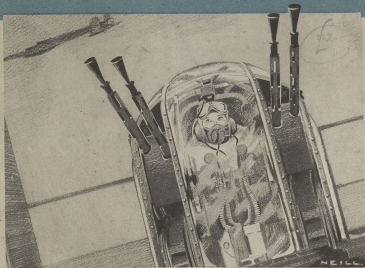




GUNNERY SENSE



A.M. PAMPHLET 132

D.T.F. 6

Gunnery Sense

SOME HINTS
FOR AIR CREWS
at
AIR GUNNERS' SCHOOLS

issued by the
DIRECTORATE OF FLYING TRAINING
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INTRODUCTION

THOSE COMMISSIONED TRAINERS AS AIR OFFICERS CAN never find out the details of their job by glancing over the training syllabuses for grammar schools and O.T.U.s. Now is there any need to tell them what an important part they will play in the operation of our big aircraft. What they will want to know, however, is what makes the successful air power, the man who can give more than he gets, who looks sharp on his job and sees his own aircraft back again, who regards operational flying as a routine shoulder exercise between home and the Land of the Red Men, who can give continuous useful services, and who is made thoughtful after by several captives. This pamphlet endeavours to show, step by step, how such men are made.

CONTENTS		
Part	Title	Page
I	Lecture rooms and ranges 3
II	Practice and preparation 7
III	Air games sometimes fly 14
IV	The Real Thing 18

I: LECTURE ROOM & RANGES

WHAT ARE THE ELEMENTS OF AIR POWER?

- (1) Ability to recognize instantly all types of aircraft, and to be able to judge their speed, direction, angle and distance.
- (2) A thorough knowledge of guns and target; how they work, and how to keep them working.
- (3) How to use target.
- (4) Practice and yet more practice.

As you proceed step by step in learning these things, by your own judgment of what you know. Deepen gradually the idea that if you are clever enough to recall only the things necessary to get good examination marks, you have completed a successful course. The German is not in the least bit interested in your passing-out percentage. If you are not satisfied that you have grasped a point, ask for it to be explained a dozen times if necessary. Tenacity is a virtue in air games. With the application of target theory in particular, to miss any step in the necessary order is clear understanding impossible; and there are to-day air gunners who do not really know how to use target against all possible possibilities of target location. In the first case, they were educated to confirm that they did not understand some particular part of a lecture, then became normally occupied in the more complicated instructions they followed, and never found their feet again.

How to be a nuisance and yet be popular

You can only think and work on an geometry by guessing if you do not start with the soundest grasp of the simple mathematics that come at the beginning of the syllabus. So if you are study on things like triangles and velocities, make it your

own business to work the fury on them from the very start. Do not wait for lecturers to find out you do not know; tell them.



Don't wait for this to find out. Tell him.

What else follows on the course to test out your knowledge. Do not be satisfied with knowing a thing only when it is presented in a particular way; have it wrapped up and digested and shot at you suddenly to see if you can extract the necessary truth.

Lecture room limitations

The best lecture rooms try to simulate flight conditions by having synthetic devices, but none of them can ever fully reproduce the real thing. Sometimes the lecture even seems to bear no relation to reality. The room is warm, you have had a big lunch, the instructor drones away—be doubtful, but there it is—operational flying seems to have no meaning at all, and as you missed the last lecture, this one is just an undignified bore.

GUNNERY SENSE



I have in my machine something that defies me in the distance the better I look before I hit the ground.

You give it up, double gently to keep yourself level, and wait for the check to provide a possible return.

Now at such times there are two sorts of air personnel in the room: the men who are going to be successful air gunners, who are neither doing nor dreaming, and the others who will be hit or missing. There may also be a few bad ones in the early stages, but they will be quickly shown the door before the course is over.

Try to see R.A.F. classrooms as something different to the classrooms of school days. In the Service, courses are interesting, crowded affairs, because it is going to be a big R.A.F., and there are a few men behind you, anxious to start their training. The lecturer hasn't got time to give each of you the individual attention he would wish, and time for reviews is severely limited. Therefore he expects you to help yourself.

From the moment a course starts, one is training for war. Air battles are tough encounters, and the most skilled gunners are the winners. So make up your mind early that you are going out at the other end of your air gunnery course ahead of and not behind the others. Form in your own mind a picture of the best air gunner and keep it in front of you constantly.

The lecturer examined

The lecturer knows when he is putting across new and difficult stuff, and nothing worries him more than a dull, apparently satisfied, class that knows, asks no questions and seems to be not very desirous of appearing that it understands. For he knows that his audience is not learning properly

and not using his brain and intelligence. He wants the class to be alive, to ask questions, to pull him up when he is going too fast or not making himself clear. What he knows that he is commanding attention, holding interest, and receiving some credit for his lecture—which are not inconsiderable. Above all, he knows that he is teaching; and he is not only teaching his class, but teaching himself too, for only by taking his knowledge on fire and increased people can he discover where he must go slow, repeat and illustrate, how much knowledge he can assimilate in his lectures and how much he may not assimilate.

A note on notebooks

There are good reasons for taking notes. First of all, the painful process of writing knowledge down helps one to learn it. Another reason is that rapid changes in attention, characteristically heavy wartime demands on printing presses, and shortage of wood pulp have made the last-book supply list behind the demand. A third reason is that the personal notebook contains in a compact and handy form professional information one may need to look up later. Maps are being taken to give air gunners printed notes in loose-leaf folders, written and illustrated so they themselves would like to do them. This will mean less writing and less stress, so maps, notes writing.

