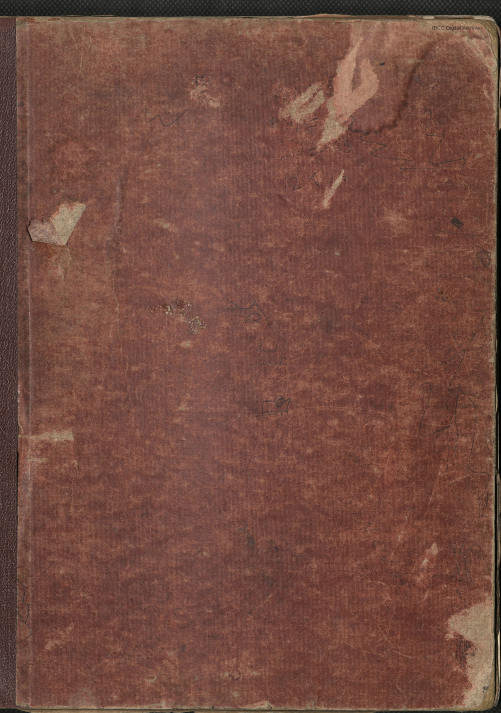




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W. BRAITHWAITE 1293577

CONTENTS - HYGIENE
LAW AND ORGANISATION

Hygiene

General

Underclothes should be changed and washed once a week. Clean sheets should be provided at least once a fortnight. Blankets should be washed once a year.

Personal

A wash must be taken at least once a day, especially under the armpits, chest and other sweaty parts of the body. One hot bath to be taken at least once a week. Hair to be cut fairly short especially in a camp. Combs and tooth to be washed once a month. Feet are to be taken of feet. Blisters prevented by powdering inside of socks with Fuller Earth or Borneo Powder. Blisters can be burst if needle is sterilized in boiling water, iodine applied prevents infection. Potassium Permanganate solution good for clearing unsightly.

Effects of Heat

Heat Stroke - Generally occurs in hot moist atmosphere. To prevent it suitable clothing must be worn, endeavor to keep fit, good food, good drinking water, and keep your bowels open.

Sun Stroke - Caused by direct rays of sun on the back of neck. To prevent keep neck covered as away from sun. Anti-glare goggles help.

Effects of Cold

Chill Bile - Loss of use in anticomforts of body, which spreads to rest of body gradually. Blisters often occur.

afterwards. Causes are temperature lowered by atmospheric
circumstances or tight clothing - loose fitting clothes best.
Wet (moist) underclothes. Lack of body movement. Not
enough oxygen (poorness lost in body). Lack of food
and drink. Poor general health. Inured by massaging
affected parts, never warm in front of fire.

3. Furred feet - Pain, swelling, and blistering
of feet. Caused by standing in cold and wet for long
periods. Epsom salt foot makes it worse. Prevented by
sawing feet and drying, then rubbing warm whale
oil until the skin is dry (dry oil is nearly as good). Dry
sinks are essential.

Air sickness

Can be avoided by clearing throat before going up.
Caused by bumping on the air, or singular movement.

In the Ward

Pace can vary from 30 to 100 per minute in R.A.F.
Marching in step is essential. A halt to be called every
hour or long marches. If marching on a curved road
file to the left be changed at regular periods. Drinking
water must be provided every 10 miles, though
indiscriminate drinking is to be discouraged. After
march the feet are to be washed and blisters
treated.

Personal Hygiene in the Countries

a. Flying Precautions - in an open machine wear flying top
and lined goggles (to be carried in closed machine).

b. All cuts and scratches to be treated with iodine
immediately as infection sets in rapidly.

(a) Tropical Diseases - causes

i. Insects - lice, sandfly, and mosquitoes

ii. Food and drink

iii. Coccidiosis getting under the skin - Jigger flea
and guinea worm.

iv. Heat strokes.

Mosquito (Malaria)

Not a pest in England. Only comes out after
raindown. See that mosquito net is in good condition
and is well tucked in at night when going to
bed. To prevent mosquito bites cut in paraffin, kerosene
oil, eucalyptus or white pine. Drain off stagnant water or
put vibron top (slope breeding), and cut away all the
undergrowth. Spray rooms with DDT 3 times a day. Take
5 grains of quinine a day (drug and habes grown). Don't
walk about with bare feet. Shake bed or clothes
before use. Keep underclothes clean (native servants
are very lazy).

Shabies Tick - red oval under arms, in axilla and
other sweaty places - contracted from the natives.
Use dusting powder on the skin twice a day. Food eat
mashed fruit or uncooked vegetables, drink water or
mashed coconuts. However to have come from a clean
source, have food or drink uncooked. Typhoid,
cholera, and dysentery likely if these don't are neglected.

Three Rules for the Tropics

1. Never lie down with abdomen uncovered.
2. Avoid Constipation
3. Don't drink alcohol until sundown.

Water

Over half the body is water. Three to Four pints are lost on urine, sweat, and in the breath etc., therefore drink from 4 to 6 pints of water a day.

In a permanent camp minimum amount for all purposes are 20 gallons per day per man. In temporary camps (bale etc) 5 gallons a day per man. In all countries the amount required will be increased.
Source of Water

Sea, clouds, rain, hail or snow. These sources cause streams, rivers, ponds and lakes. Some of the water seeps into the ground, and either collects in a hollow forming a type of underground pond or comes to the surface again in the form of a spring, everything depending on the formation of the ground.

Order of Priority:-

1. Deep wells (artesian or otherwise)
2. Springs
3. Rain water
4. Large lakes (containing salt)
5. Rivers (with streams)
6. Small streams
7. Large lakes near banks

1. Shallow wells

2. Rivers near banks

3. Ponds

Impurities in Water - Water derives its impurities from the materials through which it passes. There may be in solution e.g. chalk, magnesium, sodium or even salts of lead is occasionally absorbed from lead pipes placed in peaty acid water. Impurities may be placed there purposely by enemy action to make the water useless for drinking.

Accommodation and Conservancy in the Field

Accommodation - Man to have 1000 cub ft of air per hour. It is possible to change the air three times in an hour without causing a draught. Standard bed space is 60 square ft per man, but in war time this can be reduced to 40 sq ft per man. Under the latter conditions men must sleep head to foot. The reason for this is Trench fever which is caused by breathing foul exhalation (12 ft), about or more (20 ft).

Ventilation - means the air circulating at a suitable temperature and humidity (dampness). This can be natural and artificial ventilation. Natural - the hot air rises allowing cooler air to take its place. Artificial ventilation follows this fact and the hot air is either blown out or the cool air drawn in. Ventilation holes should be near ceiling. Blankets should not interfere if at all possible.

Ablutions

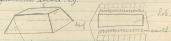
This should be 1 latrine to 7 men, and 1 hole to 100 men. Latrines should be 1 to 25 men (good after games). If in tents an ablatio. booth, 9 ft long with gutter in middle, 1 to 50 men. Laying rooms should always be provided for wet clothes.

Laying Room - 9 sq ft and 30" min of table per man.

Sanitation

1. Adequate supply of safe drinking water.
2. Protection of food from contamination.
3. Ventilation of living quarters.
4. Safe arrangements for washing and disinfection of skins and clothing.
5. Disposal of excreta and other waste products.

Latrine. Permanent latrine - 6 seats to 100 men. Temporary latrine for 50 shallow trench, eg.



This should be five for 100 hundred men and 2 for each 100 afterwards. Earth should be sprinkled in after each use and only last 3 days. After use fill in with earth until on level or two feet top, cover with oiled sack or paper and replace the tarp. Mark with white stone in a letter L.

Camp site.

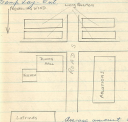
1. Keep away from away from towns or villages (bad

sanitation in hot countries) swamps and marshy ground and banks of streams (sand flies and mosquitoes).

2. Good water supply.

3. High ground is best (drainage purposes), but steep slopes are bad for transport and if too high exposed to weather and the enemy. Latrines cannot be dug in rocky soil, and a campsite used within last two months is not encouraged. The best site is ~~flat~~ a gentle slope on fairly high ground - gravel soil and a decent water supply - slope being away from prevailing wind. Most important is to have good ground for an airfield - though health of personnel is not to be sacrificed as disease can be away from the camp.

Camp layout.



Average amount of food 50g.
water 20g.

Latrine (cont.)

2. Shallow trench - for use in camps of more than three days duration. Trench must be constructed to remain usable for about 3 weeks. Measurements: 10' x 3' x 6" to 8" deep. Provision for hand-dug men is as for shallow trenches, but is removed six inches deep over an area of 4 ft. front back and side of the trench.

Soaking soaked in crude oil is laid down to cover the area the ends of the sacks hanging over the ends of the trench. The loose sand mixed with crude oil is replaced and beaten down. This measure prevents the escape of maggots which may be hatched in the trench.

Two wooden battens are placed along the front and back edge of the trench on which are erected a front 15" high, a top containing 5 seats with visors, a back 5 ft. high with horizontal battens above seat level to cover visor to flap down automatically over seat after use.

Wood must be ground and ground to make structure fly proof. Ground in front of seat is padded with duck boards. A screen in front of the latrine and roofing should be provided.

Disinfectant must not be used on this type of latrine as the automatic digestion and liquefaction of its contents will be interfered with.

3. Bucket latrine - used in belching areas, railway stations or when it is impossible to dig latrines. (rock, high water and water level) Provision is 1-100 men.

Bucket must be covered inside and out with sand

and provided with fly proof self-closing lids. Buckets are emptied every 24 hours and disposed of by incineration or buried into deep pits.

Urinals

1. Shallow trench - for camps of less than three days duration, 10' x 3' x 6", and 1-100 men.

2. Trough Urinal - for any period - high back galvanized trough, 8" wide 3'5" high and sloping to one end which is provided with a pipe leading to a seepage pit, 1-100 men.

3. Tunnel - a seepage pit 8" square provided with funnels extending up through the soil at each corner to a height of 3'5", the wide opening 12" in diameter being approved and framed with gauge to prevent fouling with cigarette packets etc. 1 for 100 men.

4. High Urinals - urine buckets should be placed near barracks rooms for use at night. They are insanitary and should only be used when proper urinals are not available. They should be emptied and cleaned each morning and a little treated and must be kept outside during the day.

Toilets, Cookhouses and Cooking

1. Food is essential for life. To repair tissues and store energy. It is divided into fats, proteins, carbohydrates, mineral salts and vitamins. These constituents must be available in a well balanced diet in appropriate proportions. For this purpose all Rite of Time are passed weekly to the Unit M. G. for his rationing and signature. One cooked food is wasteful, unpalatable and lacking in food value. Inadequately

cooked meat may cause tapeworms.

2. To encourage digestion and appetite food must be attractively served and changed from day to day to avoid monotony.

3. Food intended to be served hot, served warm, or cold is indigestible and an indication of bad management.

4. Teeth are necessary to chew food, therefore

5. A denture is a poor substitute for your own teeth. See also your teeth daily and report immediately to the Dental Officer if they show signs of disease. Should both jaws or powder not be available - common salt makes an excellent substitute.

6. Shortened tea made with boiling water is a good way of supplying safe drinking water. It is also the best restoration for tired men at the end of a days march.

7. Food should never be kept where men live or sleep, near latrines or exposed to flies.

8. Food must be kept in fly proof or rat proof stores, it must not be allowed to touch the sides.

9. Many diseases may be caused by food. They may be the result of eating meat from diseased animals. They may be conveyed to the food by flies, dust and contaminated water used for cooking or cleaning of utensils, or by the hands of persons who are carriers of typhoid and dysentery who by their dirty habits infect their hands with their own infected excreta.

10. Unsound or decomposing foods especially meat, fruit,

and starchy foods. They give rise to epidemics of food poisoning especially in hot weather. 11.

12. Tinned food will usually keep for years. If the tins are blown, rusted or badly dented they should not be used.

13. Food with no reliable to contamination that in hot countries or on active service dried milk or condensed milk is often preferable.

Physiological Effect of Service Flying

Flying like any other activity requires a quickness of mind and body to meet any extreme demands and control of an aircraft puts the body to a greater speed & strain than normally. Causes irritability in rapid movement strain or lunge at extreme heights from lack of oxygen and extreme cold. A fitter man is required for service flying than during peace. Fitness depends on many factors -

1. Regulated life with tobacco and alcohol in moderation if at all. He should sleep a flight.

2. Regular and sufficient sleep.

3. Outdoor exercises whenever possible - both from physical & mental point of view. Indoor games and hobbies good.

4. Diet - good plain food and regularity of meals.

Oxygen

Energy is dependant on the oxygen in the air (venous) about $\frac{1}{5}$ of air is oxygen.

At sea level where pressure is 760 mm. of mercury or 30 in. Hg. and composition of the atmosphere remains practically constant up to about 65,000 feet, with this increase in height the less oxygen is available for breathing. As a result, for work, fall, partying for breath occurring after 10,000 ft. The lungs also give off carbon dioxide taking up lung space to the detriment of air space.

Common effect are similar to alcohol, namely:

1. Loss of self confidence leading to unconcern.
2. Loss of reasoning power and concentration, above all by difficulty in reading instruments correctly.
3. Leads to bad mistakes in pilotage, gunning etc.
4. Larger in the victim lack of knowledge of condition.
5. Early fatigue and loss of muscular power.

Effect on Heat of Body

Leads to lack of energy through lack of heat.

Trouble prevalent

Regulations: All flights over 10,000 feet of 1 hour or more duration oxygen is required. All flight over 15,000 ft. All flight of 12,000 ft. and above with rate of climb greater than 2000 ft/min. All flights of 20,000 ft. or more require sealed cabins or suits.

If there is a proper supply of oxygen anoxia is not out. Still death and disease lead to anoxia. Common oxygen mask too soon may result in fainting, there is no harm in keeping the mask on.

Moving about an aircraft without oxygen over 20,000 ft. take a few deep breaths of 100% oxygen and hang

to your new position.

Breath-hold is dangerous round about 20,000 ft. and above stay in bite until it is imperative to jump or take big breaths of oxygen at 100% strength before jumping. A portable oxygen eliminates this.

If anyone faints through lack of oxygen give oxygen in steadily increasing amounts taking about 2 minutes to reach full strength.

Black-out occurs in steep banks, curves, power dives and turning of high speed aircraft. To the loss of consciousness up to greatly forcing the blood from the head. On the hit returning to even full consciousness returns within a few seconds there are no ill effects and is likely to move along is greater than 6 or 7. Prevention can be made by anticipating the maneuver, tuck the head as low as possible and about at the top of the nose. On many flights the rubber bar is continuous so that the feet are lower under above the normal position.

Effects of Decompression

When there is rapid bubbles of nitrogen are given off from the blood which is known as Bends. Provided it isn't too rapid, the lungs can get rid of the nitrogen, but if it is the nitrogen gets in the tissues causing pain in the back and limbs. Air pockets in the middle ear and behind the nose and the intestines stop the pressure inside from decreasing as the air rises causing pain and faintness. Warning should avoid

gas forming foods e.g. green stuff & silkworm.

