prejudice of good order & R.A.F discipline
Officers cashiered / Airmen imprisoned.

Sec. 41 - Treason. Murder. Manslaughter etc. - the right so reserved to deal with the above by Court martial.
Manslaughter - P.S. Others - Death.

Sec. 41A. Although under R.A.F act., civil court may deal with above if possible

Sec. 42 - Redress of Wrongs.
If an officer thinks that his C.O. has wronged him, & does not receive redress to which he feels entitled, he may complain to the air council to obtain justice. The air council must examine the complaint, & if required must make a report to the Secretary of State & to the King if the officer demands it.

Sec 43 - Redress of Wrongs. (continued)
If an airman wronged by any officer other than his Flight Lieut he will complain to his Flt. Lieut, & if wronged by him, complains to the C.O. who must fully investigate the matter and make full redress.

Sec. 44 - A list of punishments for all crimes committed under previous sections.
(i) Death, Penal Servitude, (Not less than 3 years) prison with or without hard labour up to 2 years.
Cashiering, dismissal, Severe reprimand, Stoppages of pay, detention up to 2 yrs, discharged with ignominy = cashiering, reduction to ranks i.e. (N.C.O.s) or reduction to lower grade

of seniority, reprimand or severe reprimand (N.C.O.'s) & for airmen - forfeitures, fines & stoppages.

Evidence

i. Direct Evidence. ii. Indirect evidence iii. Non-admissable evidence.

To prove - The court must only prove the charge against the prisoner for one crime, unless for instance a man on charge for murder, may be found guilty of manslaughter. You cannot at the same time prove him guilty of burglary. It is necessary to prove known facts

By which proof is given - A man is regarded as innocent until proved guilty.

Prosecution must prove to court's satisfaction that the man's guilt - not his innocence by the defendant

Alibi's must be proved.

Admissable Evidence - Only revelant facts

Hearsay is not admissable, Opinions are not evidence unless it is EXPERT'S EVIDENCE or opinion

Confessions unless voluntarily made are not admissable.

The wife of a prisoner may only give evidence for her husband, unless the latter authorises her not to.

Knowledge of Witnesses - Witnesses are not bound to answer indiscriminating questions against himself or his wife

Method of Giving Verbal Evidence - Witness must not be asked leading questions.

Court of Enquiry - an assembly of officers & W.O.'s may be convened by Air Council, or by O.C. of any unit. Object is to collect evidence & report on any matter refered to them. Their only duty is to collect facts, & to produce them in a concise form. An opinion must be given if the court is ordered to give one, but as a general rule, none is given. If in evidence, any person's character or conduct is questioned, that person must be allowed to be present. Evidence is not usually on oath, unless the convening authority demands it. It is only required in -:

(i) Cases of illegal absence & (ii) Returned prisoners

Recorded in narrative form in 1st Person. all evidence as above & signed. Proceedings must be recorded

in the handwriting of a member of the court. All typed copies must be signed by the President & members

◇

Messing.

1. Every station has a messing committee which meets every week, attended by representatives from all branches of the station. The Office: i/c is President
2. At meetings, complaints are expressed, suggestions for improvements made, & the diet sheet for the "week after next" decided upon.
2. In each flight is one man who is member of airman's messing committee for the squadron

Source of Food

i. R.A.S.C. – rations i.e. bare necessities i.e. meat, bread, tea, sugar, salt.

Allowance per man per day :–

Meat 10 ozs / Bread 12 ozs / Tea 3/8 ozs / Sugar 2½ Salt ¼ ozs.

Bread may be alternated by flour

ii. The remainder of food required, is issued from N.A.A.F.I, issued in kind as follows per man – Cheese 2ozs / Golden Syrup or Jam 1½ Margarine 1½ozs / Bacon 12ozs per week.

Drawings, not always made, are supplemented by "cash equivalent allowance" (C.E.A) with which to buy elsewhere

iii. Commuted Ration Allowance – A cash allowance with which to buy odd items of food.

Every month a letter is sent to every station by Air Ministry, showing cash value of goods issued by R.A.S.C. & N.A.A.F.I. The value is also given of Supper Element since supper is not included in daily menu, officially

Example

Rations	7.22d	per man per day
C.E.A.	4.09	" " "
C.R.A.	3.36	" " "
Supper Element	2.83	
	17.50d = 1/5½	

All R.A.F cooks are fully trained at Halton School of Cookery. The Orderly Officer for the day should inspect kitchens each day & visit dining hall for any complaints"

Swill & bones are sold to local farmers or pig owners. Proceeds are paid into "Bi-Products Fund" which is used for increasing messing allowance from time to time etc.

-

Purchases made from N.A.A.F.I., from C.R.A. & on all purchases made over N.A.A.F.I. counters, a rebate is made by N.A.A.F.I. of 6% per month to service Institute, or P.S.I.

N.A.A.F.I or Service Institute.

Came into being last century, when licensed pedlars were allowed to trade on stations

In 1860 - regimental canteens were started

1894 - Canteen & Mess Co-op. Soc. not under War Office control but controlled

1914 - A board of control was set up to directly supervise canteens

1917 - Army Canteen Committee } thus
1918 - Navy " "

founded ~~N.A.A.F.I.~~ N.A.C.B (Navy & Army Canteen Board)

The Air Force joined next & in

1921 - N.A.A.F.I was started. It is an Incorporated Company, & is supposed not to run for profit. Although not a Government dept. it is under Government control and is run on behalf of the Forces.