Note-taking is an art; the nobody will do it. But nothing worth having was ever obtained without some pains. When you first open the crinkling covers of your brand new notebook, think of what you want it to be in a few months' time. First of all, you want it well to be in your possession; so get your rank, name and number on it in good solid printing, an elementary precaution that many will neglect. Next think of the two sorts of notebooks you have seen—the rugged, new, unshined ones full of loose bits of paper, and the compact, clean readable ones; then decide which you would rather have. You are embarking on a creative act, and the matter is entirely in your hands. Would you read a dirty, dog-eared

GUNNERY SENSE

library book, badly printed and with pages stained and missing? You wouldn't. Neither will you have any use for a notebook like that; it will end up in the dustbin, and you might as well have saved yourself the trouble of ever putting pen to paper.

Copying up rough notes into a nice book at night is a grievous trial and an enormous waste of time. Keep a slip of blotting paper in the notebook; carry a full fountain pen and a pencil, and write up the notes in ink in the classroom. Lightly sketch in diagrams with pencil so that you can make them more permanent with ink or colored pencils at odd moments. Ink is or organic (if you do not know what this word means you can't write) some kind of small waterproof material for inkless note books, pencil and pen.

Do not waste notes on simple subjects. If you know them, be pleased with the fact; but remember that one day—perhaps sooner than you think—you may be interested on these very subjects. They may seem to be simple as they look and you will be glad of the records you kept about them.

Aircraft recognition

There is no short cut to learning to recognize aircraft. Various systems exist, but they are only methods of grouping information, the base upon which the facts and cases of knowledge must be hung. No one can sit down and read through scores of pages of description and expect to learn about aircraft that way. Absorbing knowledge is short and frequent doses is part of the secret, and making the process interesting and even competitive is a still larger part. The one of the secrets we have already discovered—is remember constantly that nothing worth having is obtained without taking pains.

To keep the aim in view—that the crack air gunner must be able to recognize friendly and enemy aircraft as long as well as their range, firing the correct label to each type by looking at its contour and sit in the air, and gauging its speed, direction and angle. Test your knowledge



Friendliness almost my own!

by grouping in blocks to challenge you in naming types and spaces correctly from test charts, photographs and models which have no lettered information underneath. Do not miss a chance to identify British and American aircraft in the air and on the ground, for this is the finest way of learning two-thirds of the types you will have to know. There can never be a substitute for the real article. Get up competitors to combine pleasure with business; 'Fanny on the Evans' and the proceeds in the R.A.F. Benevolent Fund, with perhaps ten per cent, an organizer's fee.

Reflections on the reflector sight

At first sight, the reflector sight seems to be based on an ingenious theory that can never work out in practice.



What you see must come down.

The hole severely that it strikes one will just point the gun at the target—drop, enemy air-

COMMON SENSE

such as whatever it might be—press the trigger, and let the enemy come crawling out like water from a drenched fireman's hose. That should build up a good 'local density,' a kind of bulwark that the enemy cannot possibly escape. Air gunners have tried that, however, and it has done not work out in practice.

(c) It is necessary and sometimes desperately wonderful to remember.

(d) You have got to hit the enemy solidly several times in the same place to bring him down.

(e) Enemy aircraft have a reasonable habit of coming through such hosepipe-like completely unscathed.

On the other hand, many air gunners have tried out the latest theory in practice and have brought down enemy aircraft with so few rounds that it surprised them. The whole business, as you know, is this:

(1) You must be able to recognize the threat instantly as an enemy. Do not shoot down

a British aircraft; on the other hand, do not let a Hun get away—or walk into your—because you think he is a British aircraft.

(2) You must be able to judge the enemy's eyes and height.

(3) You must be able to put him into the correct plane in the reflexive sight, with regard for his speed, direction and angle of approach.

(4) You must have the nerve and confidence to wait until he comes to a decisive stage.

Then give him the works.

Fit this sequence firmly in your mind, and from the first lecture-room days and first air practice on the ground, do not depart from it. Knowledg to use an ideal method, and although results may sometimes be disappointing, you will learn fast and improve because of those very disappointments. For example, accurate explanation of enemy theory and yet a clean drop-out has taught many an air gunner that day's right harmonization by himself and by nobody else is one of the secrets of air gunnery.

II: PRACTICE & PREPARATION

THE FILM "TAKE YOU EASY" summarizes a great deal of the public in one big report. "We did not know" they said "that there was so much preparation behind such heading talk." Another thing they did not know was that do they only showed a quarter of the preparation that really does go on. Recalled the film. Did you see guns being cleaned, sights harmonized, guns and gears tested? Did you see engines and motors and windows are being tested? Did you see batteries and workalights and cell-sights being tested down, head racks being deep-tested with dummies? And so on through scores of points which the film, of necessity, only hinted at or left out. What the film also had to take, of course, was the records of training and practice and preparation that made the whole thing possible, and made it appear to run so smoothly and naturally.

Definitions of genius that will interest air gunners

Two shrewd definitions of genius are:

- (a) An infinite capacity for taking pains.
- (b) One-inch inspiration and nine-inch perspiration.

In other words, hard thought and painstaking preparation with the closest attention to detail are essential if brilliant results are to be achieved. What is why we do not just leave how things work out and that go straight to a free-line equation as we try it out, and that is why all these procedures and drills play such a large part in the training. They are often tedious and dull, but try to supply the finishing work of genius yourself by seeing the reason behind them all.