Bolds in the heads may result while flying, causing pain in the ear caused by the ear & nose spaces being unable to equalize the pressure. In rapid ascents swallowing constantly helps.

Effects of Rapid Ascents.

Pain caused by increases in pressure on the ear drums. Holding the nose & pushing internal pressure on the ear will counteract it.

The main points are to keep fit, and of felling off when dirt begins to report to the M.C. immediately & a crew may depend on your fitness.

Spreading of Disease By Insects

Man actually carried by the insect itself e.g. hairy legs of the house fly.

Insects & parasites which in turn carries the germs.

The remedy is to destroy insect as early in life as possible. Stopping breeding grounds. Preventing insects getting onto anything to infect it, or keeping the insect away from infection. Good water and food supplies.

House Fly.

Genus - *Cyphod*, para-cyphod, *chloera*, *dytiscus* etc.

To prevent keep flies away from latrines etc.

Breeding ground - horse and human manure, decaying refuse. One batch of 150 eggs can result in 100,000 flies in 7 weeks.

Method of Disturbance - remove all excrement & rubbish - swathing - fly traps - fly paper.

Mosquito.

Breeds by laying eggs in stagnant water developing into maggots that require air & are suffocated by lack of oxygen unless in water, only way to clear is to pour out on the water.

Protection - Mosquito nets (must be kept in good repair) stretched tight at night to allow air to get in, and raised the net before getting in at night. In the morning tie up tightly with tape. Calafogon - oil of citronella & liquid paraffin & camphor & 2 barbitol acid. It is used only for short periods.

Party?

Boys
Neph
James
Linnell
J. Sharp
Pep
He.
Danish
Seguso
Gerry.
~~Lincoln~~
~~Lincoln~~

Girls
Judy
Irene
Eugene
Ellen
Jane
Vicky
Julia
Cathy?

Open to suggestion

Depends whether guests are out
before 12:30 - when all Sparks are out
1:30 - when it gets
bring your own music. Hottel
all boys and girls
will be great off.

R.A.F. Law and Organization

R.A.F. Organization

Up to the year 1913, from its formation, the R.T.C. was under the jurisdiction of the War Office. Then in April 1912 the Royal Air Force was born.

Successive steps leading establishment of R.A.F.

1. Had its start in the forming of a Balloon school at Farnham in 1879, for instruction of Royal Engineers in aeronautics.
2. Moved to Farnborough where a Balloon Factory was built.
3. In 1900 it was reconstituted under the name of the Balloon B.C. (1st office and 1st B.C.).
4. In 1902 further approval was granted for the development of an Aeronautical Service for Naval and Military purposes, under the designation of R.T.C. which absorbed the Air Balloon, which ceased to exist.
5. In 1909 the Naval section renamed Royal Naval Air Service.
6. In 1913 the R.A.F. was authorized to be formed by the Constitutional Act of 1913.

Royal Air Force Act

This is received yearly by the Parliament by means of the Army and Air Force (Annual Act) embodied in the publication "Manual of Air Force Law".

In practice however, it will be necessary to refer to various rules and regulations contained in R.A.F.

and "Air Council Instructions".

Law:- all personnel in office and service are subject to British law as well as the Force law.

Subjects of Military and Air Force Law

a. Maintain discipline, etc., which in civilian life are nearly breaks of contract, are punishable.

a. Provide for Administrative matters.

Criminal Law:- the position of an officer or airman as criminal law is the same as that of a civilian, and is punishable by civilian courts. Various liabilities are incurred by an officer who, when asked to hand over a man under his command, and refuses to do so.

Civil Law:- an airman or officer cannot be compelled to appear in person before a civil court on account of any debt, damages or sum of money (other than theft) under 50. This exemption applies only to the airman not to his civilian property. Breach of contract and law execution providing the service pay antecedent and left undisturbed.

Stoppage cannot be made from an airman's ^{current} pay or pension, and persons who suffer airman to contract such debt do so at their own risk.

An officer or airman is unable legally to charge or assign his pay or pension.

Wills:- a soldier or airman may execute of an unattested document, such as a letter to a beneficiary or a letter to

any person stating his wishes as to the disposal of his property. A verbal statement is also valid, provided it can be proved to the satisfaction of the law. To establish such a will does not necessarily have to prove that a will was intended to be made, but only that the airman intended stating his wishes as to the disposal of his property in the event of being killed. Such a will continues in force until superseded or revoked, or is revoked or subsequent marriage or if it was such that its language only, referred to the possibility of the testator dying during that particular expedition.

Rate:- the only exemption by an officer or airman from Rate is when an officer or airman occupies property in respect of his office or occupation, in which case it is treated as occupation by the Crown and is therefore not liable to be rated.

Voting:- an officer or airman is entitled to be placed on the list of absent voters. Even if he is in the United Kingdom he needs to vote by post, or if serving elsewhere a proxy can vote on his behalf. Officers are responsible for taking all steps to register their own votes, but the C.O. is responsible for the facilities for their men.

Air Force Law

Enacted in the Air Force Constitution Act 1917, the Force Act and a number of other acts applying to the Air Force - rules of procedure, H.R., Air Council Instructions and A.M.C. and Regulations (A.M.C.) Orders, permissions and

Regulations which are temporary).

The Air Force Act is the Army Act adapted for the Air Force, and is a standing code dealing with discipline, Courts-Martial, enlistment and other service problems, but is not permanent, but remains in force as long as Parliament decides, but is part of the Statute Law of England - that is it is administered by Air Force Courts only, but the procedure of Civil Courts is allowed to a person has means of defending himself.

Discipline - from A.R. and A.F.C. Chapter 15 Paragraph 1370

Aquaintance with Regulations

1. Every officer will make himself acquainted with, obey, and as far as he is able enforce the Air Force Act, A.R. and A.F.C. for the R.A.F. and all other regulations, instructions, and orders which may from time to time be issued. He will also conform to the established customs and practices of the Service.

2. Every airman will be held responsible for making himself acquainted with -

(a) his Unit Station and other local orders and instructions as are necessary for the due performance of the duties appertaining to his Service employment and,

(b) such orders and details of duties that are posted in barracks, and he will further be required to conform to established customs and practices of the Service.

These various orders are issued from time to time by higher authority and take the form of -

(a) A.M. O's circulated to all units - Section A being standing orders and Section B temporary orders and notices.

(b) Daily I.R.O's dealing with procedure, discipline and routine in a particular station.

(c) I.R.O's order issued daily by the C.O. of the unit giving instructions for the day as to parade, orderlies and other duties.

It is the responsibility of all ranks to make themselves acquainted with the contents of all orders which affect him and ignorance of duly published regulations or orders will not be admitted as an excuse for their non-observance.

3. An officer or airman is forbidden to publish in any form whatever or communicate either directly or indirectly to the press any Service information or his view on any Service subject without special authority; he will be held responsible for all statements contained in communications to his relatives or friends which may subsequently be published in the press or otherwise; he will not pass judgement which are under the consideration of superior authority by the publication anonymously or otherwise of his opinion and he will not take part in public in any discussion relating to orders, regulations or instructions issued by his superior.

4. Any information of a professional or technical matter (action) which an officer or airman may acquire in the performance of his duty or in the course of his studies will be regarded as the property of the Air Council and will not be published or communicated either orally or in

writing to any person not directly employed by the Air Ministry without the previous sanction of the Air Council.

5. The above clauses one to four apply equally to an officer who has retired or who has otherwise ceased to be an officer on the active list and to an ex-airman or to an airman no longer on regular Air Force Service.

6. In dealing with commercial firms for the Air Ministry care will be taken to ensure that particular kinds of development in any given matter which should be kept secret are not made known to the firms.

7. An officer or airman without the permission of the Air Ministry is forbidden to publish any article whether purporting to be fiction or fact which in any way deals with, Naval, Military or Air Force subject. A similar prohibition extends to the broadcasting of talks.

8. When permission is sought under the above clause the matter intended to be published or broadcast will either be type-written or in proof form, and will be submitted in duplicate through the usual channels to the Air Ministry in the first instance in India to the C-in-C, secondly passed by a statement from the authority under who the applicant is immediately coming to the effect that there is no objection to permission being applied for. One copy of the document will be submitted to the Air Ministry

will be kept at the Air Ministry for reference. Permission to publish or broadcast will apply only to the text as submitted and no alteration therein, except such as are of a purely editorial nature and will be made subsequently without the authority of the Air Ministry or the C-in-C. The permission if given will not convey endorsement of the contents of the document and not statements tending to imply official endorsement or approval will be included in any part of the published article or talk, nor will any reference be made therein to the fact that the Air Ministry sanction has been obtained. The officer or airman concerned will take particular care that no information of the nature referred to in the third or fourth paragraphs is communicated to the publishing or broadcasting authority until the Air Ministry permission has been granted.

9. Official reports or correspondence, or copies thereof will not be furnished without the special sanction of the Air or other Office Commanding to any person not officially entitled to receive them. These reports or photographs will not be permitted to attend the crews of any aircraft.

10. See also para 853 acts allowing admission to stations; and para 854 as to the disclosure within the service of information contained in secret and confidential publications.

Relations with the Press (Para 1072)

1. Any communications affecting the Service generally or any branch of the Service which it may be considered desirable to make to the Press will be made by the Air Ministry. In Commands communications to the Press may be made only when they solely affect the command concerned, and then they will be made by the Command G.O. except as provided in the following Clause.

2. Articles or notices concerning non-technical and non-official subjects which do not contravene the provisions of para 1072 entitled 'Restrictions of Information' and social or athletic matters may be communicated to the Press by an officer or airman but a G.O. will be responsible for taking suitable action disciplinary or otherwise should any officer or airman under his command publish matter in the Press which is objectionable either in form or substance or is likely to reflect discredit on the Service.

Responsibilities of Officers in General (Para 1073)

1. An officer will be responsible at all times for the maintenance of good order and discipline.

2. An officer will afford the utmost aid and support to his G.O. in his duty to detect, repress and energetically report any negligence or impropriety of conduct on the part of airmen whether on or off duty and whether the offenders do or do not belong to his particular unit.

Treatment of Subordinates Para 1074

1. An officer of any rank will adopt towards his subordinates such methods of command and treatment as will not only ensure respect of authority but also foster the feeling of self-respect and personal honour which are essential to efficiency.

2. An officer will not reprove a G.O. or A.C.O. in the presence of other airmen unless it is necessary for the benefit of example that the reproof be public.

3. G.O.s and A.C.O.s will be guided by the foregoing principles in dealing with each other and with other airmen. They will avoid interpreting language in an offensive manner.

Criticism of Superior (Para 1075)

1. An officer will refrain from making remarks or passing criticisms on the orders or orders of his superiors which may tend to bring them into contempt and will avoid saying or doing anything which if seen or overheard by or reported to those under him might discourage them or render them dissatisfied with their conditions or with the Service or which they are or may be employed to communicate and tolerate with C.M. Officials (Para 1075)

1. An officer is forbidden to write private letters to officials at the C.M. on official personal matters such as promotion, posting etc.

2. Attempts by officers or airmen to obtain favourable consideration of any application by the use of outside influence are forbidden and if resorted to will be

regarded as an admission on the part of the applicant that his case is not good or its merits and it will be dealt with accordingly.

3. When an interview is asked for or a letter is written on behalf of an officer via any person other than himself, such communications will be deemed to have been made at his suggestion unless he can show to the satisfaction of the authorities that he has no knowledge directly or indirectly of it.

Bankruptcy etc. (Para 1079)

If an officer by serious financial embarrassment, bankruptcy, liquidation or other legal proceedings or finds himself unable to meet his engagements he will at once notify the fact to his C.O. The latter will report the circumstances for the information of the Air Council who will decide whether the officer can be permitted to continue to hold the Magister Commission.

Gambling (Para 1080)

All gambling in camps, stations or barracks is forbidden. This includes book-making or acting as an agent for a bookmaker. An order will be promulgated in these lines in local orders at intervals not exceeding three months.

Intoxicants (Para 1081)

The introduction of wines, spirits and other intoxicants into barrack-rooms and such other places as may for the time being be specified in standing orders is forbidden. Topi-

and hereafter may however be permitted to receive one pint of beer with their dinner. Appointments and Boy Scouts will not be allowed to consume any liquor.

Local Employment etc. (Para 1082)

1. An officer on full pay or an aviator is not permitted without the special sanction of the A.M. to belong to the directorate of any public, industrial or other company or to assist or advise any such company or firm relating to their plant, processes or products. An officer or aviator is forbidden to act either with either directly or indirectly as an agent for or accept any paid post in connection with any company, firm or individual engaged in trade.

2. An officer on full pay or an aviator is forbidden to engage in trade or accept any continuous civil employment of profit. He may however (except as regards flying civil aircraft as to which see Paras 1089 and 1090) with the sanction of superior authority accept casual employment provided that:-

(a) he does not replace and receive the remuneration of a civilian who is on strike.

(b) he is not remunerated at a rate lower than that paid to a civilian in like employment.

3. The Air Ministry will in no circumstances accept any responsibility for any accident or damage to Air Force personnel (whether serving on full or half pay) other persons or property incurred during employment outside Air Force duty.

1. The restriction in the paragraph do not apply to women on leave immediately preceding discharge or transfer to the reserve. An woman who while on such leave obtains employment as a civilian under the Air Ministry may draw still his service pay and allowances or his emoluments as a civilian whichever amount is greater, but not both. Women about to be engaged in a civilian capacity under the A.M. will be informed of these conditions.

2. The position of an officer on half pay in the regard is dealt with in para. 3702.

Conduct of A.M. (Para 3703)

In every unit there is to be a standing order stating that an airman who is suffering from VD is to report himself sick without delay. This standing order will be read to the unit on parade at intervals not exceeding three months, care being taken that it is brought to the notice of all recruits on joining. Conduct of A.M. will be dealt with under Part II Air Force Act and not under Part III) or Part IV.

Witness in Private Law Suits (Para 3704)

1. Applications for the attendance of R.A.F. personnel to give evidence in private law suits will be reported at once through the usual channels, if urgent action necessary, directly to the A.M. when matters connected with their service duties are involved in order that it may be considered, any question arising of claiming grounds of immunity otherwise before will not in any case be given

on expense. About the report will be made to the A.M. or other officer commanding who will give the necessary instructions.

2. Only in very special circumstances would A.M. authority be given for an officer or airman to appear as an expert witness in connection with matters on which he has acquired knowledge or experience in the course of his official duties. Requests to give expert evidence should be declined, and, if they are pressed, reported at once to the Air Ministry.

Rank and Badges of the Royal Air Force, Relative Ranks with Royal Navy and Army Distinguishing Flags and Colours

1. It is one of the duties of every airman on entering the Service to acquaint himself with the badges of rank worn by officers of the Royal Air Force and also to be conversant with the corresponding ranks in the Royal Navy and the Army. There are twelve commissioned ranks in the Royal Air Force commencing with

1. Marshal of the R.A.F. down to Acting Pilot Officer which is the lowest commissioned rank.

2. The distinguishing badges of officers in the Royal Air Force are appended below:-

(a) The Air Officer (as Air Commodore and above). A band of two inch broad round the sleeve, with seven of its broad above the band according to rank.