12 Members, 4 from each service control its policy.

Management is composed of 6 person (3 civilians & 3 Officers {1 from each service})

Purposes of N.A.A.F.I.

i. To supply messing other than supplied from R.A.S.C.

ii. To provide a club for the forces

iii To ~~provide a club~~ pay a rebate of 6% on purchases over refreshment counter & from C.R.A.

iv To supply ordinary necessities - soap, polish etc

Annual "Profit" is used for paying additional rebate or applied for personal comfort of personnel as Air Council decides

Persons excluded from using N.A.A.F.I. i A defaulter except as authorised by the C.O. ii Airmen sick or on light duties unless C.O.'s permission is given iii. Airman may entertain friends in N.A.A.F.I

{K.R.s omitted}

Para 1078. – Relations of Officers and Men

Officers of any rank will adopt towards their subordinates such methods of command & treatment as will not only ensure respect for authority but also foster the feeling of self respect and personal honour which is essential to efficiency. An officer will not reprove a W.O. or N.C.O. in public, unless absolutely necessary.

Para 1088 – Criticism of Superiors. An officer will refrain from making remarks or criticising the conduct or orders of Superiors which may tend to bring the Superior into contempt. He should not say or do anything which is seen or heard by or reported, to those under him which may discourage them or make them dissatisfied with the Service or employment.

Para 1085 – An Officer is forbidden to communicate with the Air Ministry with regard to posting or personal matters

Para 1089 – Bankruptcy – If an officer is seriously financially embarrassed, or bankrupt, he must notify the facts to the C.O. who will report it

to the Air Ministry. It will then be decided there whether he should retain his commission or not.

———— ◇ ————

NAVIGATION [continued]

YEA

	From :- STAGE To :-	Ht. 3000 ft.	From:- STAGE To :-	Ht. 3000 ft.
FLAMBORO	YEA rad. / WALNEY L^T		YEA / FLAM	090/20 K
FLAMBORO	WALNEY L^T / WALNEY L^T / WALNEY L^T / YEA.		FLAM L^T / L^T WALNEY / WALNEY / YEA	095/25K / 100/22K / 090/20K

From :- To :-	Alt K. TAS	Tr.	Dist.	Ht.	G.(T)	Var.	G.(M)	G/S	Time	ETA	ATA.
YEA	130	75°	58 n.m.	3000	077	11 W.	088°	110	32 min.	1032.	
FLAM.											
FLAM.	130	317°	65	3000	324	12 W	336°	147	26½		
Pos. X W of L^T											
L^T.	130	231	81	3000	224	12 W	236°	144	34		
WAL.											
WAL. YEA.	130	102	55	3000	100	12 W	112°	110	30		

IAS : 120 K. CAS : 129.5 TAS : 130 approx.

TIME	R.T.T.	Dist.	G.(T)	G.(M)	OBSERVATION
0956					Airborne - watches Synchronized
0958					W/T Go
1000hrs	75°	58 n.m.	077	088	YEADON S/C FLAMBOROUGH. TAS 130K. IAS 120K. H^t 3000 ft. E.T.A 1032
10.03					Drft 10° P
10.12					Crossing R. Tees in Posn. 53 59½ N 0109 W W/V 103/37 AIR PLOT
10.17	082	28 n.m.			Posn. 54 03½ N. 0051 W A/C for FLAMBOROUGH E.T.A.. 1034.
10.33	317 324	65	324	336	FLAMB' S/C posn. X

TIME	R.T.T.	Dist	G.(T)	G.(M)	OBSERVATION
10.34					M.T.B (1)
10.35			324		Drft 7° P
10.37			024		A/c Drift 11° P
10.39			264		A/c Drift 1° S.
10.41			324		A/c W/V 090/25 5 drift.
1101					Crossed coast A/c visually 'X' for posn.
1103					Posn. X S/C Walney E.T.A. 1134
1104			224	236	M.T.B (2)
1106					Drft 10° S.
1115					Crossed R. Tees YEA rad bears 300° loop 164 (T) W/V 095/32 AIR PLOT Posn 54 39½ 0220½ W a/c WALNEY E.T.A. 1137
1120					
1137					WALNEY S/C YEADON E.T.A. 1204
1138					M.T.B (3)
1204					YEADON

TIME	R.T.T.	Dist. (Statute miles)	G.(T)	G.(M)	OBSERVATION
0700					Airborne - watches Synchronized
0702					W/T Go
0705	085	220	93	102	LINCOLN S/C TER
					H^t 5000' TAS 150 m.p.h. CAS 131 m.p.h E.T.A. 0822
0718					Crossed coast. OUTER DOWSING bear 048°(T) W/V 230/20 AIR PLOT

TIME	R.T.T.	Dist. ~~Dev.~~	Co(T)	Co(M)	OBSERVATION
					Posn. CROMER KNOLL A/c for TER ✱
0732					
					E.T.A. 0824
0800					M.T.B (1)
0823	195				TER + s/c for SCH
0828	195		259	267	A/c Drift 7½° S.
0830			139	147	A/c Drift 12° P.
0832			199	207	A/c W/V [232/32] Double Drift
0900					M.T.B (2)
0912					SCHIPOL
0914					Attacked grounded aircraft
0916	274	173	265	274	SCHIPOL s/c CAMBRIDGE E.T.A. 1042
0921			330		A/c to avoid E/A.
0923			290		A/c to seek cloud cover
0926			270		A/c
1000					M.T.B (3)
1000					Fix at ORF +
					W/V [ ]
1005					D.R.
					A/c for CAMBRIDGE

You are the navigator of an aircraft stationed at BASE 53°13' N / 02°25' W and ordered to attack pos. 52°34'N/09°56'W. Airborne 0845 hrs. s/c. 0900 hrs. at 2,000 ft. climbing to 12,000 ft. at CAS 140 K. at 400 ft. per. min. Use CAS 160K at operating ht. 12,000 ft. Mean W/V = 315°/28K.

1. How long to reach 12000 ft.
2. TAS for climb + TAS for op. ht.
3. Course (T) + (M) for climb
4. Co (T) + (M) op. ht.
5. G/S at op. ht.
6. E.T.A. target

At. 0948 hrs pin pt. Withow Hd. light.