Magazine drills

You may or may not go to a squadron where guns are magazine-fed. All the same, when you come to magazine-fed guns in your training, will

yourself that you will go to a squadron equipped with them; then if you do, you will be at the top of your class.

Rapid and accurate magazine changing is a most important part of the air gunner's art. Cold, wearing thick gloves, strapped in and very cramped and bound about, and being fired at by enemy machine-guns—these are the various conditions under which it may have to change the enemy. Develop a routine. Details such as changing the magazine with the right hand and having a full one in the left may save invaluable seconds.

Therefore, practice, practice and practice until your magazine drill becomes a quick-change act worth heading about. Skill in magazine changing, acquired in lecture rooms and on ranges, may save a British aircraft and crew, and rob the enemy of an equally valuable fighting team and weapon.

Gun handling

Think of some of the clever things that men can do, not from ability inherited at birth, but only from constant and serious practice. In the beginning, we find the musician painfully scraping a fiddle or picking out piano notes with one finger, the boy falling off his first motor bike through trying to change gear and turn a corner at the same time, pupil pilots gasping making their first banked turns and heavy landings. Then look again and what do we find? The polished violinist, the concert hall pianist, the five-track motor cycles giving displays of trick riding, and accurate pilots looping and rolling with wings tied together. Then we examine such one more closely, and find a common factor—that the instrument are no longer something separate from their operators, but they are now extensions thereof. They are handled naturally and freely, with precision and skill. The men think of their instruments not as something that is different but as something that is part and parcel of themselves. Indeed, they

GUNBURY SENSE

often only feel happy when they are engaged in their chosen work, just as a sailor feels his when he is not aboard ship.

The three air gunners think of their guns in the same way. At first they also see them as rather awkward things that crash and vibrate, and feel awkward and unwieldy; they also had the suppressed feeling that the guns and not themselves were in charge. But as they learned to give their guns close personal attention and firm handling, the guns gradually became their useful friends and allies. Therefore, when you see guns; handle them your own rights; handle the guns as often as possible, not only by looking, but handling as well. The gun is a very high efficiency weapon. The instant you press the trigger, it develops full power. If you expect it to stand by you in battle, TAKE CARE OF IT.

You light the enemy with your guns, and you need not run home. You can land your barrel coils as if you see them as levers with which to use your mountings, to look after them and see them only for lighting.

Practice with full flying in on, and with the minimum movements of arms and hand as soon as you have become proficient at ordinary handling, until at last you know every badge and groove and lever by instinct, and can carry on all gun operations at high speed under light conditions without looking at handling, and with an absolute minimum of effort. Then the guns have become an extension of your dominant personality, derivative weapons that you can handle with a certain and continuous superiority.

Annotated film loop

The best gun in the world will cease being important or become ignored altogether if it is fed by a magazine or a belt that has been dented, dented, or clogged through careless handling or dropping. Therefore treat magazines and belts as you would a sea gull's watch. Do not leave them where they can collect grit, mud, and bits of grass. This applies now, in the classroom, at

the cleaning bench, and on the range. For when you do care (with or without conscious thought) you will do by habit later on.

Handling drills

Without a proper attitude to them, handling drills are the dull, most boring things imaginable; but approached in the right spirit, their importance becomes clear.

There are not very good reasons why a lot of valuable equipment is conserved in every flying unit by handling drills. It is quite as true that from many cases, one aircraft suffered during an air firing practice in fine weather at a safe height over the sea, and all eight occupants were killed or drowned because not one of them had made one serious attempt to practice parachute and dinghy drills as crew. Get hold of a copy of The Lines No. 4 and read there an account of the unnecessary hardships suffered by a crew about in a dinghy, because they were not prepared.



Illustration 1. We forget the water.

Thousands of incidents like these have firmly convinced the author that considerable practice in instructional handling is essential if parachute and dinghy are to save life. The Royal Navy and Merchant Marine have learned similar lessons. Lifeline drill is part of their daily routine; they don't wait for the ship to collide or capsize before they start working themselves out.

It is not sufficient to know where the parachute and dinghy are stored and to practice using them now. One must know how to handle on them and see them readily and instinctively, in

GUNBURY SENSE

the dark, in freezing cold, in the confusion and excitement of emergency, hampered by the confined space and obstructions of aircraft, doused in full flying in and constricted by lightning harness, last-come, and oxygen tubes in the aircraft. It is in this business angle of making mental pictures—thinking ahead, trying one's imagination first on and play out all possible incidents and their combinations, preparing them in the last detail. A great war captain once said: 'If I always appear prepared, it is because before carrying on an underwriting I have meditated for long and have foreseen what may occur. It is not genius which reveals to me suddenly and suddenly what I have to do in circumstances unexpected by other people; it is education, it is meditation.' His name was Napoleon.

First of all, learn the necessary drills. Now, pose yourself a hundred questions. Would I wear my parachute when flying in this or that landing box? How long would I have to get out if I had to jump at that height? Can I unlatch the door without looking at it? How do I get rid of oxygen and R/T leads quickly? If I have my parachute half-way down the handle, how long will it take me to get it when the second pipe is in the way? When alighting on water, where do I stand, which way do I face, when do I hang on to? In the dinghy part of it, windward or leeward? In the dark, how does one know which is windward and which is leeward? As a crew, how do you agree exactly what each does (and when) to get the dinghy and other gear out?

Find the answers to such questions; then practice in full flying clothing against a stop watch. This kind of thoroughness has already saved scores of lives in this way.