(b) Ten officers below Air Rank seven of band

round the spine according to rank.

23. A "V" made of black and blue band on the sleeves, and is similarly indicated on the shoulder strap of great coats.

24. The distinguishing badges of other ranks in the R.A.F. are as follows:-

Rank	Badge
Warrant Officer	Royal Warrant
Flight Sergeant	Three stripes and crown
Sergeant	Three chevrons (stripes)
Corporal	Two chevrons (-)
L.C.C.	Peppercorn (Two Blades)

A.C.1

A.C.2

25. (Badges of Rank of Officers)

26. The Relative Ranks of Officers and Aircrew with the Army and Navy:-

R.A.F.	Army	Navy
Commander of R.A.F.	Admiral of Fleet	Field Marshal
Air Chief Marshal	Admiral	General
Air Marshal	Vice Admiral	Lieut. General
Air Vice Marshal	Rear Admiral	Major General
Air Commodore	Commodore (or Captain)	Brigadier
Group Captain	Captain	Colonel
Wing Commander	Commander	Lieut. Colonel
Sgt. Leader	Lieut. Commander	Major
Plt. Lieut.	Lieut.	Captain
Flying Officer	Sgt. Lieut.	Lieutenant
Pilot Officer	Air Sgt. Lieut.	2nd Lieut.

R.A.F.

Navy

Army

Army Pilot Officer
(but junior to Navy and
Army ranks)

Commissioned Officer from
Warrant Rank.

Warrant Officer (but
senior to Army ranks)
metal pin (but
junior to Army ranks)

Conductor (R.A.F.)
Master Gunner 1st Class
1st Class Staff Sgt.
Major

All warrant officers
below are except those
marked with stars
above.

Warrant Officer (but
Flight Sergeant)

Chief Petty Officer

Warrant Officer (but 2
Sgt. Quarter Master (Sgt.
(Household Cavalry) Petty
Sergeant or Company Sergeant
Major, Sergeant, Staff Sgt.
(Household Cavalry) or
Staff Sgt.

Sergeant

Petty Officer

Sgt. of Horse (Household
Cavalry) or Sergeant
Corporal, Bombardier,

Corporal

Leading Seaman (but
junior to Army ranks)

Trumpet, Trumpet Major, Staff
Sergeant, Driver, Gunner,
Refrigerator, Cook, Steward

L.C.C.

A.C.

A.C.1

C.P.

A.C.2

no white b'ts in the Army rank with b'ts and Bombardier, but senior to those ranks and to corresponding ranks in the Royal Navy and R.A.F.

As Lance b't and Lance Bombardier in the Army rank with Trooper, Gunner, etc., but senior to those ranks and corresponding ranks in the R.N. and R.A.F.

All women will salute commissioned officers of the Royal Navy, Royal Marine, and Army also all Warrant Officers of the Royal Navy who hold rank corresponding to commissioned officers of the Royal Air Force. It is, therefore, very necessary for all women to familiarize themselves with the rank badges of Navy and Army officers, and to assist in the training of the personnel of officers of the sister services to convey to them the high standard of efficiency which it is always the aim of the R.A.F. to attain.

Distinguishing Signs and Relative Ranks in Other Services.

1. The below is to explain the status of equivalent ranks in the other services.

2. The R.A.F. in the junior service, and in so being the other ranks in the R.A.F. derive an advantage from its juniority that of simplicity. At the bottom of the ladder, against one of the four or second class are the Army P.O.s and Q.F., the Army has the multiplicity of private, trooper, gunner, driver, rifleman, guardsman, and fusilier.

3. L.A.C. ranks with the P.O., but the Army has a nearer

equivalent in the L/Plt. It wears one chevron, a badge which in the R.A.F. is only worn on these stations by leading appointments.

Strictly speaking this is an appointment not a rank and the L/Plt is not an R.O.C.

4. b't - one R.O.C. have adopted the badge and approximately the title of the equivalent Army rank, b't, in both services corresponds to the leading seaman. An artillery b't is called a Bombardier.

5. In the b't of both junior services the Naval P.O. corresponds to ours. The Army, by the way, officially spells it as one syllable with a p.

6. The b't - one opposite to the L.P.O. in the Navy, the Army has an equivalent the old rank, The Army has an equivalent the old rank of L.C.M. b't, and colour b't.

7. The R.A.F. W.O. is equal to a R.A. Major who wears the royal arms on his sleeve. The Navy has no equivalent to these ranks. R.O.C.s are in and between these and commissioned officers. Watchmen who carry the torch and 8. and the sword, are parallel to them.

Commissioned Ranks

(Below) The Army's major and next two ranks are known as field officers as distinct from subaltern officers.

The Women

1. Dress - in uniform as at all times, whether on or off duty, be cleanly and smartly dressed. Uniforms and accessories not only reflect directly on the woman's character and the good name of the Service. Only the approved pattern of uniform as issued will

known; particular attention being given to the details in A.M.C. 227/20 and A.171/22

2. An officer or woman will not wear the flying, observer, air gunner or any other badge until proper authority for him to do so has been granted. The authority duly granted the badges can be worn of all descriptions of R.A.F. uniforms.

3. Discipline among airmen will be held personally responsible for:

a. R.O.s and R.O.s, for the R.O.T.

b. Such Station and other local orders as are necessary for the due performance of the duties appertaining to his service employment.

c. Such order and details of duties as are posted in barracks.

A copy of R.O.s and R.O.s will always be available in the Station Reference Library or some other convenient place.

Reduction of an R.O. to a lower grade or to the ranks may be recommended after:-

a. Conviction by a Court-Martial

b. Misconduct or inefficiency

c. General Report:- as long as a man gives due respect and salute an officer at all times. As then an R.O. loses respect at times they might never back.

d. Certificate of Service - Use of this card airmen character and bad proficiency recorded. This can be read by airmen once a year after Jan. 1st.

Meals. All senior R.O.s must be a member of the Station Mess (meaning in a messing out) Senior R.O. or R.O. is responsible for good order in the Mess.

Under the direction the R.O. can reduce a Sgt. to the ranks, either for mis-conduct or inefficiency, whether he is efficient or not. How duties or not.

Status of R.O. rank, and correct relations with other ranks, must be correctly maintained. An R.O. must always be aware of his rank at all times.

Prisoners Messing

Efficient record of messing at Station. Prisoners Messing Committee on every station - consists of representatives of every unit comprising the station. An officer is appointed President by the C.O. A senior R.O. or one 1000 or a Sgt. to assist him. The committee meets each week. Weekly diet sheets are submitted to the M.C. for approval by the Messing meeting. The R.O.C.T. requires a copy of the diet sheet a week ahead to order up for the forthcoming week's rations. The diet sheet under discussion always refers to the meals in the week next but one following.

Source of supply of food stuffs are in two ways - we have the ration which are issued in kind and are drawn from the R.O. & C. on the following scale per man per day.

Meat (fowl or frozen)	10 oz.
Bread	12 oz.
Tea	3 oz.
Sugar	2 1/2 oz.

Salt 2 oz.

If second flour may be drawn instead of bread 9 oz being equal to 12 oz bread.

Butter can be drawn on same basis.

All other provisions come from the R.A.C.T.S.

There is an issue in hand per man per day

blouse 2 ozs.

For a long time

Waggon 2 ozs.

Beaver park per week 10 ozs.

These commodities need not be drawn in full, and under drawings can be drawn in cash equivalent allowance.

There is a commuted ration allowance in cash for purchasing the variety of items to complete the messing.

As the army rate of the four daily meals is only 1/18 food inspection must be sharp and economical. Salt and bones are sold to contractor. The money thus raised is used for buying special cookhouse & mess room etc. equipment which cannot be drawn on a service issue (By Private Fund).

Service Documents and Records.

Complete service history kept of each individual (grade, to conduct, trade efficiency and progress).

as Original Documents - subitaneous papers and are kept by G.D. Records.

As Service Documents - permanent records carefully maintained which accompany women.

Service Documents (18):-

as Quinine Record sheet (Action Service, Form 1578.)

as General Conduct sheet - form 121.

as Medical History envelope.

As to not maintained for a U.C.

Alcohol:- keep away from alcohol who about to go on ops or do work of any kind. Take it in moderation with tonic.

Tobacco:- interferes with the breath, causes shortness of breath, and palpitations. If poor standard encouragement when not good for catarrh. Bad for the vision. Not down flying sailing at any good angle.

Bookhouse should be situated on one side of the camp and away from latrines. Should be a building with one side open facing away from the wind. Should only be closed when it is fly proof. Then for the floor and should be impervious (should have a glass top). All tables, chairs etc. should be thoroughly cleaned after each use. Sinks and cups should be kept in a covered receptacle. No one employed who has suffered from typhoid, dysentery, jaundice, and U.C. before women handle food to U.C. should use them.

Transmission of disease.

The following abbreviations are used in recording punishment on the conduct sheet.

1. Confinement to Camp - C.C.
2. Confinement with Hard Labour - C.H.L.
3. Detention - Det.
4. Hard "A" clothing
5. Penal Servitude - P.S.
6. Reverts to permanent grade - in full

Vague letters such as "proper conduct" are forbidden.

Form 21

Contains Service Medical History of a man - confidential. On receipt in Custody Room it is passed on to the M.O. A man cannot examine his own documents or have access to it. The front and back of the envelope contain tables which show -

1. Contents
2. Medical category
3. Immunizations
4. Vaccinations
5. Dental Treatment
6. Appliances and Surgical Appliances
7. Blood group

Service Documents on Posting

Documents are forwarded with form 21 (Receipt) to a man's new station under confidential cover after being completed.

Service Institute (R.R. & R.L. chap 21)

R.R.R.I. (1921) was incorporated under the Companies

act, as a company not for profit and limited by guarantee. The policy is controlled by a council of twelve members four being appointed by each service. The management is vested in a Board of Management which comprises three civilian business men and one officer from each service.

Service Institutes aim at providing and aiding the comfort of airmen, their entertainment (reading, writing, games and concert), and provision of refreshment and articles of common requirement at reasonable prices. It will supply families of officers and airmen with household requirements. Officers and NCOs may obtain supplies from Service Institutes. Open house decided by the C.O. should not hold during dress service on Sundays. Only officers to visit the Institute daily, defaulters excluded except for one hour daily as decided by the C.O. Medical permission must be given before sick or light duty airmen can visit the Institute. The airmen may entertain a male friend, spouse or civilian in the Institute. Institute profits benefit the service collectively.

Section 10 - 100

- a. Shameful conduct in the face of the enemy - punishable by death or flogging to carry out a warlike operation.
- b. Minor offences of above - disobeying orders while on active service (disgraceful or shameful) - penal servitude.
- c. Intentionally giving the enemy information of landing, striking a sentry, leaving post before relieved etc.
- d. Mutiny and Insubordination or any conspiracy to cause mutiny or disquiet (Mutiny is collective insubordination of two or more persons. A man may be charged with mutiny if he attempts to start a mutiny.) - Death.
- e. Striking or Attempting to strike a superior officer (an NCO is a superior officer) The only applies if the officer or NCO is acting within his rights - Penal servitude.
- f. Insulting - incurred by disobeying an order which is given directly from the person issuing the order whether verbally, in writing or by signal. - penal servitude.
- g. Breach of Discipline - breaking out of camp, being concerned in a quarrel, refusing a call - imprisonment.
- h. Neglecting to obey any local or general orders.
- i. Drunken - fraudulent Entertainment - A.C.C. - Penal servitude.
- j. Further offences to fraudulent entertainment not covered by Section 12.
- k. Absisting or conniving at Absention.
- l. Absence from duty without leave - not parading etc. out of bounds.

16. Dishonest conduct of an Officer - sanctioned.
17. Fraud by persons in charge of Service or Public Property, eg. R.I.P.
18. Dishonest conduct - pretending to be sick, pretending to be sick, pretending to be sick, any act of this kind not provided for in any other part of these sections.
19. Breach of - improvement on fines up to £5. C.O. can only impose a fine & offences, any other to be approved by the A.C.C. up to £5.
20. Permitting a person to escape who is in custody.
21. Illegally keeping a person under arrest or in confinement.
22. Any person being in lawful custody escapes or attempts to escape.
23. Corrupt dealings in respect of supplies to the force.
24. Infraction and damage to arms and equipment.
25. Falsifying official documents and making false statements.
26. Neglecting to make any Report or Return which it is an officer's duty to do.
27. False Accusations or False Statements.
28. Certain offences in relation to Court-Martial.
29. Giving false evidence - before any court an Officer authorized to administer an oath.
30. Offences in relation to billeting.
31. Offences in relation to the false imprisonment or use of force.
32. Anyone who shall be dismissed from the Service dishonourably without disclosing the fact.
33. False statements on Attestation.

34. General offences relating to enlistment.
35. Insolent words regarding the King.
36. Impose or injurious disclosure concerning Service matters.
37. Ill-treating sailors.
38. Betting and attempting to commit suicide.
39. Refusal by authorities to deliver to the Civil Power any rank who has committed a Civil Offence.
40. Any act or conduct, causing death or neglect to the prejudice of the Force good order and discipline, misapprehension of anyone else's property, improperly using M.S., wearing uniform or rank badges, and many more crimes not mentioned in any other section or rules & regulations of the R.A.F.
41. Given Military Authorities power to try any offence Civil or otherwise committed of anything but murder, manslaughter, rape, seduction, treason, and treason felony committed anywhere but the United Kingdom except on special circumstances arising under Section 42.
42. This provides that nothing in Act 41 shall prejudice the jurisdiction of a Civil Court to try a person subject to this act.
43. Right of an officer to redress a grievance.
44. Right of an officer to redress a grievance.

Bombing Theory

Effects on a falling bomb

1. Angle
2. Air Speed
3. Wind Velocity (Speed and Direction)
4. Air Resistance
5. Gravity

The Ideal Bomb

An ideal bomb is one so perfectly streamlined that air resistance has no effect on it.

Therefore ignoring Wind Velocity for the time being we can plot the curve of an ideal bomb using the given formula

$S = ut + \frac{1}{2}at^2$ where S is distance fallen, u is initial velocity, t is the time of fall, and a is the uniform acceleration or in other words gravity which is 32 ft per sec.²

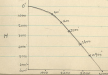
$$\therefore \text{Height} = (v \times t) + \frac{1}{2}(32t^2)$$

$$= 16t^2$$

$$\therefore t = \sqrt{\frac{\text{Height}}{16}}$$

∴ the time of fall of the ideal bomb is $\frac{1}{2}\sqrt{\text{Height}}$

In future this time will be represented by T and height by H .



Let speed = v ft/sec

The bomb has two forces acting on it $2/3 \propto$ Gravity. The ideal bomb will move forward $T \times v$ while the bomb is through H feet, and will be $V \times T$ in directly below the observer.



Bombing angle is the angle between the vertical height of aircraft at time of release with the line of sight.

Wind Velocity can now be brought into play as an additional force on the ideal bomb. The bomb will be blown a distance along the direction of wind equal to Wind Speed multiplied by the time of fall or VT .