7. What is mean W/V
8. Co. (T) + (M) allowing 5 min. for calculation
9. E.T.A. target from 0953 hrs.
10. What is lat long Fix at 1010½ hrs

At. 1003 hrs. your true bearing from ATH + is 154° – 1010½ hrs your true bearing from ATH is 191°

11. W/V experienced from W.T. Ht new Co. (T) + (M) and E.T.A.

DATA	WORKING	ANSWER.
Airborne 0845 hrs. s/c 0900 hrs at 2,000 ft. 400 f.p.m. climb to 12000 ft. G/S for climb = 138 K	CAS × $\frac{57+x}{57}$ = T.A.S. = 140 × $\frac{64}{57}$ = ~~140 ×~~ $\frac{8960}{57}$ = 157 K. ~~T.A.S. = 140 × $\frac{140 \times 69}{57}$ = 169½ = 170 K approx~~ 160 × $\frac{69}{57}$ = $\frac{11040}{57}$ = 194 approx Dist gone in 25 m on track = $\frac{25}{60}$ × 138 = $\frac{115}{2}$ = 57½ K. Time = $\frac{\text{Dist}}{\text{Speed}}$ = $\frac{220}{176}$ × 60 = 75 m.	1. 10.25 hrs. 2. TAS for climb = 157 K op. ht. = ~~170 K~~ 194 K 3. 6 = 270° (T) = 282 (M) 4. 6 = 269 (T) = 283 (M) 5. 176 K 6. E.T.A. target = 1040 hrs

DATA	WORKING	ANS
0948 hrs pin pt. Wicklow Hd.	Distr blown in 23 min on course. = $\frac{23}{60} \times \frac{194}{1}$ = 97 (30 | 2231174, 210, 131, 120) = 7¼ n.m.	Y. W/V = 321/18 K. ∴ (T): 266 (M): 281 E.T.A. 1035
	Distr. blown off track in 23 min: 6½ n.m. is 52 48 N 0805 W	Fix at 10 10½ hrs.
	. . . . . for $\frac{13 \times 60}{23}$ = $\frac{390}{23}$ = 18 K. approx	W/V: 040/15K
	Distr. gone in 5 min from Wicklow. = $\frac{1}{12} \times 194$ = 16⅙ n.m.	S. Nerco (T): 261 ∴ 276
		E.T.A = 1032.

Time

The day

The star is in transit for observer A, or any observer on the same meridian.

A celestial body is said to be "in transit", at the instant when it in the plane of the meridian through the observer

The period between two successive transits is a day

A solar day, and the lunar day differ from the sidereal day because of the motion of the earth round the sun, and of the moon round the earth.

◇

Owing to the fact that the path of the earth round the sun is not circular, a solar day is variable in length. A particular value is called apparent solar day. A watch following apparent time would have to show days of variable length.

The mean solar day is the average taken over many years - the mean sun is an imaginary

body whose successive transits with meridian 180° mark the beginning and end of a mean solar day at GREENWICH. The maximum difference between the mean and apparent solar day is 16½ minutes

Longitude and Time :- It is often convenient to measure time in terms of longitude. The sun (mean) moves through 360° in 24 hours.

24 hrs = 360°
1 hr. = 15°
4 mins = 1°
4 secs = 1'

When converting angle into hour etc, divide the degrees mins & secs in turn by 15. When converting hrs etc into an angle multiply secs mins & hrs in turn by 15.

E.G. What ch. long corresponds to a time difference of 3 hrs 10 mins 2 secs.?

2 secs. x15 = 30" = 30"
10 mins x15 = 150' ÷ 60 = 2° 30'
3 hrs x15 = 45° 45°
= 47° 30' 30'

What time difference corresponds to ch long of :-
125° 30' mins 45"

15 | 125° 30' 45" (2 hrs 5 mins 3¾ secs.
120 300 150
5 60 | 330 (5 | 2 25 | 3
300 180
30 45
4

Divide by 15

15 | 125° 30' 45" (8 hrs 22 mins 3 secs Ans.
120 300
5 15 | 330 | 22
30
30

Time Diff	Arc.
5 hrs 30 mins 0 secs	82° 30'
10 hrs 10 mins 15 secs	152° 33' 45"
5 hrs 20 mins 12 secs.	80° 3' 0"
1 hr 0 min 4 3/5 secs	15° 16' 10"
10 hrs 21 min 42 secs	155° 25' 30"
2 hrs 35 min 20 secs.	38° 50'
10 hrs 20 mins 30 secs.	155° 7' 30"

Local Mean Time (L.M.T.) is the mean time applying to a particular meridian i.e. the day for any particular meridian begins with the transit of the mean sun with its anti-meridian and would be 00 hr 00 mins 00 secs L.M.T

Greenwich Mean Time (G.M.T.) — as a standard time for many purposes the local mean time of the Greenwich meridian is accepted internationally it is called "G.M.T." and counts therefore from the transit of the mean sun of Greenwich anti-meridian 180° E. or W.

Greenwich Date (G.D.) is the date at Greenwich and is really part of G.M.T.

1 If G.M.T is 1140 hrs find L.M.T at the following places

(a) NEW YORK 74° 01' W
(b) SAN FRANCISCO 122° 25' W
(c) STAVANGER 05° 46' E
(d) PHOEBES 32° 38' E
(e) WELLINGTON (N.Z) 174° 47' E
(f) BERLIN 13° 28' E
(g) ZWOLLE 06° 07' E
(h) BOMBAY 72° 54' E
(i) LIBYA 65° 00 W
(j) BUENOS AIRES 58° 20' W
(k) CYPRUS 33° 00' E
(l) TRIPOLI 35° 45' E