Know your own aircraft

Ignorance of an aircraft may have tried consequences in some cases, written in blood. Consider the two following incidents which actually occurred. A bomber landed in a Spitzer airfield towards dusk in bad weather. The crew turned out at four a.m. next morning to

take off again. They tried for an hour to start the engines, without success. It took them two more hours to find a man who knew what exactly the levers, the different positions for the pressing cocks (which were out of sight). The net result of ignorance: several ragged hours, extra as many blasted beds, and less hours' sleep. The other case concerns a bomber which abandoned an operational flight because the heading system broke down and the oxygen ran out. The observer had turned a cock to 'off' instead of 'on' and lost the low-water bottle; the wireless operator had left the oxygen straps broken entirely unused, because he did not know where they were. Such cases can be multiplied indefinitely, and every case is a direct reflection on the crew concerned.

Deal with training aircraft, in which you may only fly for a few weeks, as early as possible, make it your personal business to get the maintenance crew to show you over them from top to bottom. Even on a large operational aircraft, the whole job can be done in under an hour, and it will surprise you what a lot you can learn in this time. What will also surprise you is that very soon you come to be regarded as an authority on the type; then you go really interested, and begin to learn a bit about the jobs of other people in the aircraft; and this is a good thing, for the more you know about each other's work, the more clearly and efficiently you will work together.

Preparing for air practice

Even experienced crews are being caught out occasionally because it takes longer than they expect to prepare for a flight. Write down some time the number of things you have to do before getting into the air for every simple local flight; it looks like a morning's work in itself, and indeed it nearly is if you have to go any distance in the aircraft. Allow plenty of time and take your time when preparing for flying. The too-rapid-rehearsed feeling is easy to acquire, but will do your flying exercises no good. In training areas, pilots who are flying all day have to keep their engines running

SUMMERY ISSUES

when cover change over, and get off again with a little delay as possible. Help to keep this landing period down to a minimum, not only because pilots do not like sitting still twiddling their thumbs, but because engine overhaul, if up and do it sort of casual things if left sitting over too long.

Despite most earnest intentions to profit from this advice, it is true to say that on your first few flights you will find you have forgotten all sorts of things—batter, gloves, ammunition, parachute, and even the lessons on sighting, turret drill and gun manipulation which you tried to juggle on the ground. Do not worry too much about these omissions (except the parachute and ammunition), but do not neglect the lessons they should teach.

Physical Fitness

These two words may seem out of place in this pamphlet, but getting fit is just as important a part of the preparation as learning guns.

There was once a young chap here who could think—and talk—of nothing but the machine he had taken or meant to take. One morning, he came in, slapping his chest and rubbing great

lumps of air. 'By jove, I feel fit!' he announced. An aide red face appeared above a lowered newspaper. 'Fit for what?' asked a wiser man who smiled for him. The air gunner need not be fit for short-stopping friends, but he has a definite purpose for keeping fit.

Don't imagine that because an air gunner is sitting down most of the time when he is on the job that demands no never made on his stomach. Struggling across an airfield on a steady night, dressed in full flying kit and carrying a parachute and a few hundred pounds of ammunition, soon sorts out the fit from the flabby. So does keeping a keen lookout for bases on real when one is cold, cramped, weak, hungry and bored. Therefore put so much fitness-courts into yourself as you can by getting into good time and staying like it. Think of the training a base or a base crew put in all for a show that lasts a few minutes. Your show is much more important than anything they do.

Choose games you like; that adds greatly to the value you get out of them. Ball games are best, because they give useful eye-training, and the fellow who can gauge the flight of a ball is one man when it's an enemy plane he's out for.

III: AIR GUNNERS SOMETIMES FLY

SOME GUNNERS WILL ARRIVE ON AN AIR-BUSINESS' course without ever having flown in an aeroplane before. Others will have done a few hours' flying during their wireless training; but all will find things a little strange the first time they are pushed into a powerful aircraft and told to fire at some distant aiming mark. Whenever the type of aircraft in which you carry out your initial exercises, you are almost certain to be worried at the large number of things to be thought about and done at the same time. It has been said that there are fifteen possible mistakes which the pilot can make when driving off. An air gunner who is a game of skill, and the object of your training is to enable you to make a number of bewildering things and build a sound technique out of them. An instructor made this check on show how he felt when firing from a Deacon turret on the beam for the first time.



The Deacon firing.

It will remind older gunners in an amusing manner how the knock of the wind seemed to make breathing impossible, equipment disappeared overhead as a most annoying nuisance, how the gun jumbled up at the moment when it should fire, and ammunition pans were torn from the hands by a howling gale which deflected every endeavour to keep anything in the right place at the right time. The pilot does not show, but one can readily see the worried look on the pilot's face as

the turret swung violently in his direction, while one cannot see's own discomfort and gave him the best attempt at a restraining smile. This was the first trip, and although one reached the beam time would be different, for several reasons it would not be so uncomfortable; it was a different type of aircraft, it was very hot, and the motion made one feel slightly sick.

It is in this manner that everybody first discovers the fine distinction between theory and practice. He doesn't get excited if on your first try the noise of the aircraft, the rush of the wind, the bumps and swirl of the oil, and the queer feeling that you are out on your own and that it is up to you to put up a show, combine to give you that sinking feeling. Everybody feels that way at first, and everybody grows familiar with the conditions after a few trips. Don't be alarmed, either, by any sickness during the first one or two trips; plenty of people experience this too, and get over it quite quickly. The Medical Officer is quite used to such cases, and he will give you simple advice on how to minimize the risk of sickness. Soon you will be so much at home that you will wonder at your previous bewilderment and will revel in the chance to pump the drop-up full of holes.