Air Resistance of Practical Bombs



Air Resistance creates itself in two ways on a practical bomb, one force being horizontal setting down the forward motion of the bomb, and the other in a vertical direction

retarding the downward motion, or in other words increasing the time of fall. This

will cause a practical bomb to fall to the rear and at some time later than an ideal bomb. This lag is known as Air Lag. Horizontal distance between the trajectories of a real and an ideal bomb released simultaneously from the same uniformly moving aircraft at any moment, during the time of fall, and is always known by a li.

The extra time taken by a real bomb is called *t*, which gives the total time of fall of a real bomb $T + t$. This is also known as *Time Lag*.

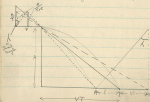
In this extra time *t* the aircraft will have moved forward through the distance of Vt , this distance plus *Time Lag* at ground level will give the distance which is known as *Trail Distance*.



Trail Angle is the angle between a vertical dropped from a uniformly moving aircraft and a line joining the trajectory of the real bomb at any moment during its time of fall. (Can be considered constant though).

Trail Distance = $h \cdot Vt = H \cdot \tan \theta = \frac{H}{V} \cdot \frac{V}{\cos \theta}$ approx.

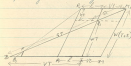
Trail Distance is inversely as to the terminal velocity of the bomb. To construct a Bombight (without wind)



First we must construct a sight for the ideal bomb in conditions of no wind. For construction of graduation scales it is necessary to make the bomb in $\frac{1}{2}$ sec. the height bar in every fall per second.

Then we take the point on the ground vertically below the position the aircraft will be in when the real bomb bursts and produce a line from this point through the foresight to the height bar. *V* remain constant but instead of $\frac{1}{2}$ we have $\frac{1}{2} + t$ governing the graduation on the height bar. The point of burst of the ideal bomb is then considered. To get a line of sight on it using the angle scale $\frac{1}{2} + t$ this scale must be moved forward. In reality however the height bar is tilted forward through trail angle (can be proved by similar triangles). This calls for a slightly different graduation for bombs of different terminal velocity.

Incorporating Wind Velocity



Trail Distance is always along a line parallel to the heading of the aircraft. The actual distance between the point of impact of real and ideal bombs is called *Ground Lag* + *Bomb Distance* which is denoted by *L*. Use of Bombight with a Moving Target.

To make the bombight useful for bombing moving targets, the bombight is offset in the direction towards which the target is moving, and to a distance proportional

to the target speed.



- 1. B is point of impact.
- 2. T is position of target.
- 3. B is normal sight.
- 4. B is sight to hit T at R.

Use of Bomb Sight

- 1. Set lateral and fore & aft levels.
- 2. Set height.
- 3. Set Air Speed.
- 4. Set Wind Speed & Direction ensuring that the tail of the W.S.D. arrow is pointing ^{to} the direction from which the wind is blowing.

1. Set Terminal Velocity.

Use of Low T.V. Attachment.

Used for Low Velocity Bombs of low terminal velocity.

- 1. Set T.V. to 0.
- 2. Turn R.F. & Turn Height (special ^{height} scales for different bombs).
- 3. Set Turn Height on sliding arrow against Turn R.F. scale on hinged arm and lock screw in this position.
- 4. Turn arrow up & maintain hinged arm in line with R.F. bar and back sight coincident with the foresight.
- 5. When target lines up with fore & back sight, release the bombs.

Storage and Transportation

- 1. To Remove Sight from Base:-
 - a. Remove levelling bracket.
 - b. Release bomb sight catch and remove bomb sight off the spigot.

2. To Store Sight:-

- 1. Wind Speed to zero.
- 2. Enemy Speed to zero and enemy direction to 0° or 270°.

3. Air Speed to maximum.

4. Terminal Velocity to infinity.

5. Set height slider on red scale to

(a) 5000' on Mk. 1.

(b) 7000' on Mk. 2.

6. Lower wind gauge bar onto compass bowl.

7. Fold auxiliary knife wire over to the left (adding).

8. Lower height bar.

9. Slide sight onto spigot ensuring entire recess without strain until catch engages.

10. Replace levelling bracket if not fitted to the aircraft so that one of the positioning leg slots engages the pin. The adjusting screw must be clear of the knife wires.

Inspection Before Flight

Enemy Speed to zero - T.V. to infinity - enemy direction arrows to 0° or 270° - W.S.D. to zero - rotate

A/D down until one foresight is over a pair of beads and maintaining the same head position and line of sight which opposite foresight over opposite pair of beads. Maintaining the same setting, lower the height bar, rotate height bar until one foresight and one back-sight, over one pair of beads, taking same precautions as for foresight check the other fore and back-sight. This can be checked with the height bar in a vertical position.

Moving Beads

Set to 0 - turning speed to zero - W/P to maximum (30 up. M49). Set A/P at double the W/P. Rotate compass bowl until maximum drift is recorded, this should then be repeated in the opposite direction, and in both cases the drift should be 30°. Note errors on both sides and if combined errors exceed 3" the boat sight should not be used. This checks the wind gauge bar.

Back Lock.

Set turning speed to zero - P/L to 0. W/P to maximum and A/P to maximum.

Rotate compass bowl until A/P and G/P are equal. Unblock verge very and ~~put~~ turn the grid ring until the red H is against the bubble line, unlock and rotate the compass bowl clockwise through 180°, rotate anti-clockwise until the A/P once again equals G/P. Any backlash will be indicated by the position of the red

H. Maximum error allowed is 2". Unblock and replace H against the bubble line and check in opposite direction.

Compass Bore

i) First Division - make needle deviate through 90° by means of a magnet when magnet is taken away compass should return to within 2° of normal and go to latter with a slight tap.

ii) Second

iii) Bubbles

iv) Sluggish needle (weak magnets). Deviate through 90°, and when magnet is removed needle should return to within 3° of normal in direct and original position within 15 sec.

v) Distortion of bending of compass needle, damping wires, and grid wires

vi) Liquid seal.

Check levels and drift wires.

Lubricate all moving parts sparingly with anti-freeze oil, and spigot with anti-freeze grease.

Isothermal Laws.

1. M.H.T. Pressure of 1013.2 millibars.

2. Constant temp. for all heights of + 10°C.

Check Tachometer Computer.

- a) Height. (i) Temp. to $+10^{\circ}\text{C}$
- (ii) Height to zero
- (iii) Ground Pressure to 1013.2 mb.

Ind. - lowest pointer should then coincide to Air Head.

Alt. Temp. to $+15^{\circ}\text{C}$ & I.P.B. pointer should coincide.

Check P.C.B. Computer.

- i) M.B.L. Pressure to 1013.2 mb
- ii) Temp. to $+15^{\circ}\text{C}$.

I.P.B. pointer should coincide

NOTE. Allow for a lapse rate of 1.98°C per 1000 ft. up to a height of 36,000 feet after which the temp. remains constant at -56.5°C .

Wind Speed and Direction Finding by Three Gauge Method.

Before taking of obtain Ground Pressure, Alt operational height obtain temperature, indicated height, and indicated wind speed. Compute for True Aft. and True Height.

Set true Aft., energy speed to zero, and wind speed to maximum. On any course adjust for drift, level sight. Release verge ring and set red on red, then release Low wind gauge bar, with yellow grease pencil through the hole in the cursor draw a line down bearing plate. Alt. course 60° to port or starboard and repeat operations. Alt. course 60° in same direction or 180° back in opposite direction and repeat operations.

The three lines should all cross in same place, but generally they form a cocked hat. Mark the center of the cocked hat (wind point). Release verge ring and put tail of wind direction arrow ~~over~~ the wind point and release. Wind Direction is now determined. Rotate compass bar until wind arrow is at right angles to the air speed bar. Lower wind gauge bar, and with milled knob wash off wind speed until hole in cursor is over the wind point. Wind speed is now set.

Low Level Bombing.

The four scale is ignored for either the first or second pair of beads on the drift wires. Attack is always made into wind, therefore by subtracting wind speed from air speed the ground speed is obtained. The height is always set on the red scale. This height is ~~found~~ found from a low level bombing graph which has the line marked in actual height, and the vertical scale in height to be set on the sights, and then an ground speed circles marked on the graph ranging from 120 to 280 mph.

eg.



There are different graphs for bombs above 1000 ft. see T.V. and 200-1000 T.V. There are graphs for same T.V. used with a 1/2 ft. range in knots.

Bombs

A bomb is a container for high explosive, smoke or incendiary mixture together with the means of detonating or igniting it.

Bombs are classified under the following headings:-

- i. General Purpose
- ii. Remote Picking
- iii. Semi Remote Picking
- iv. Anti-submarine
- v. Practice Bombs
- vi. Incendiary
- vii. Smokey Bombs

High Explosive: body is filled with H.E. material, and may have a heavy or a light case.

1. Fragmentation
2. General Purpose
3. A.P. and S.A.P.
4. Anti-submarine.

General Dr. Diagram.

NATURE OF BOMB	COLOR OF BAND	POSITION OF BAND	DEFINITION.
FILLED WITH EXPLOSIVE.		ROUND NEAR MOUTH	ANALOGY, PARADOX.
DESIGN OF T.M.T.	GREEN	DIAMETER OF BODY	OR T.M.T. BOMB.
ANTI-SUBM. BOMB	RED	ROUND NOSE	WING IS FILLED.
S.A.P. BOMB	WHITE	NEAR THE BAND	S.A.P. BOMB.
A.P. BOMB	WHITE	FOR THE 100 YD. BOMB	A.P. BOMB.
BOMB CASE		THE NOSE OF BOMB	INCENDIARY
WITH JARILLITE	GREEN	BACK TO THE MOUTH	FOR THE

Practice Bombs With Smoke

Bomb bodies painted white. When filled they have two green bands around the tail, also two green bands round the box.

Practice Bombs With Flash

Bomb bodies painted white. They have a red band around the nose and two black bands around the tail, also two black bands around the box.

Bomb Components are those parts which have to be inserted to a bomb when preparing it for dropping:-

- (a) Pistols
- (b) Detonator
- (c) Mechanical fuses.

(a) Pistols are mechanical devices containing a striker which will impinge on the cap of the detonator when the bomb strikes the ground. There are two patterns nose and tail.

The Detonator contains a small quantity of sensitive explosive which detonates when struck by the pistol striker. Generally ignited in same way as cartridge by a charge of fulminate of mercury.

As Mechanical fuse - designed to function the bomb on contact with the ground. Contains an explosive charge and combines the function of the detonator and pistol. The only one in use is the No 37 used with 200 lb G.P.

Explosive System

1. The used to obtain detonation is a main bursting charge. A small quantity of the initiator such as fulminate of mercury or lead azide which is detonated by shock through the medium of the bomb pistol.

2. A larger quantity of a less sensitive intermediary such as composition exploding which is initiated by the detonator. Explosives are built in all modern bombs and are never removed.

3. The Main Filling of a bomb, very insensitive such as T.N.T. which is initiated by the explosive.

Detonator

Consists of a thin copper tube attached to which is a large brass head. The tube contains a detonating composition together with delay composition if it is a delay detonator. The brass head houses a percussion cap, and is hollowed out to fit the end of the pistol and has a groove cut around the inside into which the hooked

side of the Detonator Extractor Rod can be fitted when removing the detonator from the bomb. The delay composition is situated between the percussion cap and the detonating composition proper in the copper tube. Detonators are marked with a colour band around the head to denote the time of delay. A label is also stuck inside the head which also bears the time of delay together with the number of the detonator.

Pistols

Ross

No 29 (Obsolescent).

No 32 Used in 20 lb F. and 100 lb G.P. with parachute.

No 38 Used in 20 lb F. and 40 lb G.P.

No 27 Used in 250, 500 lb (Mk III) & 1000, 1500 lb (Mk I).

No 1922 Used in Mk III and Mk VIII Depth Charges. It is operated by hydrostatic pressure and functions under a pressure of 20.5 - 22.3 lbs per sq. inch. Depth setting can be 50 ft, 100 ft, or 150 ft. The Mk III is a 50 lb & Mk VIII 250 lb bomb with small fuzing.

Testing Ross Pistols

1. See that body thread is clean and undamaged.
2. Remove Safety pin.
3. Remove Pressure Plate Key (Safety fork).
4. Remove safety cones or remove cone in No 32 pistol, and see that they rotate freely.
5. See that shear wire is present and in good condition.

by the pressure plate is attached to the stick.

3. Assume strike point for damage.

4. Assume and ensure when filled that the only binding stops on the dome and pressure plate are efficient.

Tail

No 23. Used in Navigative Smoke Float. Ensure that red band is visible on body thread.

No 24. Used in -

NO 25. 1900, 200 lb. Mk I G.P.

2 300, 250 lb. Mk IV G.P.

4 250, 500 lb. Mk IV G.P.

10 500, 250 lb. Mk IV G.P. (when used as load bomb)

Mk IV has plastic body.

No 26. Sharper strokes with groove above looking spring. Used in A.S. 100, 200, 500 lb. Mk IV. May also be used in any bomb when sensitive initiator is required.

No 27. Replaces No 17. in 5 classes namely:-

27 - 6 hr. delay.

27a - 12 hr.

27b - 36 hr.

27c - 72 hr.

27d - 144 hr.

39. Detonator used only.

Markings on Bombs.

NATURE OF BOMB	COLOUR OF BOMB	POSITION OF BAND	IDENTIFYING.
PAINTED WITH AMMONAL		ROUND MAXIMUM	AMTEL, BACTEL.
PAINTED OR T.M.T.	GREEN	DIAGONAL AT REAR	OR T.M.T. LAUNCH
ALL PILED BOMBS	RED	ROUND MIDDLE	BOMB IS PILED
LOAD BOMBS	WHITE	ROUND REAR BAND	I.R.P. BOMB
R.P. BOMB	WHITE	ROUND REAR OR REAR BAND	R.P. BOMB
BOMBS FORCED		ROUND MIDDLE OR RE	
WITH SODIUM	GREEN	MAXIMUM DIAMETER	EXPLOSIVE FUELING

Practice Bombs with Smoke.

Body painted all white. When filled they have two green bands around the tail, also two green bands around the box.

Practice Bombs with Flash.

Body painted all white. When filled they have a red band around the nose, and two black bands around the tail and the box.

Training Bombs.

Body is painted all black with a yellow band around the maximum diameter.

Intermediate Bombs (all except with).

Body painted dull red with 1 1/2" black band around the nose, and above the black band a 1/2" bright red band is painted.

General Requirements

Method of Stowage	Number of Bombs	Position of Stowage	Remarks
Box 10/10	Bomb Filled	Between Two Green Bands	Barrel
	With Barrel	Bands in Three Places	Filling
Box 10/20	Bomb Filled	As Above	Barrel
	With Barrel		Filling
Trunk	Bomb Filled	On Green Bands	T.M.T.
	With T.M.T.	In Three Places	Filling
G.P. 220 (or any other G.P.)	Full	Between Red and Green Bands	Non-charge of Bomb
Any Material			Chk. of Bomb
Label or Trade Mark			Name of Firm or Filling Station
Any Date			Date of Filling
Any Number			Gross Weight of Bomb with Vines but without Components

Incendiary Bombs

25 lb. 250 lb. and 10 lb.