(a) GMT = 1140 hrs find LMT at New York (74° 01 W)

	hrs	mins	secs
GMT	11	40	00
Diff in time	4	56	04
LMT	6	43	56

Gr. least

15) 74 01 00 | 4 hrs 56 m 4 secs
60 840 60
14 841
75
91
90
1

Find LMT at SAN FRANCISCO (122° 25' W)

	hrs	min	sec
GMT	11	40	00
Diff in time	8	09	40
	03	30	20

Gr. least ✓

15) 122 25 00 | 8 hrs 9m. 40 sec.
120 120 60
145
135
10

Find LMT at STAVANGER (05° 46' E)

	hrs	min.	sec.
GMT	11	40	00
Diff in time	00	23	04
	12	03	04

Gr. least ✓

15) 05 46. 00 | 00 hr. 23 m. 4 sec.
300 60
346
30
46
45
1

Find LMT at PHOEBES (32° 38' E)

	hrs	min	sec
GMT	11	40	00
Diff in time	02	10	32
	13	50	32

Gr. least

15) 32 38 00 | 2 hr 10 m 32.
30 120 480
158
150

Find LMT at WELLINGTON (N.Z) (174° 47' E)

15 | 174 47 00 | 11
24
15
9

If G.M.T. = 1140
Find L.M.T at BERLIN 13° 28' E, 53 min. 53 sec.
15

GM	11	40	00
Diff		53	53
	12.	33.	53

60
13
780
28
15 | 808 | 53
75
58
45
13

GMT = 11.40 hrs. find LMT at ZWOLLE (06°07'E)

15 | 06.07.00 (24 mins 28 secs
367 420
67 30
7 120

GMT 11 40 00
Diff in time : 24 28
12 04 28 hrs. ✓

find LMT at Bombay 72° 54'E 15 | 72 54 00 (4 hrs 51 36
60 720 72
774 540
TT4 45 90
24
15
9

GMT 11 40 00
Diff in time = 4 51 36 E
16 31 36 ✓

Find LMT at LIBYA (65° 00' W) 15 | 65 00 00 (4h 20 mi
5 300

GMT : 11 40 00
Diff. in time : 4 20 00
07 20 00 ✓

Find LMT at BUENOS AIRES (58° 20'W) 15 | 58 20 (3.53 20
45 780 30
13 600
75
50
45

GMT 11 40 00
Diff in time 3 53 20 W
07 46 40 ✓

Find LMT at CYPRUS 15 | 33.00.00 (2 hrs 12 min
30 180
3

GMT: 11.40.00
Diff = 2.12.00
13 52 00 ✓

Find LMT at TRIPOLI | 15) 35° 45' E (2 hrs 23 min
- 345

GMT: 11.40.00
Diff. = 2.23.00
14.03.00 ✓

If LMTs are as follows find G.M.T.

ONTARIO	22 hrs	00 min	Saturday	(85° 00'W)
SOOCHOW	04 hrs	50 min	MONDAY	(120° 44'E)
DAKAR	12 hrs	23 min	Wednesday	(17° 26'W)
TASMAN BAY	09 hrs	45 min	Friday	(173° 23'E)

[ONTARIO - 85°00'W]

If LMT is 22 hrs 00 min. find GM.T

	hrs	min	sec	
LMT	22	00	00	
Diff in time	5	40	00	Gr. least
= SUNDAY	03	40	00	

15) 85.00.00 | 5 hrs 40 min
75 600
10

If LMT at SOOCHOW (120° 44'E) is 04 hrs 50 min find GM.T.

	hrs	min	sec	
LMT :	04	50	00	
Diff in time :	8	02	44	Gr least.
SUNDAY	12	47	16	
	20			

15) 120 . 44 . 00 (8 hrs 2 min 44 sec
120 30 660
11

If LMT. at DAKAR (17°26'W) is 12 hrs. 23 min find GM.T

	hrs	min	sec	
LMT	12	23	00	
Diff in time	1	9	44	Gr. Best.
Wed.	13	32	44	

15) 17° . 26 . 00 (1 hr 9 m 44 s
15 120 660
146
138
11

If LMT. at TASMAN BAY (173° 23' E) is 09 hr. 45 ~~23~~ Min find GMT.

	hrs	min	sec	
LMT	09	45	00	
Diff in time	11	33	32	Gr. least.
			28	

15) 173 23 00 (11 hr 33 m 32
23 480 480
8 503 453
45 30
53 :
45
8

Zone Time (Z.T.).

To avoid confusion most places keep Z.T.
The world is divided into 24 zones marked by meridians 15° apart. The first zone (labelled 0) extends 7½° on either side of the prime meridian
The other zones have their central meridians placed at intervals of 15° from the prime meridian. With few exceptions the time kept by countries within each zone is the L.M.T of the central meridian of the zone. Zones are numbered 0, +1, +2 etc. (going west) & 0, −1, −2 etc. (going East)
To calculate zone number & sign:—

i Zone no. is the nearest whole no. of hrs. of the longitude converted to time

ii East longitude the sign is minus
West . . . . plus

E.G. Apply zone no & ~~time~~ sign to Z.T. to obtain G.M.T.
Find GMT if ZT is as follows:—

(a) ALEXANDRIA 29° 53' E. Tues. 0205 hrs.
(b) CHICAGO 87° 40' W. Tues 1400 hrs.
(c) BANCOCK ~~180°~~ 100° ~~00'~~ 30' E. Tues. 1823 hrs
(d) COLOGNE 06° 57' E. Tues. 0240 hrs

(a) ALEXANDRIA 15) 29 53 00 E | 1 hr. 59
15 840
14 893
75
143
135
−02 hrs.

14/6
84

ZT 0205
−02
00.05 min. G.M.T = Tues 0005 hrs.

(b) CHICAGO 15) 87. 40 00 | 5 hrs 50 min.
75 720
12 760
10
+06 hrs

ZT 1400
+6
2000 G.M.T = Tues. 2000 hrs

(c) BANCOCK 15) 100 30 00 | 6 4
90 630
1 − 07 hrs

Z.T. 1823
−7
1123 G.M.T = Tues 1123 hrs.