A word about flying clothing

Your flying clothing when carrying out gunnery exercises on the ground. It helps to give the right atmosphere and gives greater training value to the exercises.

Flying kit is very expensive and difficult to replace; therefore take care of these magnificent electrically-heated clothes, the parachute and harness, and remember that flying boots are for flying in, and not the keeping your feet warm on the ground. Warm rubs them, and wet boots greatly increase the risk of frost-bite when flying in really cold weather. One other point—don't walk about the camp in flying boots just to improve those who

decreases. It has precisely the opposite effect, for they know that only oxygen can give us this advantage.

Some facts about oxygen

Oxygen is not a drug. Aircraft systems merely balance up the oxygen deficiency found at high altitudes. Blood is normally nearly saturated with oxygen and any excess above requirements is breathed out again unused.

In the air, one can work up to ten thousand feet with only a slight decrease in efficiency through lowered oxygen supply; therefore, an unlimited oxygen cannot be carried, it is not normally used below ten thousand feet unless one is climbing very quickly.

Over ten thousand feet oxygen is necessary for efficiency. Over fifteen thousand feet oxygen is necessary for safety. At ten thousand feet the decrease in the amount one can do without oxygen is twenty-five per cent.; at twenty thousand feet the decrease is sixty-five to seventy per cent. Lack of oxygen prevents one thinking quickly, makes one feel cold more keenly, and makes fine-tune work likely. From these facts it will be obvious that if it is either below sea level, but just plain foolish, not to use oxygen when it is required.

The effects of oxygen lack are interesting and instructive —

- (1) Power of self-orientation decreases, to be replaced by an excessive and unaided self-confidence. Power to concentrate, reason, and co-ordinate movements is diminished.
- (2) Vision becomes affected and ability to see in the dark is decreased.
- (3) There is a tendency to become sleepy, lethargic and to lose power to move quickly. This is obviously dangerous, particularly in war when rapid movement and good landing are essential.
- (4) The last stage is complete collapse. For its onset can be so insidious that healthily and experienced crews taken experimentally to

the point of fainting through oxygen lack have declared complete confidence in their ability to pause the experiment further. Momentary fainting usually leaves no after effects, and it is a curious fact that the occurrence is seldom remembered and often faintly disbelieved by the victim.

The great danger with oxygen lack is that its effects can often pass unnoticed by the victim, who becomes very absent-minded. There is the story of an ill-fated climber who carried a gasometer camera in a goat's hair, could not remember what it was for when he got there, and carried it down again unused.

Care of ears, nose and throat

The passages in the outer and inner ear chambers must be kept open in flight. Swallowing often does this, so when climbing to and descending from high altitudes, there is much to recommend the chewing of gum, or sucking a tube and passing frequent swallows, particularly at above twelve thousand feet one may have to breathe through the mouth as well as the nose to get full value out of the oxygen mask, a process which tends to parch the throat and make swallowing difficult. When descending from high altitudes go through the motions of yawning, with the mouth shut, at every thousand feet. Before oxygen begins, when you can depress with the mask, hold the mask tightly between fingers and thumb, keep the mouth shut, and force air out of the chest until both ear drums click.

If you ever have any trouble with ears, nose and throat (and this includes the common cold), or any difficulty in swallowing prevent in both ears, seek medical advice before going to high altitudes.

A note on frost-bite

At high altitudes, frost-bite can be easily contracted and easily avoided. It is worth avoiding. Frost-bite is more likely if skin or clothes are moist and if the general physical condition is below par. Before high altitude flying have a good warm meal, but avoid alcohol because it

gives a false sense of warmth only and lowers resistance to cold. For long flights take warm drinks in thermos flasks in the aircraft.

For the underclothes, socks and gloves are thoroughly dried and warm. Underclothes should include some linens going on high-altitude flights; these flying lin is kept permanently warm and dry. Do not sweat the time and can give to each preparation by walking in flying boots over slaps or wet underclothes to the strength, and by hurrying to wash them properly. The sweater provides suitable clothing for high-altitude flying. It may be uncomfortable on wear at ground level, but every time it will be appreciated after a few hours in oxygen tanks.

Crews will be well advised to study their aircraft heating system at leisure and take a personal interest in its maintenance. Properly looked after and handled, aircraft hot-water pipes and hot-air systems give a very pleasant degree of warmth even in Arctic flight conditions.

No speaks in English

If the microphone intercom system of operational aircraft are wrongly used, you may get —

- (a) What sounds like an electrical transformer, and now and then remarks by the pilot, presumably intelligible when they come back, which make you think the Donald Duck is at the controls.
- (b) Intercoms shut from other aircraft.
- (c) Windy Night in Flight, or
- (d) Jet washing.

You may also be destroying normal inter-communication in other aircraft by making your own conversation at an overpowering strength. When the pilot begins to talk like Donald Duck, you may take it for granted that to him you sound like the Donald Duck as well.

These results may only be annoying; on the other hand, they may be positively dangerous if messages passed over the intercom system are misunderstood. Hence then one aircraft has been



Donald Duck looks a hand.

long before now because the observer said two digits, the pilot thought he said ten, and nobody did a double check. From this, learn some important lessons. First, study the intercoms system and you know it backwards. Second, when to the recognized pattern and think out what you are going to say before you say it. When you do say it, say it clearly and make sure that it is repeated back to you accurately, word for word.