Bomb Carriers

Requirements

Bomb carriers should be light, strong enough to stand strains, hold the bomb rigid in all directions. Reliable in action, have instantaneous release, and be easy to install.

Type

- a. Light Carrier (Electric Magnetic)
- b. Universal (E.M. L.T. Nos. 1 & 2)
- c. Cradle Bomb 2000 lb. E.M.

a. Stores Carried

- i. 4 15 lb. Practice Bombs (Hast & Lums)
- ii. 4 25 lb. Incendiaries
- iii. 4 20 lb. H.B.
- iv. 4 20 lb. T
- v. 4 40 lb. G.P.
- vi. 4 4" Torpedo Glass
- vii. 4 4" Reconnaissance Glass
- viii. 4 Signal Pistol
- ix. 1 Lamp Signalling Pistol Load
- x. 4 Aluminium Sea Marker
- xi. 4 Smoke Float Navigation

250 lb. Small Bomb Carrier

No. of Firing Base	No. of Bombs	Type	Letter	Quantity
No. 1 R.F.	12	200 lb.	C	1
No. 2 R.F.	6	400 lb.	B	2
No. 3 R.F.	6	400 lb. Inc.	B	2
	8	300 lb. L.F.	A	2
	2	250 lb. Inc.	A	2
	8	350 lb. Inc.	A	2
No. 1 R.F.	60	50 lb. Inc.	D	3
	24	250 lb. Inc.	C	3
	3	300 lb. Inc.	B.D.G.	1
	3	650 lb. Inc.	B.D.G.	1
	6	"W" Bombs	C	3000 lbs

One selector box is wired in series, numbers must be selected. If in parallel all release units will be operated at once.

Preparation of Universal Carrier for Attachment of S.B.C.

1. Remove plug from carrier to a/c supply pin (3 pin).
2. Turn bow from carrier and stowed in stowage position in top channel of universal carrier.
3. Fit adaptor box to front end of firing channel.
4. Plug adaptor box lead to a/c supply (3 pin).
5. Plug lead from carrier to rear end of adaptor box.
6. Raise crutcher to highest position.

⑦ Hook and test E.M. unit of carrier.

⑧ Test unit by pressing H-type plunger seated.

⑨ Be cock and test unit ready for loading and B.C.

Universal Carrier

No. 1 mks 2 + B = 50.2250 lbs. } mks strengthened for carrying
No. 2 mks 2 + B = 50.6550 lbs. } from ships.

Also carries S.B.C. mks 2 + B (carry up to 3000 lbs). Also supply dropping apparatus.

Loading

1. Ensure all switches are off.
2. Lock the unit.
3. Ensure release clip is unseated.
4. Operate test plunger and re-cock.
5. Raise front and rear crutcher to highest position.
6. Ensure that rear crutcher pads are in the correct position for the stores to be carried.
7. Raise the bow till its suspension lug engages the lug on hook, and swing it to the cocked position.
8. Move on the adjusting screw until the crutcher pads rest tightly on the store, holding it parallel to the carrier.
9. Ensure that the firing unit are in correct position.
10. Attach the fuse setting control links as required to the firing components of the store and insert the tips of the fuse setting control links into the abt. of the firing unit.
11. Ensure that appropriate safety devices are removed and headed and headed to Bomb Arm before take off.

Testing the Carrier.

1. Cock the unit and operate test plunger.
2. Raise the controls to the highest position.
3. Load the carrier with a dummy bomb the equivalent weight of the stores to be carried. If no dummy bomb is available the release can be tested by engaging a ~~dummy bomb~~ ^{safe} on the bomb hook and swinging on it.
4. Lock the unit.
5. Insert fuse setting control links in the slot in fusage unit and ensure that it enters fully.

Bombing Errors.

In operation Laplay and errors are increased by:-

- a) Lack of oxygen
- b) Fatigue
- c) Bad weather conditions.
- d) Bad bombing position
- e) Barometric flying by pilot.
- f) Hang ups due to faulty release gear.

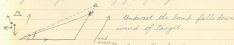
Systematic errors are those due to instrument settings on the sight caused by:-

- a) Incorrect computation
- b) Faulty Instruments.
- c) Careless setting of sight.

These are divided up into three groups:-

Group A.

- a) Wind speed error - bomb will be set up wind of target owing to oversetting of drift angle.



$E = at$ when $t = \text{error}$ as in difference between set and true wind & T is time of fall of bomb.

Disassembly Mch 2

Caliber .303

Rate of fire 1000 rounds per minute

Belt fed - continuity of feed

Length with flash eliminator 3' 8 1/2"

Length of barrel 2'

Rifling - Lee Enfield - left hand thread - five grooves - 1 turn in 10"

Weight 31 lb. empty

Weight with loading mechanism and trigger motor 32 lb. 10 oz.

Ammunition all types of Mch. 201 A.B.C.

Light - reflector 50 mph. relative speed

Loading by siphon over barrel and flash eliminator

Moving Platform

1. Barrel
2. Barrel extension
3. Breach block

Sequence of Stripping

1. Remove Flash Eliminator
2. Remove Base Plate
3. Remove Return Spring
4. Remove Breach cover and remove locking stud the Breach Block.
5. Remove locked frame and barrel assembly, then separate locked frame from barrel extension.
6. Separate barrel from extension.

Remove Barrel locking spring

a. The only authorized tool at all times. No necessary force to be used. Muzzle attachment must never be removed. Know that gun is unloaded and breach block is in the forward position.

Reassembly

1. Raise breach cover
2. Reassemble barrel locking spring and locking pins to the extension.
3. After barrel and barrel extension have been separated, connect breeching up is secured out before assembling locked frame to barrel and barrel extension.
- a. When assembling barrel, barrel extension and locked frame:

- a. Rear rear release unit is engaged at the same time.
- b. Rear rear is depressed to show rear rear lock from the bottom plate.
- c. Barrel is steady to prevent damage to barrel and bearings.

- a. Reassemble breach block with rear lug on reverse side for fine and safe mechanism.
3. Locking stud is assembled on same side as loading mechanism.
- b. Trailing pin is cocked and cocking lever is forward until barrel etc. and breach block are fully forward.

2. Replace return spring, and back plate
3. Close breech cover.

Feeding.

Feed lever comprising feed lever and barrel, feed fall, and feed-fall extension which are joined together and moved laterally in the feed slide, the belt extender, cam grooves on breech block together with the switch plate and plunger, and the two pieces on the feed platform known as the cartridge and bullet slots.

Barrel Group.

1. Barrel and Barrel Extension:-

1. Trunnion and rear barrel bearings and the barrel locking notches.
2. Ejector top and side clearances, and the bullet guide.
3. Breech block guide grooves
4. Barrel locking spring.
5. Trunnion and left flange (serves same purpose with Trigger Motor Push Rod).
6. Locking piece, and locking piece pin.
7. Locking cam grooves.
8. T shaped projection and stud
9. Ejector guide ribs.

Barrel Block

1. Transporter:- down - ejector - slow - transporter plunger and spring, transporter cam pin.

2. Switch plate and switch plate plunger.

3. Locking lever & pin.

4. Back spring return - keeper

5. Back spring return pin

6. Back spring

7. Back return

8. Back

9. Timing pin - back - spring - striker

10. Base of breech - firing pin hole - cartridge rim guide (retained)

11. Top of breech block - cam grooves, switch plate housing

12. Right - return spring housing - cocking stud housing and pin (also on left).

13. On both sides - breech block guide ribs and fire and safe clearances

14. Underneath - firing pin housing - locking screw - bent or accelerated surface.

Locked Frame.

Right and left side plates intend to form the frame joined by two cross pieces on top and bottom called separator. In front is the accelerator, barrel return spring which fits inside rear seat buffer spring which bears against the rear seat crossbar. On left hand side is return spring plunger, and at rear is locked frame return. On right is situated accelerator stop. Sides are spaced by two separator above and two below. Rear seat moves synchronously with the rear seat. Back plunger and spring are situated below rear seat.



Backward Movement

Breech Action

On the round being fired the pressure of the gases and the force of recoil act on the muzzle end of the barrel and the face of the breech, respectively, causing the moving portions, namely the breech block and barrel assembly to move to the rear.

Unlocking of Breech Block

After the moving portions have moved off from the prongs of the locked frame engage the locking piece now pin forcing the locking piece out of engagement with the locking recess on the underside of the breech block. At the same time the locking piece is moving to the rear with the barrel extension and downwards along the inclined surface of the locking cam.

Backward Rotation of Accelerator

The rear surface of the barrel extension engages with the claws of the accelerator rotating the accelerator backwards until it comes into contact with the accelerator stop on the right hand side of the locked frame. The upper surface of the shoulder of the accelerator engages inside the T shaped projection locking the barrel

extension and locked frame.

Backward Movement of the Breech Block

Breech block moves with the barrel extension until the locking piece is disengaged, then as the accelerator is rotated backwards the tip of the claw engages the accelerator surface on the underside of the breech block causing the breech block to 'overtake' the barrel assembly and to be forced fully to the rear, overcoming the pressure of the return spring until the bent engages with the rear seat, so long as the trigger is not pressed.

Backward Action of the Transporter

In the forward position the transporter engages the rear round centrally positioned on the feed platform. The claw gripping the rim of the cartridge and the spring acting as support. As the breech block moves to the rear the transporter is held in engagement with the round by the pressure of the transporter guide spring. The transporter plunger bears along the upper surface of the transporter guide situated on the inside of the left side plate of the body. As the upper surface of the boom commences to engage the ramp the transporter plunger is depressed by the chamfered surface of the transporter guide and the steeply sloping surface of the transporter ramp forces the transporter downwards, carrying the round onto the face of the breech block. The transporter plunger

the spring out and engages with the head transporter guide thus preventing the transporter from rising whilst its downward movement is limited by the transporter stop on the left side of the breech block.

Ejection and Ejection

As the breech block moves to the rear the empty case is withdrawn from the chamber by the cartridge pin guide gripping the base almost to the limit of the backward movement the new round being forced out of the face of the breech block displacing the empty case which is ejected through the bottom of the gun.

Cocking Action

The cocking lever is engaged in the cocking lever bracket and as the breech block moves to the rear the cocking lever rotates forward. The nose of the cocking lever engages with the firing pin forcing it to the rear and compressing the firing pin spring. The head on the firing pin displaces the star wheel spring back to its original position on completion of the cocking movement.

First Action of Belt Feed

The feed lever stud is engaged at the rear end of the appropriate cam groove on top of the breech block. While the breech block moves to the rear the feed lever stud moves laterally thus rotating the feed lever about its head and causing the slide to move inwards. The feed roll on the slide is depressed as it rides over

the next round in the belt and springs up again under the influence of the feed roll spring so as to engage behind the next round. The feed roll extension ensures that one round only is selected. The belt retainer roll prevents the belt from being pushed off the platform during this movement of the feed roll.

Forward Movement

Action of Return Spring & Buffer

The return spring is fully compressed and forces the breech block forward, being assisted by the recoil imparted via the buffer.

Second Action of Belt Feed

The feed lever stud is lying in forward end of the appropriate cam groove and is moved laterally while the breech block moves forward. The feed lever is rotated about its head and the slide moves inwards. The next round in the belt being engaged by the feed roll and selected by the feed roll extension is drawn inwards and positioned centrally on the feed platform its movement being limited by the cartridge and bullet stops. At the same time the remainder of the belt moves through the same distance and the belt retainer roll is depressed as the next round passes over it rising again under the influence of its spring to hold the belt in position.

Return of Cocking Lever.

The cocking lever is engaged in the cocking lever bracket and rotates backwards during the forward movement of the breech block, the nose of the cocking lever being withdrawn from engagement with the firing pin and the rear engages the heel of the firing pin supporting the pressure of the firing pin against forward motion of transporter and feeding of round.

The transporter (ejector and claw) is supporting the round on the face of the breech block the cap being opposite the firing pin hole and the bullet being in line with the chamber. During the forward movement the transporter now rests on the transporter stop and the transporter plunger engages with the lower surface of the transporter guide until it reaches the transporter cam. The transporter now rises, the ejector being brought out of engagement with the round (round now being supported by walls of chamber in barrel). In being withdrawn the ejector must swing outwards against the pressure of its spring and is permitted to do so by the ejector side abutments on the barrel extension. The transporter continues to rise up the cam until the pressure of the transporter guide spring secures its engagement with the new round. At the same time the round on the breech block is fed fully home into the chamber.

Forward Rotation of the Accelerator.

The accelerator is tripped by the accelerator surface engaging the tips of the claws then disengaging the upper surface of the shoulder from the T shaped projection of the barrel extension and allowing the barrel return spring to exert its pressure against the T shaped projection and shove against the lower surface of the accelerator shoulder. Thus the accelerator rotates by the pressure of the barrel return spring against the shoulder, and the tips of the claws moving through the same angle but with a greater radius engage on the underside of the breech block causing it to overtake the barrel assembly.

Locking of the Breech Block.

The barrel assembly moves forward then the locking piece moves out of engagement with the prongs of the locked pawl. The locking piece now ascends over the inclined surface of the locking cam and engages with the locking recess in the breech block which has been brought into position by the acceleration of the breech block.

Timing of Loading.

At the termination of the forward movement, a slight interval after the locking of the breech the rear is tripped by the Tim and Safe mechanism or Trigger Motor Rail Rod. The firing pin moves forward under the influence of its spring when the heel is disengaged from the rear and the striker protrudes through the firing pin hole out the cap of the cartridge.

Operation of the Rear Seat

As the trigger mechanism being released the rear seat bar is released thus allowing the rear seat to rise. Thus following the rear seat) in the backward movement after the controls have been released the rear seat is depressed by the rear end of the breech block and immediately rises again to engage with the bent. The shock of engagement between the breech block and rear seat is absorbed by the buffer spring.

Breaching Up

Breaching up is then applied to the correct positioning of the breech end of the barrel in relation to the front of the breech block, and when the locking piece is fully engaged in the locking recess.

1. Have breech cover, remove back plate and return spring
2. Remove breech block and withdraw receding portions until barrel locking notches are about 2" clear of the gun side plates.
3. Remove locked frame.
4. Disengage barrel locking spring and with spring on barrel extension
5. Raise rear barrel to top
6. Remove from breech block transporter, insert plate finger, cocking lever and pin, and cocking lever.
7. Reassemble the breech block in this condition to the barrel extension.
8. Rotate complete assembly through 180° and ensure

- the locking piece is fully engaged in the breech block.
1. Have barrel in until breech end bears against the front surface of the breech block.
2. Engage barrel locking spring in appropriate notch. As 3/4 inch does not register with spring ensure barrel sufficiently to enable it to do so.
3. Return assembly to gun and test breech block for movement.
4. Reassemble gun.

Changing of Feed (for left hand feed)

1. Feed bar plunger and spring to rear of feed when breech cover is down.
2. Feed fall is on left of slide.
3. Feed fall extension to rear of feed fall when breech cover is down.
4. Bulb & cartridge stops on right
5. Ball returner fall on right
6. Tilling piece on right.
7. Piece of groove in switch plate to let in on breech block.
8. Ejector on right of transporter.