(d) COLOGNE 15) 06 57 00 |
Zone. 0 GMT Tues 0240 hrs

{E is −
W is +}

~~Find~~ G.M.T. 0945 hrs Find Z.T. i Hamburg 10°00 E
ii Warsaw 21°00' E, Detroit 83°03' W
Yokahama 139°36' E, Azores 27°00' W

GMT. i = ~~0945~~ 1045 ii = 10.45 iii 0345 iv = 1845
V = 0745

LMT. is given – Find Z.T.		LMT.	ZT.
1. SAN FRANCISCO	122° 25' W	12.40.30	
2. CYPRUS	33° 00' E	05.35.20	
3. DAKAR	17° 26' W	08.30.00	
4. HAMBURG	10° 00 E	20.54.20	
5. AZORES	27° 00 W.	10.15.00	
6. BERLIN	13° 25' E	17.30.30.	

1/ LMT. at SAN FRANCISCO is 12.40.30 (hrs min secs) – Zone is +8

	hrs	min	secs	
L.M.T.	12	40	30	
Diff in time	00	09	40	~~ADD~~
	12	50	10	✓
	~~12~~	~~30~~	~~50~~	

122 25
120 00
15) 02 . 25 . 00 | 0 hrs 9 min 40 sec
120 600
145
135
10

2/ L.M.T. at CYPRUS is 05.35.20 – Zone is −2

	hrs	mins	secs	
L.M.T.	05	35	20	
	00	12	00	add
	05	47	20	

33 00
30
15) 03 . 00 . 00 | 0 hr 12 mins 0 sec
180

3. Zone is +1

LMT	08 .	30 .	00.	
	00	9	44	add
	08	39	44	

4. Zone is −1

	hrs	min	sec	
LMT is	20	54	20	
	00	20	00	add
	21	14	20	

5. Zone is +2

10

17 26 00
15 00 00
15) 02 26 00 | 0 hrs 9 m 44 s.
120 ~~165~~
146 660
135
11

15 00 00
10 . 00 00
15) 05 00 00 | 0 hrs 20 mins.
300

30 − 27 = 3
15) 03 00 00 | 0 hrs 12 min
15 | 180
12

60° 00' N   45° 00' W

LMT Sunrise   0527 at 60°   0527   60°

GMT.   0800 add   3 hrs diff.

0827 hrs

54° 30' N   130° 30' E

L.M.T. Sunrise - 0534½ at 54° 30' N

0842

March 31st   20 51½

44° 49' N   75° 20' E

LMT sunrise . 0542 at

05 01½

24 40½

GMT. 40½ mins aft. midnight

0532 at 56
0534 at 54
02 +   2

ø.

08 . 42
15) 130 30 00
120 630
10

45   0542
40   0545
5   3 mi

CLOUD FORMATIONS.

NAME	DESCRIPTION	HEIGHT USUALLY FOUND
i Cirrus	Like white cobwebs	30,000 ft.
ii Cirro Stratus		
iii Cirro Cumulus	Like rippled storm ahead	20,000 ft.
iv Alto Stratus	High fibrous bluish gray	
v Alto Cumulus	Solid pattern of Cumuli	
vi Cumulo Nimbus	or Thunder head Danger within	5,000 ft.
vii Fractus		
viii Cumulus	or Wool pack or cauliflower	4,000 ft.
ix Stratus Nimbus	or Low rain head	3,000 ft.
x Stratus	Low gray overcast	1,800 ft.

HYGIENE

Personal - at home & in the tropics

Must be 100% healthy - wash as much of the body as possible especially sweat parts
Hot tub at least once per week, Hair kept short
Wash hair brushes at least once per month in warm soap water. If feet sweat wash in potassium permanganate
Blistered feet can be helped by putting powder in socks & prick blisters with a sterilised needle.

Teeth - should be cleaned at least twice per day use a tooth pick

Constipation - should be avoided by ensuring that habits are regular

Heat Stroke - results from a rise in a bodily temparature under hot atmospheric conditions
Tight or heavy clothing aggravates it. Keep fit and wear suitable clothing. Drink as much water as possible

Sun Stroke - Direct rays on back of Kneck or spine. Keep topee on till well after 5.30 pm to 6.30 pm. Sun anti-glare glasses are useful

Effect of Cold - In extremities - toes & fingers
Symptoms - dead feeling in limb affected,
A lowering of bodily temparature in cold atmospheric

conditions. Aggravated by lack of clothes, food oxygen in high altitudes & insufficient exercise Circulation not normal.

Cure for frost bite - Rub or massage.

Trench feet caused by long standing - Reddening swelling and blistering [in cold or wet] aggravated by tight clothing and boots & puttees Treat feet before going out by rubbing whale oil on them.

Air Sickness - Caused in hot bumpy weather To avoid - take a dose of something before going up. Dose of calimell and salts - 24 hrs before. (Same applies to sea sickness).

Forced Marching - If in marching order

see

RULES OF SIGNALLING.

A dah is three times the length of a dit. The space between component parts of a sign forming a letter or figure is equal in duration to one dit: that between letters or figures to one dah: and between words or groups to two dahs or six dits. Barred letters are made without a pause between them.

PROCEDURE SIGNS.

Commencing Sign	VE
Code, cypher, or long break	BT
Full stop or plain language	AAA
Short Break Sign	II
Erase Sign	Eight to ten dits
Comma	III
Ending Sign	AR

NUMERALS.

1	· — — — —	dit dah dah dah dah	(wun)
2	· · — — —	dit dit dah dah dah	(two)
3	· · · — —	dit dit dit dah dah	(three)
4	· · · · —	dit dit dit dit dah	(four)
5	· · · · ·	dit dit dit dit dit	(fife)
6	— · · · ·	dah dit dit dit dit	(six)
7	— — · · ·	dah dah dit dit dit	(seven)
8	— — — · ·	dah dah dah dit dit	(eight)
9	— — — — ·	dah dah dah dah dit	(niner)
0	— — — — —	dah dah dah dah dah	(zero)

MORSE CODE.