Funny words on the radio may be pleasant, but dangerous, is safer.

GUNNERY SENSE

Training begins but never finishes

Does it surprise you to know that the fighter pilots engaged in the Battle of Britain carried on training even while the battle was in progress? Each day they equipped notes, probed their capabilities, learned from each other's mistakes and adventures, and constantly strove to improve their technique. This is training, and the same thing goes on in all squadrons in which air gunners are posted. Attention and improvements are constantly taking place in equipment, tactics, formation flying, fighting control and so on. Mistakes occur from which all must learn. This means repeated talks and demonstrations, and by underlines their value is simply boss-headed. The following are actual notes taken from the diary of a squadron gunnery officer:

- (1) Three doors reportedly hot in flight through not being shut properly. Two aircraft had to abandon raids through this cause.



It doesn't come off this way to drop them.

- (2) Some A/Cs do not know how to adjust various types of reflector lights for rotation and elevation. Quite wrong in lower order flights on angle brackets.
- (3) Two cases of A/Cs broaching flying gear incorrectly. Serious results.

14

- (4) One gunner found who had not harmonized his sights for three trips. Report order that sights must be harmonized every day.
- (5) Talk to new A/Cs about the vital need to take personal interest in own equipment in one aircraft. Give examples from recent squadron records of gear stopping because they were not completely free from dirt, grease and oil, and involuntarily dry before flight.
- (6) Two cases of stoppages through bad fitting of link chains. Chains must be a good fit and be fitted correctly.
- (7) One of hand built in reflector sight. A/C had no spare. Took ten minutes to borrow built from sight of another crew. The next raid was cancelled.
- (8) Two more aircraft found about to go on operational flight with unsecured perspex. Ingress that it is no use to clean perspex when the film is coming in so much.
- (9) Another case of gunnery gear. A/C did not know enough about turret hydraulics to stop it.



One example. Always so too many.

GUNNERY SENSE

So you see the kind of thing some people will have to learn when they get to their squadron. Make your own and the squadron gunnery officer's tasks easier, and incidentally increase the squadron's efficiency, by knowing thoroughly the fundamentals of your job when you arrive. The squadron gunnery officer do not want A/Cs that they have to teach; they are content to be the lecturer for air gunners who know their job well enough to be able to give advice a hand. There is no hesitation about recommending the best of each man for all general considerations.

A lesson from the past

The great fighting pilots of the last war no doubt differed from one another in character and temperament as much as any other random collection of men of different races and nationalities. But if you read the stories of their lives, as told by themselves or by others, you will find that in one point there is an extraordinary similarity between them.

They each began their careers as fighting pilots with a period of frustration, in which they were cramped by the difficulty of adjusting themselves to the conditions of their job. Once these first troubles were overcome, they felt their skill as pilots, their resource and resolution as fighters, to

be sufficient to give them success in battle with the enemy. Yet there followed, in each case a period of bitter disappointment, in which they had nothing to show for their best efforts but a series of dismal and at first inexplicable failures.

It was at this point that each of them made the discovery on which his success in the future was to depend; the victory in battle is only possible in an effort that takes an efficient gun. Therefore, they all spent endless time, indeed every moment of their spare time, practicing firing, lining up their sights and evolving various technical and mechanical aids to accurate gunnery. Success came to them when they had thus appreciated where the gap in their efficiency lay.

This phase is so well marked in the careers of all the famous fighting pilots of the war, and stands out so clearly in their histories, that we can take it for granted that the great fighting pilots and gunners of the future will also pass through it, and that they will not succeed till they have similarly revealed the defect. We have had examples in the recent war when our aircraft have closed with the enemy and yet, in spite of their superior armament, have failed to shoot them down. Such failure is a matter of good equipment and being skill, and each pilot and gunner must study and strive to remedy for himself the flaw in his efficiency to which it is due.