Loading Gun

1. Be that gun is set to safe
2. Ensure cocking stud is in forward position
3. Have breech cover.
4. Engage first round of belt over ball returner fall

ensuring ball is smooth side up.

2. Close breech cover and cock the gun.

3. Release breech block by means of rear seat release unit (put trigger ^{not to safety} to fire).

4. As cock gun, the gun is now ready to fire.

STOCCAGE

RESULT	CAUSE	REMEDY
Block Position:- Immediate Action:-	Looking dead at fully forward end of slot. cock gun and fire, watching the feed.	
1. Gun fires	mis-fire, defective ammo	
2. Feed takes place but does not fire	a) Does not faulty firing pin or spring b) Bolt or breech slips in firing pin or way in breech block c) Defective fire control mechanism or insufficient pressure in system	a) unload, change firing pin or breech block b) clean or change breech block. Reload continue firing. c) Examine and test fire control mechanism.
3. Gun does not fire feed does not take place	a) Defective transporter b) Defective feed-pulling spring c) Defective retaining pull spring	Unload, change defective part and continue firing.

RESULT	CAUSE	REMEDY
Block Position:-	Angle of release, fully forward + fully back position.	
Immediate Action:-	Cock gun + fire.	
1. Gun repeats stoppage	a) Transporter fails to lift due to defective plunger or spring b) Loose link jammed in feed way	unload a) change transporter, reload + continue firing b) clear link, + ensure full ball is undamaged Reload etc.
	c) Bore-fed due to restriction in feed way may also cause stoppage in front position. d) Separated bore	e) Adjust ball, clear the thrusting. Be avoided by correct fitting of links + positioning of barrel in ball sl. If exception is indicated bore barrel will showing plug, unless it is brought out by round or breech face Reload etc.
Block Position:-	Fully back	
Immediate Action:-	Cock the gun and put rear breech cover down gun, operate rear seat release unit. Close the breech cover. Cock gun and continue firing.	
1. Gun fires	Defective ammo. Empty case and extracted from breech block	OK
2. Gun repeats stoppage	a) Defective breech block b) Defective ejector	Unload + change defective part Reload etc.

Navigation

The Earth's axis is a line between the N. and S. poles on which the Earth rotates.

A great circle is a circle made by a plane passing through the center of the earth. Its radius is also the radius of the earth or half its Circ.



There are several kinds of great circles.

1. All circles which pass through both N. and S. poles and are called Meridians.

2. The equator is a great circle (circles parallel to the equator are not great circles but are called Parallels.)

Meridians - If you travel either north or south on two different Meridians your tracks are not parallel.

e.g.



It is (difficult) impossible to represent accurately any part of a sphere on a plan. surface. All maps are therefore distortions, but they are distortions to a certain set rules and are chosen each for a specific purpose. Except on a Mercator (also c) projection the meridians are straight lines which converge towards the nearest pole and the parallels are concave curves to the nearest pole. (Not used

for maps of great circles).

e.g.



Between any two points on the earth's surface a great circle is the shortest distance, because a great circle is the largest circle that can be drawn on the earth's surface and is therefore nearest a straight line.

Latitude

The latitude of any place is the arc of the meridian measured from the equator to the place or it is the angle at the centre of the earth between the radius to the place in question and the plane of the equator and is measured in degrees, minutes, and if necessary seconds. The letter N or S must be placed after latitude to signify whether North or South of the equator.



On the surface of the earth, G is the point in question, X is the point on the same G.C. as G and is on the E.C. formed by the equator.

$\angle GXC = 40^\circ$

Point G is (40°) N in latitude.

But it is impossible to measure the angle at the centre of the earth so that the arc along the meridian is measured and this with a

knowledge of the circumference of the earth will give us the required angle in the following manner.

$$\frac{\text{Arc}}{\text{Circumference}} = \frac{\text{Angle}}{360^\circ} = \text{Angle}$$

One 1° of latitude is the arc of a great circle subtended by an angle of one degree at the centre of the earth it follows that all degrees of latitude will be the same size. H.E. the measure that the earth is a perfect sphere. A minute of latitude is one nautical mile (approx).

On the diagram P & Q are in the same latitude.

Longitude

The longitude of any place is the smaller arc of the equator cut off between the prime meridian and the meridian through the place. It is always marked E or W according to its position in relation to the 0° Meridian (prime). It is really the angle at the centre of the earth between the radius to the point where the prime meridian cuts the equator and the radius to the point where the meridian through the place in question cuts the equator, like latitude however it has to be measured by the arc.

Change of Latitude

From one place to another is the arc of a meridian intercepted between the parallels of the places e.g. going from $54^\circ 30' N$ to $74^\circ 51' N$.

Lat 5 $54^\circ 30' N$

Lat 7 $74^\circ 51' N$

Ch lat $20^\circ 21' N$

Rule: same polar direction, unlike poles repel
 eg. N & N in place 11 N & S in place 5 or S & N in place 11
Change of Longitude

It is the small arc of the equator intercepted by the meridians of the places.

eg. Find arc long from $40^{\circ}20'N$ to $15^{\circ}30'E$

Long $40^{\circ}20'N$

Long $15^{\circ}30'E$

Alt long $55^{\circ}50'E$

Rule: same as alt but only direction is $E-W$

If a bar magnet is suspended freely one end points to the Earth's North Pole. This is called the Red or North-seeking Pole. The other end is the Blue or South-seeking Pole.

Like poles repel, unlike poles attract.

The Earth as a Magnet: The earth has the properties of a normal magnet, but what we call the North Pole is really a Blue pole as it attracts the Red pole of a magnet.

The magnetic poles do not coincide with the ends of the earth's axis. Approximate positions are N pole $71^{\circ}N$ $26^{\circ}W$ and S pole $71^{\circ}S$ $155^{\circ}E$.

Magnetic Meridian: the magnetic meridian at a place is the line taken up by a freely suspended magnet in the earth's field at that place. This is obviously not the same as the true meridian except where by chance the magnetic pole and the true pole lie on the true meridian through the place.

Since the method of finding the meridian through a place must be done by compass or on a map it is necessary for us to know the angle between the Magnetic Meridian or that which is found by the compass and the true Meridian from which all bearings are measured. Variation: the above mentioned angle is called variation and is shown on maps and charts by these methods.

1. Isogonals or lines of equal variation.
2. A double compass rose.
3. Statement or diagram on the margin of the map.

Variations may be of two kinds

as Westerly



or Easterly



Easterly Variation Variation east, magnetic least.

eg. Bearing $88^{\circ}(M)$ variation $10^{\circ}E$

$\therefore$ Bearing (T) 98°



Westerly Deviation Deviation West, magnetic East



Deviation

The magnetic needle in an aircraft attracts the compass needle causing it to deviate from the magnetic meridian. The deviation varies according to the direction the aircraft is pointing.



R. & T. Form 315 (Plot Deviation Chart)

True Bearing	Dev. & Variation	eg. true (a) 050 Landmark Portland Bearing (b) 056 True Deviation Bearing (c) Variation and Bearing (d)
N 050	3.5	
NE 045	0.1	
E 050	1.5	
SE 055	0.3	
S 050	0.3	
SW 055	2.3	
W 050	3.5	
NW 045	3.5	
N 050	3.5	

Bearing

The true bearing of an object from a station is the angle at the observer's position between his meridian and the great circle joining his position to the object. This is sometimes called a great circle Bearing. N.B. YOU CAN'T GET A GREAT CIRCLE BEARING ON A PLOTTING CHART.

A great circle does not cut meridians at the same angle for each meridian.

Rhumb line

A rhumb line is a line which cuts all meridians at the same angles. Mercator's Bearing is that angle that an observer takes from his meridian to a rhumb line joining his position to the object.

R. & T. Bearings are great circle Bearings - so to plot on a plotting sheet they must be converted to a Rhumb line. N.B. a great circle bearing on a Mercator chart is a curve converging to the nearest pole.

Mercator's Chart is a modified cylindrical projection in which the meridians are parallel straight lines and the parallels are the same increasing in distance apart as the poles are approached. This leads to great exaggeration in size towards the poles - eg. Greenland appears larger than India, but all the angles are correct. On Mercator's chart Rhumb lines are straight lines and by b. curve towards the nearest pole Home and Land.

The course of an aircraft is the horizontal angle from the meridian passing through the aircraft to its longitudinal

view. The course is the angle between the meridian and the way on aircraft points, as long as there is no wind there is not the way the aircraft travels in relation to the ground.

The track of an aircraft is the horizontal angle from the Meridian passing through the aircraft to the line representing the direction in relation to the ground along which it flies. The track is its direction over the ground. It is shown represented by a single arrowhead about mid-way up and track a double arrowhead.

Bearing, Distance, and Track can be expressed as True (T), Magnetic (M) or Compass (C). It should be added that all positions are to be recorded as (T).

Maps

No part of the surface of a sphere can be reproduced accurately on a plane. A map projection is an orderly construction to represent meridians and parallels on a plane surface.

The method of projection is chosen to meet the special purpose for which the map is required.

Scale of a map is the relation between a distance on the Earth and the length of that distance as represented on a map. It may be represented in the following way.

(a) A statement in words e.g. one inch to one mile or large scale maps are often named to the ground unit of scale e.g. 6" and 6" maps mean 6" and 6" represent 1 mile respectively.

(b) Representative fraction e.g. $1/500,000$ - the fraction has the map distance as numerator and actual distance as denominator. Maps in the R.A.F. are generally

scaled in this manner the chief fraction being $1/500,000$, $1/500,000$, $1/500,000$.

(c) A graduated scale line.

The scale of a map determines the amount of detail that can be shown e.g. a road which appears to have many bends on a 6" map would probably be shown as a straight line on a 2 1/2" map.

Relief Methods of showing:

1. Contours and form lines

2. Hachuring

3. Hill shading

4. Layer Tinting

5. Spot Heights

Hachures are lines drawn down the direction of the steepest slope, the steeper the slope the heavier and closer together the lines.

Hill shading, similar to hachuring it assumes that light can cast a shadow on the face of the mountain despite the shadow, steep the hill.

Layer Tinting is colouring between the contours - similar to contour lining.

Spot Heights are definite heights shown in figures on a map.

Angular Requirements

131 *Fagelia* *fulva* will probably arise 1/200,000

The Bombardier will probably use 1/100,000 plotting map or 1/500,000, the 1/100,000 or 1/500,000 type graphical map.

May 20, 1902

$$i^* \text{ Pulling map } (g \text{ and } g \text{ and etc.)} \text{ eval } i^* \text{ process}$$

2, 1/200000 Topographical Map (G. I. G. 2731)

a 1,500,000 Topographical of the British supplemented by
topographical of 200,000 of Europe.

4. 1/200,000 map of Europe (5-15 (1912))

by the late H. P. map of J. A. Borden.

2. Community Alerts

1. Specially prepared target maps (generally photographic reproductions).

4- Plotting Sheet - the map is a black outline on a Mercator projection. Its reference number is given as the latitude and longitude of its S.W. corner e.g. the map of England and Wales & N.W. Europe is called Sheet No. 48-14. Little detail is shown, it is kept clear for plotting purposes. Things are shown boldly, coastlines, frontiers, important towns and cities. S.T. stations are shown by name in abbreviated form e.g. SW for Southampton. Marine lights, and hill peaks and some spot heights are shown roughly. A minute gridwork is shown on every map (network of large and bold) so that topographical details can be found easily by cross references. Spot heights are shown for each degree of variation.

and compass roses are shown over sea areas. The scale of the map is 1:500,000 or 18" of scale of Statute miles are printed on each side of every sheet. The latitude & longitude scale being available for Nautical Miles. Distances may be measured with reasonable accuracy provided the scale opposite the two points between which distance is required is used. To find the portion of the scale to use

we find the mid - latitude of the two points

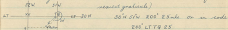
Place divider in the point on the scale and spread then approximately half the distance on each side of the mark to make the whole distance. If the distance is over 50 miles spread 25 miles either side and apply the remaining distance as before up to 100 miles.

Monstrous Chart. - on a Monstrous chart the meridians are straight parallel lines, instead of meeting at the poles. As the poles are approached the relative area of land masses are not increased. The shape and size are altered, but the correct angles are retained. This causes the scale of the map to be changed as to the different latitudes. For latitude it's the scale is 1/1,000,000, and this is taken as a standard for all Monstrous Charts. Since the longitude scales are - as the same at the poles as at the equator, the longitude scales are not very good for measuring distances only on the equator. All rhumb lines are straight lines, and all great circles are curved to the nearest pole. If a great circle bearing is given this must be converted to a Rhumb line.

Method of Reporting a Position

Latitude and Longitude are used generally for reporting position, but owing to time conditions a code must be used. Bearing, landmark, and distance can also give the position. e.g. An aircraft is 27 statute miles south of North Luffham or 180° 00'00" 27 (Place names must be given in capitals, and bearing in three figures e.g. 090°)

For finding position the graticule is used. (rectangle made by 1° lat 1° long)



Naval method would be (take from nearest graticule)

24° 52'N 25° 00'W or in code
24° LT 28 25

R.A.F. method would be (lat long take from 5W corner the minute coming after, lat min first and long min last).

24° 52'N 25° 00'W or in code
2455 2848.

The code letters for each degree of lat and long are changed each day, the Navy and the R.A.F. using the same code.

Abbreviations

airspeed = $\frac{1}{2} \frac{1}{2}$ Speed of the aircraft relative to the air.

Ind = $\frac{1}{2} \frac{1}{2}$ The angle between the meridian and the line representing the passage over the earth. $\frac{1}{2} \frac{1}{2}$ is the speed of the aircraft relative to the ground.

Wind Velocity or $\frac{1}{2} \frac{1}{2}$ Speed and direction of the wind over the earth surface.

Bearing is the angle between track and course, measured to port or starboard relative to the aircraft head.

Map Reading

Maps are not made specially for the R.A.F. but are Ordnance Survey Maps or Admiralty Charts adapted for A.F. use. A man on the ground has a small field of vision therefore goes into more detail, but in the air this is a wide range of vision therefore the detail is less. Using a map for travelling or not to remember each detail, but the relationship between such details.

Good landmarks are:

- a) Water (good angle and day)
- b) Railways
- c) Woods (show up as masses of colour & definite shape)
- d) Roads (not too good)
- e) Towns (shape or by the position in regard to other features).

Mark a black - as marks

- a) Roads and rails
- b) Lightships, large buoys
- c) Stone marks
- d) High houses & large buildings on the coast
- e) Cliffs (noted)

Map reading is not accurate at night as details cannot be picked out easily, and the moon cast funny shadows altering and even putting in places & landmarks.

about wind direction. Rainy, and water (river, lakes, something) are best at night.

Use of Map

(1) In a topographical map, don't take the edge of map to indicate time etc.

(2) Read marginal note, noting scale, distance and gear of journey (any necessary amendment should be made either in old or for permanent and pencil for temporary).

Always note the greatest height when going from one place to another.

WINDS	LANDMARK	Dist. - Indicated	DIRECTIONS.

Below is a practical table for tabulating a cross-country flight for map-reading.