A (Ack)	· —	dit dah.
B (Beer)	— · · ·	dah dit dit dit.
C (Charlie)	— · — ·	dah dit dah dit.
D (Don)	— · ·	dah dit dit.
E (Edward)	·	dit.
F (Freddie)	· · — ·	dit dit dah dit.
G (George)	— — ·	dah dah dit.
H (Harry)	· · · ·	dit dit dit dit.
I (Ink)	· ·	dit dit.
J (Johnny)	· — — —	dit dah dah dah.
K (King)	— · —	dah dit dah.
L (London)	· — · ·	dit dah dit dit.
M (Monkey)	— —	dah dah.
N (Nuts)	— ·	dah dit.
O (Orange)	— — —	dah dah dah.
P (Pip)	· — — ·	dit dah dah dit.
Q (Queen)	— — · —	dah dah dit dah.
R (Robert)	· — ·	dit dah dit.
S (Sugar)	· · ·	dit dit dit.
T (Toc)	—	dah.
U (Uncle)	· · —	dit dit dah.
V (Vic)	· · · —	dit dit dit dah.
W (William)	· — —	dit dah dah.
X (X-Ray)	— · · —	dah dit dit dah.
Y (Yorker)	— · — —	dah dit dah dah.
Z (Zebra)	— — · ·	dah dah dit dit.

NOTE.—Plain language must be written and code printed. Names of persons and places should always be printed. Full use of the phonetic alphabet must be made during all lamp signalling exercises and buzzer checks.

No.59 AIR BOMBERS Course

Progressive Examination.

All questions must be attempted — Time allowed 2 hours.

1. Define and explain the meaning of Trail Angle. What settings on the C.S.B.S. make allowance for this factor.

2. What are the factors which determine the length of the height scale (for a real bomb) Which is the longer scale - one for a high or one for a low T.V. bomb and why ?

3. (a) Tabulate the patter used by both pilot and bomb aimer during a typical bombing run.
   (b) Explain breifly why it is necessary to keep "Red on Red" during a bombing run.

4. How would you test the accuracy of an isothermal computor for Ht. and A/S, in High Level Bombing.

Why is it necessary for a computer

5. Explain with a diagram, the Theory of bombing a moving target. (Note: Marks are allotted for the correct marking of all vectors.)

6. What is the object of harmonization ? How is this achieved with a V.G.O. gun fitted with an observer type reflector sight.

7. What is Bullet Trail. When would you expect your allowance for bullet trail to be (a) maximum (b) nil.

8. Describe fully the locking and unlocking of the breech block in the V.G.O. gun.

August 3rd 1942. — 31 B & G S. PICTON.

FINAL NAVIGATION EXAMINATION.

No. 33 AIR NAVIGATION SCHOOL.

NO. 59 COURSE (AIR BOMBERS).

TOTAL MARKS.- 50 — TIME ALLOWED. - 2 HOURS.

MARKS.

10 **Question 1.** Explain the construction of a fixed square search. When is it used?

10 **Question 2.** Tabulate ten properties of target maps.

5 **Question 3.** Define:-
(1) Period of a light.
(2) Alt.
(3) Gp. Fl.
(4) Gp. Occ.
(5) (U)

5 **Question 4.** Explain fully with examples:-
(1) Lettered co-ordinates.
(2) R.N. Method of reporting position

5 **Question 5.** The D.R. circle of Error. Explain and show how it is used.

15 **Question 6.** Answer True or False

(1) Details on small scale maps are never recorded true to size.

(2) If the compass course is 295° and the actual drift is 3° Starboard, then the T.M.G. is 298°.

(3) Occulting means that the period of darkness is greater than the period of light.

(4) For short distances, the Rhumb Line track is used because it is shorter than the Great Circle Track.

(5) Contours, when accurately drawn are called form lines.

(6) Once trail angle is set, it remains constant for all airspeeds.

(7) If actual drift corresponds to the D.R. Drift, then W/V used is correct.

(8) The distance in plan view between successive contours is called the vertical interval.

(9) To convert Great Circle bearings to Rhumb Line bearings, conversion angle must always be subtracted.

(10) Due to small errors in projection, the scale of distance on a topographical map is not constant.

(11) On the C.S.B.S. minus denotes Starboard drift and plus port drift.

(12) The only reason topographical maps are not used for plotting purposes is because they are covered with detail that makes plotting difficult.

(13) Rev = Revolving. A steady light with a regular eclipse.

(14) In finding Track & G/S winds on the C.S.B.S. care must be taken to ensure that the bearing plate is always locked.

(15) On topographical maps, the meridional graduations represent statute miles.

High Altitude Flying

Atmosphere at ground level composed { approx 20% oxygen
. 80% nitrogen

Smaller parts of argon, helium & carbon-di-oxide
Air pressure at ground level is approx 14½ lbs □"
OR the ht. of a liquid which the air can support. - Ht. of mercury air can support = 760 mm.

Laws of Partial Pressures

In a mixture of gases, the pressure exerted by any one gas is proportional to the percentage of the gas present.

152 mm. - press. of oxygen at ground level
Air Sacs - thin membrane corresponding to leaves on the tree. Press. of oxygen in air sacs at ground level = 100 m.m. of mercury.
Blood vessels divided from air sacs by two very thin walls. 96% of blood is saturated in oxygen, when pressure in sac is 100 m.m.

As you ascend, atmospheric press. decreases and when at 18,000 ft, press. = ½ atmospheric
i.e. 50 mm. mercury. - much less oxygen
i.e. 70% of blood saturated.

Body is composed of numerous cells.
Each burns i.e. Sugar & energy is produced in the form of heat muscular / chemical
Thus cells suffer from oxygen lack - first to suffer are brain cells.

At 30,000' pressure is ⅓ Atmospheric
. 42,000' . . ⅕ .
. 63,000 . . 47 mm. Mercury

At this ht. the human body would burn o Burn.

Effects of oxygen lack

1. False sense of self confidence - defective judgement - lack of accuracy. Mental process is slowed down. May become hilarious, pugnacious or morose & sleepy.