15

IV: THE REAL THING

WE WOULD LIKE TO KNOW WHAT YOU SAW ON THE JOB that looks about it, before we see two instructions from the radio table given by air gunners. The first is by a flight lieutenant in command, and the second, by a W/O operator in command, and the third, by a W/O operator in command, and the fourth, by a W/O operator in command. The fifth, by a W/O operator in command, and the sixth, by a W/O operator in command. The seventh, by a W/O operator in command, and the eighth, by a W/O operator in command. The ninth, by a W/O operator in command, and the tenth, by a W/O operator in command. The eleventh, by a W/O operator in command, and the twelfth, by a W/O operator in command. The thirteenth, by a W/O operator in command, and the fourteenth, by a W/O operator in command. The fifteenth, by a W/O operator in command, and the sixteenth, by a W/O operator in command. The seventeenth, by a W/O operator in command, and the eighteenth, by a W/O operator in command. The nineteenth, by a W/O operator in command, and the twentieth, by a W/O operator in command. The twenty-first, by a W/O operator in command, and the twenty-second, by a W/O operator in command. The twenty-third, by a W/O operator in command, and the twenty-fourth, by a W/O operator in command. The twenty-fifth, by a W/O operator in command, and the twenty-sixth, by a W/O operator in command. The twenty-seventh, by a W/O operator in command, and the twenty-eighth, by a W/O operator in command. The twenty-ninth, by a W/O operator in command, and the thirtieth, by a W/O operator in command. The thirty-first, by a W/O operator in command, and the thirty-second, by a W/O operator in command. The thirty-third, by a W/O operator in command, and the thirty-fourth, by a W/O operator in command. The thirty-fifth, by a W/O operator in command, and the thirty-sixth, by a W/O operator in command. The thirty-seventh, by a W/O operator in command, and the thirty-eighth, by a W/O operator in command. The thirty-ninth, by a W/O operator in command, and the fortieth, by a W/O operator in command. The forty-first, by a W/O operator in command, and the forty-second, by a W/O operator in command. The forty-third, by a W/O operator in command, and the forty-fourth, by a W/O operator in command. The forty-fifth, by a W/O operator in command, and the forty-sixth, by a W/O operator in command. The forty-seventh, by a W/O operator in command, and the forty-eighth, by a W/O operator in command. The forty-ninth, by a W/O operator in command, and the fiftieth, by a W/O operator in command. The fifty-first, by a W/O operator in command, and the fifty-second, by a W/O operator in command. The fifty-third, by a W/O operator in command, and the fifty-fourth, by a W/O operator in command. The fifty-fifth, by a W/O operator in command, and the fifty-sixth, by a W/O operator in command. The fifty-seventh, by a W/O operator in command, and the fifty-eighth, by a W/O operator in command. The fifty-ninth, by a W/O operator in command, and the sixtieth, by a W/O operator in command. The sixty-first, by a W/O operator in command, and the sixty-second, by a W/O operator in command. The sixty-third, by a W/O operator in command, and the sixty-fourth, by a W/O operator in command. The sixty-fifth, by a W/O operator in command, and the sixty-sixth, by a W/O operator in command. The sixty-seventh, by a W/O operator in command, and the sixty-eighth, by a W/O operator in command. The sixty-ninth, by a W/O operator in command, and the seventieth, by a W/O operator in command. The seventy-first, by a W/O operator in command, and the seventy-second, by a W/O operator in command. The seventy-third, by a W/O operator in command, and the seventy-fourth, by a W/O operator in command. The seventy-fifth, by a W/O operator in command, and the seventy-sixth, by a W/O operator in command. The seventy-seventh, by a W/O operator in command, and the seventy-eighth, by a W/O operator in command. The seventy-ninth, by a W/O operator in command, and the eightieth, by a W/O operator in command. The eighty-first, by a W/O operator in command, and the eighty-second, by a W/O operator in command. The eighty-third, by a W/O operator in command, and the eighty-fourth, by a W/O operator in command. The eighty-fifth, by a W/O operator in command, and the eighty-sixth, by a W/O operator in command. The eighty-seventh, by a W/O operator in command, and the eighty-eighth, by a W/O operator in command. The eighty-ninth, by a W/O operator in command, and the ninetieth, by a W/O operator in command. The ninety-first, by a W/O operator in command, and the ninety-second, by a W/O operator in command. The ninety-third, by a W/O operator in command, and the ninety-fourth, by a W/O operator in command. The ninety-fifth, by a W/O operator in command, and the ninety-sixth, by a W/O operator in command. The ninety-seventh, by a W/O operator in command, and the ninety-eighth, by a W/O operator in command. The ninety-ninth, by a W/O operator in command, and the one hundredth, by a W/O operator in command.

A tail-gunner's story

I am going to tell you something about the life of a tail-gunner in one of our heavy night bombers. But if you expect a long catalogue of thrilling incidents, you will be disappointed. We certainly have our excitement, but for the most part our workings look like Hollywood stunt. The high-lights of combat come only now and then. At the end of seven and a half hours in the tail turret one rather sights for them.

The tail-gunner is part of a crew, and his own's life depends not only his flying hours but his whole existence. You come together, six or seven, describe individuals—young and old, tall and fat, officer and non-commissioned officer. You eye each other in a rather British sort of way, and wish you could find something graceful and appreciative to say. You can't. You think how odd they look, and I suppose you must look just as odd to them. None of you would probably have chosen each other if crews were made on the picking-up principle, but, after a bit, you would not dream of changing. It is really very curious.

The two other things that are all important to an air gunner are his turret and his gun. He is entirely responsible for their upkeep and efficiency. Daily he cleans them, fills the ammunition boxes, looks to the sighting. As in his turret, it is his

1 From *Flight Week*, William Heinemann, Ltd.

home for all his flying hours. He is practically always working in the dark. At first, one is always at sixes and sevens. One gets down the landing handle or the spanner or the dummy round, and can't find it again. One bangs one's head, and one's neck's back. After a bit, it becomes almost brotherly familiarity. One knows the exact position, the weight and recovery of each fitting, and each seems to have a personality which one regards with affection even in its most stubborn moments.

I will take you with me to-night on an ordinary sortie over Germany. The first time it is rather a thrill, but after a bit it becomes an unexciting routine. So settle down in the seat. Our turrets are power-operated, swinging easily in any direction, and so you see your turret, moving in to and fro by pivoting on a pair of handles. And finally you load and rack the guns, putting on the safety catches, because one may meet a brother Bitch at any moment. All this makes you feel rather lost, because, leaving you may fly high, you have got on a couple of pillows, a leather brace over which is fastened, leather gaiters with silk lining and heavy flying boots. You apply your body gently in the seat. Seven hours in a good long sit. I can never say however that the last few months have made me a connoisseur of comfort.

Then you watch over your last-comer, and speak to the Captain to show it is working all right; you both often doing the same, and in all you get a very fine idea of what is going on all round the aircraft. Presently, I never talk down the inter-com, unless I have anything that needs saying. My first Squadron Commander told me that a garrison tail-gunner was an infernal nuisance—and I wanted his words.