Time and Speed scales

1 mile = 5280 x 12 inches

In a map of scale of 1:50,000 this is represented by

$\frac{5280 \times 12}{50,000}$ inches

At a speed of 120 mph, 10 miles are covered in 5 mins. Below could a map in 5 mins. in $\frac{5280 \times 12 \times 5}{50,000} = \frac{1,584,000}{50,000} = 31.68$ inches. from this calculation the distance for any time for any speed can be found.

ie 240 mph is represented by 3.17 inches for 5 mins travel

Barometric Indicator



The pressure of the air varies as we rise, but this has no effect on the reading of the Barometric Indicator, because the pressure inside the capsule (the bar) is kept the same as outside by the static head. The density of air also varies as the height, and this decrease in density means that the pressure of the moving air will decrease, causing the uncorrected indicator to read low.

Corrected Indication (see also Chap. 7, Para. 2.1)

The density of air depends on two things, one pressure, and the temperature.

The approximate way of correction is to add 1 ft. of indicated airspeed for every 1,000 ft. above sea level.

2. The Wright & Simpson Computer, used by, setting Barometric Pressure, Temperature, Indicated Alt at 1, & the Correct Alt is indicated at 2.

There is still one more, that of the position of the pressure head, which by reason of its being on the plane must be influenced by the current set up over the aerofort. The position varies on the same although for one make of plane. ie. Alt. Indicator are calibrated at 1000 ft. mean (mean sea level pressure) $\pm 15^\circ \text{C}$.

1000 - 300 ft. 1000 - 3000 ft. 1000 - 3000 ft.

A indicator is a pressure of 1000 ft. or 1000 ft.

If the holes on the static head are not cleared - pressure

the pressure in the capsule will remain higher than outside pressure and will stop the smaller capsule expanding correctly.

In A.P. 1232 (Chap. 1, Para. 12) Calibration of A.P. Indicator

Altitude (A.P. 1242 Instruments Manual.)

The main air principle of the Aneroid Barometer is corrugated metal box (in) is partially evacuated (near comp. a vacuum). The pressure of the air tends to make the box collapse, which is prevented from doing so by a flat spring, which is connected to a pointer so that movement can be recorded on a dial.

Pressure decreases with height, and height can be marked on the dial in place of pressure. As you rise in the air pressure decreases and the tin box (capsule) expands allowing the spring to move, and the pointer also.

The Fortin and P.O.P. Altitude

To convert either of these types you require to know:

- a) Pressure and temp. in aircraft.
- b) Ground pressure,
- c) Temp. of air in between ground and aircraft.

Results of temperature on air

1. If the air is warm on low levels (i.e. near the ground) the air tends to expand and the pressure and density is lower. This causes the upper layers to become denser thereby causing the pressure to increase on the altimeter as the bird rises. This causes the altimeter to read lower than

2. If the air is cold or the ground the pressure is reduced, the altimeter reading higher.

3. The Fortin altimeter is calibrated on the assumption that the temp. at any height is 10°C , which causes this type to be inaccurate.

4. The P.O.P. altimeter is calibrated on the assumption that the temp. from 15°C at sea level drops 1.98°C for every 1000 ft rise until 36,080 ft where the temp remains constant at -56.5°C . This type is more accurate.

13. When using a Computer, the Fortin or P.O.P. one must be used according to the altimeter in use.

If a computer is not available Briggs Rule can be used which states that if you subtract $1\frac{1}{2}\%$ of indicated height for every 5°F the temperature is below or above 50°F .

E.g. bar alt reads 5000' over Tower. ground temp. -40°F
Temp at 5000' -20°F . Find the true height.

By Briggs rule you subtract $9.375 \times \frac{5000}{1000} = 468.75'$

$\therefore$ True height = 4531.25 ft.

E.g. 2. You set out from A, 400 ft & pressure = 1000 millibars to fly to B, 500' pressure = 1013 millibars. Reduce both pressures to sea level pressure using rule that

1 millibar = 30' and find the reading of the alt. at B.

$\frac{101}{100} = 1.01$ - 1012½ millibar the level pressure

$\frac{102}{100} = 1.02$ - 1023 - - - - -

Difference in pressure - 4½ higher
- 4½ x 30
- 280 ft.

on landing the alt will read 10'

or flying from 1000 to 100 pressure, altimeter reads
dangerously high. There is dangerously low

Note on the Altimeter

1. Alt. can be set to 0' on the height of the 'dome above sea level.' - if on a long flight set alt at the height of the dome, and when on a circuit set at 0'.

2. (a) When the alt is set at 0' it records the pressure at the aerodrome end.

(b) When the alt is set at height of dome the pressure is that at sea level.

3. If the barometric pressure is known at the dome, and the alt is set for that pressure, the alt will register 0' on landing.

4. The Sensitive Altimeter is called a special I.S.A.N. and registers height to a few feet.

Meteorology

Pressure of Atmosphere

Pressure is measured in millibars.

1000 mb = 1 bar.

1 bar = force of one mega dyne on the area of 1 sq cm.

1 dyne is the force required to produce an acceleration of 1 cm/sec² in a mass of 1 gm.

Pressure maps are marked in isobars.

An isobar is a line joining all points of equal barometric pressure.

A Depression is a roughly circular shape of isobars with low pressure in the middle.

An Anti-Cyclone is similar, except high pressure is in the middle.

A Secondary pressure is anticyclone, one marks the H.

A Trough of low Pressure is a "valley" in the depression.

A ridge of High Press is opposite to low pressure trough.

A bel is the space between a secondary Depression.

Temperature - decreases with height.

The Lapse Rate - with fall of temperature with height.

Normal is 3.6° F per 1000'.

Dry Adiabatic Lapse Rate

In an adiabatic expansion any heat gained or lost is kept within the subject.

is conservative of heat.

In an adiabatic expansion any heat gained or lost is given out.

is Temp. remains constant.

Concepts

air ——— 55° The ball of air is 55° at 1' so it rises
air ——— 56° it cools by 5.5° per 1000'. As it goes
air ——— 57° up it decreases further until it
air ——— 60° reaches 2000' where it then equals
air ——— 60° that of the air around. But it will
1' ——— 60° go up further and it own radiation
until 3000' is reached when it falls gently down to the
earth again.

Humidity

the air - moist - pressure decreases - expands - cools
and under adiabatic condition - there is no transfer of heat
to the air around.

If air is dry the adiabatic lapse rate is 5.5° per
1000'.

Dry Adiabatic Condition give rise to a stable atmosphere.

Wet Adiabatic Lapse Rate - wet air rises and cools,
condensation taking place. This procedure produces
latent heat which tends to replace some of the heat lost
by condensation. Thus wet air does not cool so quickly
as dry air.

Direction of Winds With Height

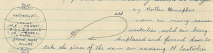
1. At about 1500' surface friction is negligible and winds increase in velocity.

2. The wind blows in a clockwise direction somewhat as known as veering.

Summary: Winds veer and increase with height.



West winds increase and east winds fall off with height. Low-level easterlies are replaced with westerly winds at height.



Deep Cellulose

Standing with your back to the wind in the Northern Hemisphere your left hand will be towards the lowest pressure. The same holds good for in Anti-cyclones.

Therefore if you experience a backward drift you are heading towards low pressure, and the altitude will tend to rise dangerously high (Northern Hemisphere). In the Southern Hemisphere exactly the opposite occurs.

Diurnal Variation of Wind

Turbulence occurs during the day caused by irregularities on the ground and the effect of the sun on the air and the ground. Turbulence is very rare at night. This causes wind to back and drift at night generally.



Beaufort Scale of Winds

Beaufort No.	Description	Range of Speed
0	Calm	less than 1 m.p.h.
1	Light Air	1-3 m.p.h.
2	Light Breeze	4-7 m.p.h.
3	Light Breeze	8-12 m.p.h.
4	Moderate Breeze	13-18 m.p.h.
5	Fresh Breeze	19-24 m.p.h.
6	Strong Breeze	25-31 m.p.h.
7	Moderate Gale	32-38 m.p.h.
8	Fresh Gale	39-46 m.p.h.
9	Strong Gale	47-54 m.p.h.
10	Whole Gale	55-63 m.p.h.
11	Storm	64-75 m.p.h.
12	Hurricane	76 m.p.h. and above

Turning and Acceleration Errors (Compass)

Turning Error

1. North Magnetic Hemisphere - turning west on a westerly course it is necessary to undercorrect - turning east requires

the the same action.

As Northern Hemisphere - all turns must be
considered as exactly the reverse of the Southern Hemisphere.

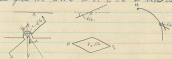
Turning from North to East causes easterly deviation.

Turning from North to West causes westerly deviation.

Turning from South to East causes easterly deviation.

Turning from South to West causes westerly deviation.

The maximum effect of this course is obtained during a
turn from N.E. to N.W. or S.E. to S.W. or vice versa.



4. Deviation Error - As on East and West courses, the N. Hemisphere
inclination on an easterly or westerly course gives apparent
westerly turning. Inclination gives the reverse. In the S. Hemisphere
the conditions are reversed or an apparent westerly turning is
noticed.



11.2 All these effects only last a few seconds.

Standard Abbreviations

L	Track
lv	Course
ETA	Estimated Time of Arrival
ATA	Actual Time of Arrival
Gfd	Ground Speed
I.A.S.	Indicated Air Speed
T.A.S.	True Air Speed
Posn	Position
air	Air Position
B.R.	Dead Reckoning Position
T.M.G.	Track Made Good
A/c	Airbourne
A/p	Afterburner
A.C.	Back Drawing
B(R or S?)	Compass, Magnetic, True
Pfd	Position Line
Pst	Post
d	Distance
h	Height
n, st, m	statute miles
n. m.	nautical miles (symbol ?)
ft	Feet (altitude)
ft	Foot
W/S	Wind Velocity
W/D	Wind Direction

W/S

Wind Speed

W.D.

Direction

W/S

Direction

W/S

W/S Contact will have been established

THE PROBLEM

It is obvious that as we can map, read we must have some suitable representation of the earth or portion of the earth's surface on a flat plane. By experiment, on a globe and even it can be seen that it is impossible to wrap a flat piece of paper smoothly round the globe or even to flatten out the surface of the globe and at the same time maintain spherical properties on a flat surface. Thus ~~our~~ map-makers are left to decide which of the following properties are to be depicted truthfully, shapes, areas, great circles (i.e. the smaller arc of which passing through two points is the shortest distance between the two points). The preservation of areas is of no concern to map readers but great circles are of greater importance. Projections depicting shapes and great circles may be constructed by general compromise and are sufficiently accurate for map reading and measurements of distances.

Two classes of projections.

1. Topographical - map reading.
2. Navigational - plotting.

Type of projection used depends on the shape and size of the land mass under consideration.

The map reader is not concerned with the why and how of the projection but merely its properties. Rhumb-lines - Regular curved lines from the surface of the earth cutting all meridians they meet at the

same angle. Just a line joining any two points is not necessarily the shortest distance between the two points, but the bearing relative to North is constant along its whole length. It can be seen that if the path of an aircraft holds a steady course it will be a Rhumb line. Thus an ideal map would show shapes depicted correctly and great circles and Rhumb-lines as straight lines, however such is impossible, and our nearest approach is to be found in Cassini's Modified Mercator, Lambert, Conical Cylindrical (Conformal) and Mercator Projections in which shapes suffer minimum distortions and great circles and Rhumb-lines are almost straight lines.

Limitations of Topographical Projections

1. Scale constant over each separate sheet.
2. For all practical purposes straight lines most nearly represent great circle arcs.
3. Bearings and distances on Great Circle Bearing and Distances.
4. A Rhumb-line drawn east to west in comparison to nearest Pole, thus the path of an aircraft flying a Rhumb line track will at all times be on the Equator side of his intended track.

Scale

The ratio between a given map length and the actual distance this represents on the earth is the map length over earth distance.

Representation of Scale

1. Representative Fraction
2. Statement in words
3. Graduated scale line.
4. It should be noted & remembered that a latitude scale in margin of map is also in nautical miles scale 1 minute of latitude being equal to 1 nautical mile. Although smaller the scale the less the amount of detail shown on the map.

Representation of Relief

1. Spot Heights (accurate)
2. Contours (approximate)
3. Form Lines (interpolation)
4. Layer Tinting
5. Hill Shading
6. Hachuring.

It is obvious that to be able to read and understand a map one must know the scale, Relief, Conventional Signs and method of orientation of that map. The efficient map reader must know by heart the legend in the margin of the map sheet he is likely to come in contact with for he must be able to interpret at a glance the detail shown on his map.

Ascertaining Position

- By Day :-
- a. search the area with eye to your back
 - b. know your scale, time perspective and amount of detail.

a. Know conventional signs.

b. Orientation of map, always read your map with map turned so that track you are flying down the track line.

c. Appearance of objects in different seasons.

d. Pick out outstanding objects and check the inter-relationship of features e.g. hills, rivers, roads, railways etc.

e. Always calculate a ground speed after every 10 and then check each new feature.

f. Beware of cloud shadows particularly over water.

g. Land marks :- railways, roads, river, woods, water, hills, hedrows, coastlines, sandbanks, lighted p.

Preparation of Map Before Flight

Much worry and trouble may be saved if the following points are observed in practice.

1. Draw in intended tracks remembering at the same time that the aircraft may not necessarily follow along the line drawn on your map.

2. Using D.R. Ground Speed, and draw in 5 minute lines (once equal to five minutes flying)

3. Draw in circles of uncertainty at predetermined points along your tracks particularly at turning points.

4. Study significant features along and at both sides of tracks and check same, at the same time

calculate approximate B.T.A.

2. Memorize as much of the route as possible particularly the target area before flight.

3. Mark on your map any area of expected wind change.

In Flight.

1. Orientate your map so that you look down track.

2. If any doubt of fix-point exists draw what you see, compare with the map and sketch B.T.A. with R.T.A.

3. Remember that drawing will last indefinitely whereas what the eye sees may soon be forgotten. Relative element must always be considered.

4. Always anticipate a feature.

5. Work from map to ground as anything shown on the map will most probably appear on the ground whereas the mass of detail on the ground cannot be shown on the map.

6. Make constant and intelligent use of your time and speed scale.

In the Unlucky Event of the Navigator Becoming Lost.

1. Above all avoid rushing unless to identify a prominent feature.

2. Assume an approximate B.R. position from first Navigator and construct a B. of U. for some time ahead and whilst maintaining a steady course, study carefully the anticipated B. of U.

3. Study the ground for some minutes ahead of and

and after your B.T.A. as ground speeds may not be accurate due to wind change etc.

4. During the time draw what is seen and if some definitely identifiable landmark does not show up compare your drawing with the map.

5. Whenever possible double check each fix-point. The risk for this becomes apparent when one realizes that there may be a great similarity between any two fix-points, yet the relationship of other clear features will help in identification.

6. In a pinch to conclusions and above all DON'T Panic, much physical and mental agony may be saved by sitting back for a few minutes and taking mental stock of facilities on hand.

Map Reading in Poor Visibility.

1. Draw what is seen as relationship of features will be restricted whereas the strip diagram will minimize any ambiguity of position.