Symptoms first showx themselves at 10,000'-15,000'
Unconsciousness occurs at 26,000'. Pilot does not know when he is likely to pass out
Much the same as too much alcohol.

When you come round after oxygen lack - you feel alright. Vision is impaired especially night vision. Weakness in muscles, and cramp
It is Very important to use oxygen.

Rate of flow corresponds to the altimeter.

When additional oxygen is required, On all flights up to 10,000' you can last 1 hr. or longer additional oxygen is required
All flights at 15,000' require add. oxygen
. . . . or over ~~20~~ where rate of climb is 2,000 ft. per min or more. require oxygen from the ground.

Moving about in aircraft.

Quite a considerable amount of energy is used. Take about 10-12 deep breaths from oxygen supply. Then hold breath, take off oxygen tube at pt & plug in to new position when breathing may be resumed

Parachute Drill.

Before baling out, take about 20 deep breaths from oxygen supply — then hold breath, unplug oxygen pt. — bale out holding breath as long as possible & pull rip cord. Make sure you pull the rip cord while you are conscious

DATA	WORKING	ANSWERS

From LEICESTER to EXETER
W.V. = 280/30 m.p.h.
T.A.S. = 150 K.
Dist. = 144 n.m., G/S = 136 K

Co. (C)	Dev.	Co. (M)	Variation	True
243°	-4	239	11° W.	228

Time = Distance / Speed = 144 / 136 = 1 hr 3½ min

136) 144 (1; 136; 8 — 8/136 × 60/1 = 60/17 = 3½ min.

Dist gone in 10 mins travelling at 144 K = 1/6 × 144 = 24 K
" " " 150 K = 25 K

Time of arrival = 60 mins

Answers: Tr = 219°; Co (M) = 239°; Co (C) = 243°; Time to a/c. = 0856½ hrs; New W/V = 302/24; Pin Point LAT = 52°20' N, LONG = 02°23' W; Course remains the same; Time = 0956 hrs ✓

From EXETER a/c. SHREWSBURY

Dist. gone in 22 mins = 48 K
" " 1 " = 48/22
" " 60 " = 48/22 × 60/1 = 11) 1440

From CROYDON to OSTEND
TAS = 140 K
WV 210/34 K
Ht. 10,000'
Dist = 115 K.
Speed = 151 K.
A/C at 1900

IAS	CAS	I.E. + C.
90	86	-4
110	110	0
130	134	+4
150	156	+6

Co. (C)	Dev.	Co. (M)	Var.	True
		116	9W	107

CAS = TAS × 57 / (57 + x) = 140 × 57 / 67

140 × 57 = 980 + 7000 = 7980; 67) 7980 (119

119

110 - 0; 116 +1; 122 2; 128 3; 134 4

Time = Dist. / Speed = 115/151 × 60

151) 6900 (45; 604; 860; 755; 105

= 45¾ mins

E.T.A. =

Answers: IAS = 118°; CAS = 119°; Co. (M) = 116°; E.T.A.: 1946 hrs

(1) Give bearing & dist. of pos. 52 26 N. 02 14 W from Leicester, statute miles
Ans 254/41

(2) Pos of aircraft is 263° Cromer Knoll lightvessel 12 n. miles
Indicate pos in Lat & Long. Ans. 53° 14½' N, 01 01 E

(3) An aircraft on a track 184° T from Lowestoft finds IPSWICH bears 263° find fix in Lat & Long Ans 52 06' N 01 43 E ✓

(4) Give Lat Long of aircraft if HULL bears from it 150° T & YORK bears 240° T Ans 54° 06' N. 00 42' W ✓

(5) An air left CAMBRIDGE at 10.35 on tr 251° T
At what time was it in a position 042° Bristol 20 K
G/S 160 Kts

(6) Report Cardiff by RAF system of Lat coordinates

At 1925 crossed coast EG 60 Lt v. bears 091 (T)	Dist. gone in 25 min = $\frac{25}{60} \times 151 = \frac{755}{12}$ = $62\frac{11}{12}$ or 63 Kts $5\frac{1}{2}$ $\frac{11}{2} \times \frac{12}{5}$ $\frac{66}{5}$ = 13 $7\frac{1}{2}$ $\frac{15}{2} \times \frac{12}{5}$ = 18	Dist. run = G/S = T.M.G = 101° W.V. experienced = 189/

Care of Barrels -

1. Powder Fouling - This consists of the unburnt portions of the propellent being deposited on the interior surface of the barrel. It takes the form of a dark film, which if allowed to remain becomes hardened.

To Remove - In its early stages powder fouling may be removed by the use of flannelett, either on a cleaning rod or pull through. If neglected hardened fouling will necessitate the use of a double pull through.

2. Metallic Fouling - This is caused by deposition on the surface of the barrel of particles of cupra-nickel from the bullet envelope

To Remove - Metallic fouling should be removed by a solvent (A solution of diluted ammonia and Kings Norton nickel solvent {K.N.S.}) OR in certain circumstances by the use of the double pull through and wire gauze.

It should be noted, however, that the latter method causes wear and should be avoided if possible.

3. Chemical Corrosion - The stresses stresses set up in the bore during firing, result in stretching of the metal and the formation of numerous very small invisible cracks or cavaties. These cavaties act as a seating for chemical corrosion. The products of combustion are deposited in these cavaties and, if allowed to remain will absorb moisture and initiate the corrosive action

To remove - This is best removed by the internal application of boiling water. Care must be taken to dry the barrel thoroughly after use of water & the barrel should subsequently be cleaned daily as for powder fouling for a period of not less than 10 consecutive days or until all signs of rust have ceased to appear

1⅛ ammonia 1⅛ or mole 2 K.N.S. tablets [mix together & use for 1 barrel]

What are heatstroke & Sun Stroke

Mark XIV Altimeter

1. Base on ICAN laws - errors due difference of air temperature from the ICAN standard are usually negligible

2. The altimeter is free from LAG i.e. It may be relied upon to indicate any change in height as quickly as it is made

3. The altimeter is sufficiently sensitive to make it usable as a landing metre. The smallest sub division indicates a difference in height of 20' & fractions of this can be estimated

4. A small millibar scale visible through an opening in the face is linked to the zero setting knob in such a way that.

It shows the pressure at which the altimeter will record Zero

Thus (a) When the alt. is set to show the h^t of the aerodrome above M.S.L. then the millibar scale shows M.S.L. pressure

(b) When the altimeter is set at 0 feet on the aerodrome then it records aerodrome atmospheric pressure

(c) If the barometric pressure at an aerodrome is known & set on the altimeter, the altimeter will record 0 ft. on landing

Probable questions 1. Summarise main items of personal hygiene to be followed to promote individual health & efficiency in the service home & abroad - washing etc.

2. Having selected a site & laid out camp what everyday points must be borne in mind to preserve health of men.

Answer Water supply river marking off - wells - latrines must be filled in at the first possible moment & disinfected regularly - Strict supervision of cookh.

3. Discuss the value of oxygen as an adjunct to high flying - Lack causes change mentally etc.

4. Outline treatment to be administered in a case of profusely bleeding scalp injury.

5. Discuss the use of tobacco alcoholic stimulants by air crew personnel

6. What treatment would you apply to a patient with an obvious compound fract of the leg when no medical aid is near

7. Outline the methods necessary to safeguard river drawn water supplies when "in the field"

Mark off with flags - purest water from centre of river

8. What is a tourniquet & how is it used.

Have left a more than 20 min - Put label with time of application etc

9(a) What are Symptoms of oxygen deficiency to bodily?

Defective judgement, pugnacity

Alertness dimmed & finally unconsciousness

Psychologic changes - Like a motorist suffering from alcoholic excess. - Different people taken a different ways - Following common - Defective judgement - False self confidence - inaccuracy - irritability - pugnacity or hilarity - defective memory - irresponsibility

Later alertness dimmed, mental processes slowed down & finally unconsciousness may supervene without airman knowing

(b) What bodily conditions tend to aggravate these symptoms - (Not 100% fit over indulgence)

10 (a) What are general the principles underlying of treatment of burns & scalds.

Solution of bicarbonate in a dressing

Describe emergency treatment of severe burns when Medical aid is unlikely to arrive for some hours.

11. Place in order of purity following water source

1. Shallow wells 2 Rain water 3. Springs 4. Ponds
6. Small Streams

Assuming only have aircraft first aid outfit How would you purify doubtful water supply..

Filter in sand - put iodine in

Cookhouse cleanliness – Drain gulley cleaned every day with heavy oil + paraffin. Grease traps must be fly proof. Refuse to be burnt – Meat safes clean + nothing but food to be kept in them.

See tables are clean. – If sand is used to scour utensils, it must first be baked. Cleanliness of personnel i.e. Clothing + person.

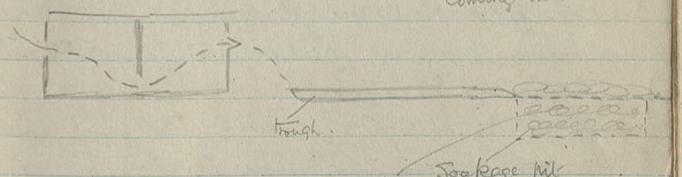
Ablution – Ablution benches. A double sided one 9' long required for every 50 men. – Gravel + duckboards either side – Water in gutter must first go through a grease trap.

Latrines – At leeward side at least 100 yards away from kitchens i. Shallow trench for temporary camp i.e. Not more than 3 days – 3' long 1' wide 2" deep in rows. Soil placed at back – 5% first hundred + 3% for every subsequent 100.

Every 24 hours turf should be replaced + freshone dug or when 6" from top.

ii. Deep trenches – for permanent camp
a Trench if very hard surface + cannot be dug – buckets used
6 to 8' deep 3' wide + 10' long
5% first hundred 3% for every subsequent
Box seats 5 holes per 10' bench.
Seats collapsible – 4 walls canvas or other + roof

A deflector under seat in front of trench to force
for disinfectant – Not soil but bleach powder 2 times a day + seats washed with Cresol. When trench 3' from top – put sacking in + fill in with soil.
Urinal at night – Put a row of buckets outside line of tents to be taken away each day.
Field Conservancy Grease traps construction
Straw – rough filter of twigs straw bracken heather or pine – a tank with holes + water will run through leaving grease behind
Cold water type – If hot water runs will suffer anon of cold – will cool off + allow fat to come to surface + it can be skimmed off 5 times cold water to 1 of hot water coming in.



Mosquitoes – breed in stagnant water – carry disease
Get rid of stagnant water round camp –
Some – spoonful of Kerozene or paraffin on top of water will form a film thus preventing wriggler i.e. young mosquito from breather

Hygiene

Camp site - selecting - as far away from any habitations or towns as possible (to avoid infection). Avoid broken & swampy ground & river banks. Have water supply handy - Sho Higher ground possible grassy & with good drainage - with gravel soil. Keep away from long grass & woods. Easy approaches & pick a site which may be a permanent one. Should be open to the wind - Sleeping quarters to front - Messing kept separate Transport to the rear. Latrine area to the leeward not too far away.

Accomodation - On active service 45 □' per man [illegible]
Bell tents - not more than 10. Note that flaps should be away from prevailing winds. - Balances should be tied up every morning. Blankets & bedding aired daily - If floorboard - to be taken up every week & ground [illegible]
No food to be taken in tents. A trench should be dug round the tent to take away rain water.

Water supply - Decant source - protected Abroad for local supply or wells to be dug.
5 gallons per day per man water.

Camp Cookhouses - Tents & corrugated iron - 1 side left open away from prevailing winds - fly proof covers & safes. Receptacles in which to put refuse - emptied every day. If poor soil for drainage - dig deep hole & put clinker & rubble.