2. Remember association of time and distance, calculate B.T.A. of prominent features.

3. Low flying may not help and is dangerous if area over which you are flying is not known as the perspective changes features pass too rapidly to identify them.

Map Reading at Night.

1. See the area between yourself and the moon whenever possible.

2. There is a minimum of light or no light in the cockpit as human eyes tend to focus on the nearest available source of light.

3. Remembers visibility increases as much as 50% at night for the same conditions as prevailed during the day and therefore distances are deceptive.

4. Vary the focus of your eyes as little as possible i.e. map to ground.

5. Look for water, rivers, lakes, woods and coastlines.

6. Traffic on roads and railways.

7. Beware of cloud shadows in the moonlight.

8. Low flying may help, but is dangerous.

9. If flares are used, turn and fly past the flare, shade your eyes and scan the ground, between yourself and the flare. Know what is seen remembering orientation, the check on the map. Circle of uncertainty and Time and Speed scale will help.

Circle of Uncertainty

By analysis of many air operations & exercises it was found that the error in E.R. position could be calculated as being somewhere within a circle of radius 12% on a distance flown around the E.R. position, thus it can be seen that the more frequently pin points are taken the less the radius of the loop and the smaller the area to be searched.

To understand the Conf. U. and the E.R. position all require further elucidation as follows:-

Track (Required True Track): the path of an aircraft over the ground.

Course (Co): the direction in which an aircraft is heading Course (T.D.): rate of ~~exchange~~ change of position on the air Groundspeed: Rate of change of position relative to the earth Drift: Angular distance between course and starboard measured port or starboard of course.

An actual position may be determined by knowing the Track made good, the Groundspeed and the time of flight (conversion of time and distance). But a E.R. or Reduced Position may be found by knowing the E.T.T. and the wind to be encountered en route thus the E.R. position and actual position will differ if the W/V used in deducing the E.R. position is different from the actual wind encountered in flight. This error is always present and accounts for the fact that map reading and navigation are unnecessary throughout the flight and not only preparatory to the commencement of the flight.

Methods of Giving Position

1. Latitude and Longitude

2. Lettered co-ordinates

3. Distance and Bearing

4. Naval method (lettered co-ordinates).

Navigator Log

(How my flight plan)

Photography

Value and Uses of Air Photography

One of the primary duties of the R.A.F. both in war and in peace time is Reconnaissance, most especially in war time when it is vital that the movements and the disposition of the enemy may be known as accurately as possible.

In this respect Air Photography has proved of great value both in supplementing and confirming Observer reports.

The idea is not to replace the Air Observer with a camera but to supplement and enlarge his report as well as making a permanent record.

Should the Observer be killed, wounded or engaged on some other duty, provided the aircraft returns to its base and camera has been working, the record of the flight is not lost. Further the Observer can only concentrate on watching one particular spot at a time and is quite liable to miss much valuable information in the opposite direction. The camera does not suffer from this fault, it gives an all round record and there is no danger of misinterpretation, in such things as the number of tanks concentrated in a certain area.

Service Uses

a) Strategic: Photographs taken to show the details of supplies, bridges, movements and disposition of troops.

etc. From this the intended moves of the enemy can often be seen beforehand. It is also used for the identification of targets and to show the results of previous bombing raids.

b) Tactical: Used chiefly by the Army to obtain a knowledge of their immediate front, using both vertical and oblique photographs. By means of these an Army Command is able to know the position of enemy batteries, machine gun posts, trench systems and supply dumps.

c) Topographical: The provision and revision of maps. The continent as a whole is rather poorly mapped, some parts not having been surveyed for many years. During that time they have become out of date owing to the growth of villages, cutting of new roads, clearing of timber etc. The photograph is right up to date and usually of a much larger scale. Further, the map is made up of a number of conventional signs which are limited in number and do not always give any idea of size as in the case of a bridge or post office. Such things as woods and rivers are shown as lines on the map but do not show their true scale, whereas a photograph does and knowing the scale of the photograph these things can be measured. From this an Army Command can judge the amount of traffic a road will take or the amount of material required to bridge a river.

COMPARISON BETWEEN CAMERA AND HUMAN OBSERVER

Observer	Camera
Has a large field of vision as a result of movement, but can only concentrate on one point at a time and has to take some time standing to pick out details.	A much smaller field of vision, but concentrated over the whole area at the same time and records all detail in a short space of time.
Can only remember a little of the details he observes and therefore has to make notes, while this is being done much valuable information may be lost. These notes must be of a hurried nature and should be of very little use.	Records all details instantly.
Comparatively large target and liable to be hit.	Comparatively small target and less liable to injuries.
Affected by glare, ill health, fatigue, liable to imagination and wrongful thinking.	Free of mechanism and therefore not liable to these defects.
Must note progress of work over a period of time and is hampered by other duties.	Photographs can be compared and studied under ideal conditions and the camera has only to be loaded.

Very often has to guess the size and scale of an object or object.

Can report the results of his observations at once.

A certain amount of time must elapse between the aircraft landing and results being submitted to the intelligence staff.

The Camera.

The T. 20 is the standard air camera used in the R. A. F. It is of all metal construction, to withstand hard usage and varying climatic conditions.

It is a film camera giving 5" x 5" negatives, the length of film being either 25, 50 or 125 exposures.

It may be used entirely by hand, semi-automatic, or fully automatic, and can be used to take hand-held oblique, fixed oblique, or vertical photographs.

The main units are

- (a) Magazine
- (b) Grabber complete with instrument panel (either coded or under pressure)
- (c) Shutter
- (d) Camera Body
- (e) Lens and Lens Box.

Magazine.

The use of film instead of plates reduces weight and space, allowing more exposures to be made. When removing or replacing a magazine care must be taken not to touch the

the middle portion of film, causing the pressure pad to be lifted allowing light to reach into the magazine fogging the film. The magazine has two counters on the right hand side. The red and white indicators being known as the Film Wind Indicator, the other the Exposure Counter. Incorporated in the magazine is a function loading device to compensate for the varying diameters on the feed and receive spools.

Shutter

The shutter is a focal plane, fixed slit, variable speed type and is capped by means of an auxiliary blind. There are two types the 'A' and 'B' types.

The type A has a 1" slit and speeds from $\frac{1}{100}$ to $\frac{1}{10}$. This shutter is used in the emulsions and in bad lighting conditions.

The type B has a $\frac{3}{4}$ " slit, with speeds from $\frac{1}{100}$ to $\frac{1}{10}$ and is used in commerce or in very bright weather.

The speed of these shutters is controlled by a manual adjustment which protrudes through the camera gearbox, near the instrument panel. Normally the shutter is used at full speed, but should lighting conditions very bad the speed can be decreased slightly thus giving more exposure. The danger of this adjustment is movement on the resultant negative and so whenever possible the speed of the aircraft should also be decreased. 500 ft. to 1000 ft. to 100 ft. - long photography & action photography.

Exposure

Either a watch or Vande counter may be used, the latter

illuminated by two festoon type lamps, the image being transferred to the corner of each negative on a prism and a small lens system on the inside of the camera quadrant.

Camera Body

Consists of an all metal casting in which is incorporated a plate glass register which in conjunction with the pressure pad on the magazine holds the film flat in the focal plane. Focal can must be taken if this register glass when changing magazines away dirt or scratches on it will show on every negative taken afterwards.

Lens and Lens Cover

The lens which is incorporated in the lens box is attached to the camera body by means of three bolts and is interchangeable, allowing various focal lengths to be used on any camera.

The various focal lenses used in R. 2. 7. are

3 $\frac{1}{2}$ " extreme wide angle - little detail large area

5" wide angle

8" medium angle

16" & 20" Telephoto lens - detail well marked, area small

In conjunction with these lens a filter (yellow, orange, or red) is always used to absorb the blue haze which is always present in the air between aircraft and ground.

Quadrant

The gear box is attached to the shutter frame by means

of two screws and contains certain, mechanical, electrical, and optical systems. The mechanical system, which may be driven by either hand or by the electric motor, provides the means by which:-

1. The shutter blinds are wound.
2. The pressure pad on the magazine is raised and lowered.
3. The instrument is operated (Weeder counter).
4. The exposed portion of film is wound over.
5. The shutter is released and an exposure made.

The electrical system provides the means by which:-

1. Two lamps are lit during the exposure to illumine the watch on Weeder counter.
2. The shutter is released.
3. The electric motor is switched off and on.
4. The remote signal is operated while the motor is working.
5. The counter on the Type 35 control is operated.

When opening up the camera to allow for more light, a smaller number is used on the indicator on the lens cone. To let less light, or to shut down, a larger number must be used. Range of numbers 4, 5, 6, 8, 11.

Installation of F 35 Camera.

Power Leads

No 1 lead from Push Button to Power Point.

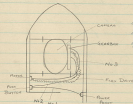
No 2 lead from Push Button to Fuse Box.

No 3 lead to Pilot Indicator Lamp (connected in Brown)

No 4 lead from Fuse Box to Motor.

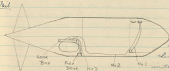
Also Drive from Motor to Fuse Box.

Wiring



Take one exposure over at the beginning and two at finish of exposure.

Feed



Take two exposures, the first to start ground light image, then to check exposure indicator with tail. Take two exposures over at finish to stop fogging film.

General Photography

Aerobase photography or oblique photography is divided into two classes, Dead and Dead Aided.

Use of Oblique

1. Rough-hair boundaries who are not trained in reading aerial photography can readily understand them.
2. Recognition of targets when bombing at low altitude.
3. Photographing enemy territory without actually flying over it.
4. Rough survey of large areas with large definite features such as lakes and forests.

In the Air

1. Camera pointing mid-way between 'down-sun' and 'over-sun'. This causes buildings etc. to be shown in relief.
2. Aircraft flying as nearly into wind as practicable.
3. Choose time of day best suited for No 1 or in a lower respect No 2.
4. Camera pointing so that no portion of the aircraft will be visible in the photograph in a position mid-way between the leading edge of the wing and the tail unit.

Normally the engine should be throttled back to the slowest speed possible in order to minimise vibration.

Dead Aided.
The Type 25 mounting is used, with either a frame or tube sight fitted.

The camera should be held firmly against the body to ensure sharp photographs.

The camera should not touch any part of the aircraft and must the camera operator lean against the sides.

The trigger should be released by a steady pressure like firing a rifle. Any tendency to snatch the trigger will result in mis-lap or blurred results.

After each exposure the camera must be turned over approximately five times, noting at the same time that the film wind indicator is working. (After exposure number 10 the direction photograph was taken in and enter on next report).

Dead Oblique

These exposures can be made either by the pilot or the observer. The camera is fitted on a Type 25 mounting and swung outwards at a known (altitude) angle, at angles to the fore and aft line of the aircraft. Aircraft fitted for fixed oblique have a sliding panel on the side of the aircraft, opposite the camera rails, this is fastened back when fixed oblique are to be taken. These aircraft have lines set on some part of the aircraft in such a way that a sight from either the pilot or observer lines through the mark to the ground will indicate the centre of the photograph.

Faults of F-4 Camera

Immediate action in case of stoppage (except a runaway camera)

1. Reconfirm your position on the map.
2. Inform the pilot of breakdown and ask him to circle the area (except over enemy territory).
3. Look for the fault, and having found it thoroughly test the camera.

4. Once the fault is ascertained inform the pilot and restart the job from a point just previous to where fault was discovered.

In the case of Camera Runaway, snatch a load (other than No 3) and break circuit, thus preventing wastage of film.

First thing to do is to attempt to wind camera by hand. Check all electric leads to see that proper contacts are made.

N.B. While the camera is working constant check must be made to ensure that stoppages are detected immediately if and when they occur. All stoppages or faults must be noted on scene reports.

Fault And Indications	Probable Causes	Course
RED LIGHT AND FILM WIND INDICATOR FAIL TO ROTATE.	MAGNETS WEAK, FILING, MAGNETS.	PAUSE STOPPAGE FROM FRONT BOX.
	BURNT-OUT FUSE.	REPLACE FUSE.
	LEADS NOT CORRECTLY CONNECTED.	ALSO MAKE HOME.
	BATTERY WEAK, LEADS LOOSE.	NO LEAD IN HAND.
GREEN LIGHT TURNS ON WHEN SLIGHT RUBBER END FILM WIND INDICATOR TURNS CONTINUOUSLY WITH SLIGHT PAUSES.	DETACHED FILM BUTTEND.	LOSE GUNDS AND FILM OUT.
CAMERA RUNAWAY.	ANYWAY DEAD IN SENSITIVE.	NO LEAD IN HAND.
	BATTERY WEAK, LEADS LOOSE.	DETACH LEADS AND RETURN TO BASE.
GREEN LIGHT COMES ON, BUT FILM WIND INDICATOR FAILS TO ROTATE.	FILM HAS WIND ON TORN.	CHANGE MAGAZINES.
	DETACHED FILM DRIVE OR MOTOR LEADS.	RECONNECT.
	FAULTY MOTOR FILM DRIVE OR WIND ON GEAR BOX.	CHARGE BY HAND OR SAME AUTOMATIC.
NO GREEN LIGHT BUT EXPOSURE FINE OUT.	BURNED-OUT BULB.	CONTINUE WITHOUT CAMERA FILM EXPOSED.

Depth and Time Interval

Depth must be known so that the desired track may be laid good and so that the lateral overlap may be accurate. Time Interval controls the percentage overlap.

In survey work a 50% overlap must be maintained for stereoscopic examination. A short overlap means plotting difficulties and it is impossible to stress the whole area. An excessive overlap means wastage of film and a possible running short of film.

Depth is the angle between course and track.

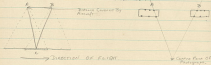
Time Interval Time taken by the aircraft to fly between two points on the ground at a distance apart equal to 50% of the area covered longitudinally by one exposure.

Find aircraft ground speed in feet per second which is represented by V . Let w be the effective width of film, H be the vertical height, f which is the focal length of lens. Then Time Interval = $\frac{w \times H}{V \times f}$ (taken to nearest sec)

Plane Plane

The eyes are at approximately 2 1/2' apart, which is sufficient to give stereoscopic relief up to 200'. Beyond this distance the light and shade on an object are the only guides to the fact that the subject has depth as well as length and breadth. Then when greater distances than 200' have to be dealt with in air work, gunnery spotting etc, some artificial means have to be found to increase

separation of the eyes. In the Navy prismatic binoculars are used. In air work it is impossible to use such instruments owing to speed vibration etc, but by taking two photographs of the object from two view points and then examining these in a stereoscope it is possible to obtain stereoscopic relief sufficient to allow for accurate requirements by taking two vertical photographs which overlap 50% having the object central to the overlapping portions the best results are obtained.



Effects of Tilting Camera



Tilting the camera will cause the scale to be wrong, or be the same as taking a level photograph of ground sloping away from the camera, causing the top negative to be wider at one end than the other.

Scales Used in Photography

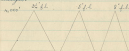
Three scales namely

a. large scale 10,000 - 100,000 ft.

b. medium scale 10,000 - 100,000 ft.

c. small scale 10,000 - 100,000 ft.

Large areas taken with shorter focal lengths at same height.



Remarks

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