The working thing about a tail turret is the sense of detachment it gives you. It has all the effects of being suspended in space. It sounds a little terrifying, but actually it is fascinating. The

effect it has on one is to make one feel that I am in a different strength from the others. I have their vision; I know that they are there at the other end of the aircraft, but I feel remote and alone. During my little show, I like to think that they are able to run their's, feeling that they need not worry about attack from the rear.

Now we are riding slowly above the familiar darkened landmarks. A pause, and we have crossed the coast, and with the Captain's permission to fly a burst into the sea, just to make absolutely sure of the survivability of our guns.

Two planes—one are over the Dutch coast, and soon we are flying high above a bank of clouds. It is lit from below by German searchlights, and this gives a sort of space glow. Ten minutes later, we are past the clouds. We have been this way before, and we going to face it quite well. Now the Germans are after us with their searchlights. Out in front there is a fish barrage. You and I as the tail turret can't see the barrage yet. The searchlights keep crossing and crossing. Now one has caught us. Yes, yes. After holding us for a moment, it passes. Ten minutes later, however, they get us good and proper. And very certainly it is, too. We feel a cross between a fly on an ice lamp and a man whose clothes have been plastered while he is bathing.

We turn and twist, hoping to get clear, and—now the party is starting!—Here comes the fish. You can see the phosphorescence come burning up at you, and going off all round you, with a sense of detachment. It would cost you a shilling at the Crystal Palace. I have never really honestly felt it could be going to hit me. But if it does catch me, we have the benefit of our marvellously constructed armor. They sound a lot of proboscis. A large hole was once made only four feet behind my seat, and I never knew the old fish had been hit.

Well, we are getting pretty close to the target now. It is a terrible temptation to the gunner to sit and watch the bombs dropping, but he really oughtn't to, because we may be attacked at any moment, and the rear gunner's job is to watch for their attack, not ours. Still, let's have a peep

at one end of the corner of our eye. The first bomb comes a bit wide, but the second hits the target square on the nose and wings, and adds to the blast. "Whooop!" shows the second pilot. "Whooop!" shows back the Captain; "Whooop!" shows you and I from the back.

We want no time, but turn to look. This is where we may expect attack. We have been fired at pretty continuously all the time, but now the fish has stopped, and there are only the searchlights. This seems to suggest fighters. A few night fighters, in this case, are in strength from our quarters out on enemy lights other just their conditions. With luck almost eliminated by German searchlights, the fighters come burning up and started banging off tracer at about six hundred yards. It was hot.

Our gunner hit him come or within three hundred yards and then got him three or four times. He banded sharply and then broke away. However, the gunner thought that was not the end of him, nor was it. He came in again, slightly above, and firing off a rod and green wave with all the enthusiasm associated with the Fifth of November at a prep school. This time our gunner gave him of his gun. But he didn't need a lot, he just went into a vertical dive, and plucked himself into the earth.

Well, we are all layed up for something to happen, but it doesn't. More searchlights, more fish, but no fighters, and in due course we are crossing the coast again, though that is itself quite an immensely long attack. It is beginning to feel pretty chilly, because we have been flying at a good height; and I suddenly find that one of my legs is getting cramped, and that six and a half hours of scanning the heavens has been a bit of a strain on the eyes; and then my hands have grown weary of holding the grips that operate the turret. In short, quite suddenly one finds that a lot of time has passed much to one's surprise, and that one feels tired. Well, nothing very happens at any moment; one keeps telling oneself, one must not relax.

Now we are over our own coast.

GUNNERY SENSE

We have had a good trip. Things have gone well. The target was found easily and was well and truly hit. There has been a happy atmosphere inside the line—though nothing is said. You notice the behaviour thing. It is sort of psychological.

Well, here we are, talk over the microphone. It is no come—a good landing, and lay up in the hangar. The C.O. is on the tarmac and wants to know about it, and then we go and pull off our flying kit, swap a few experiences in the crew room, and get in the sport. And so it happens and eggs, and hot in the pale light of dawn.

I wish I could tell you something about this military tail-gunner's casing, that was more spectacular than the things which have happened to you and me. . . . But the life of the tail-gunner has been horrible in one of those hours of the machine. I am glad that no much of the rank-and-file accountants talked about tail-gunners in the early days of the war has dried up—quick chicks, and the sort of filchery. We counted it. But I should like to say a word of thanks to the designers and work-people who gave us our optical, reflecting guns, and to the mechanics who at all hours and in all weathers keep them in action. They are heroes of the war, and it is they who make our work something in which we have a full measure of confidence.

A bomber engages three enemy fighters.

It was on the way back from a raid in the Ruhr when we were picked up by searchlights. They laid up right across the nose of Wood, then the pilot finally got out of them.

There was an anti-aircraft fire, so I was keeping a particularly sharp lookout for fighters. Suddenly, three bombers started flying past the hangar, and I saw three fighters coming in at us from the rear. One was coming in from the rearward quarter, and below us. The second was above and practically in astern, and the third was five or six degrees to port, and he—the first one on the other side—was also attacking from below. To me, it seemed that all three were converging on the rear turret.

The one on the starboard quarter seemed to be

pretty close, so I had first shot at him. The first burst seemed to hit. If you can get your first burst in all right, you can usually guarantee to get your following ones in too, unless things are particularly awkward; so I just kept pumping quick bursts into him—six or seven altogether. He was hitting us, too. Some of his shots went through the tailplane, the rudder and the wireless mast, and an explosive shell from his cannon hit the engine plating of my turret. I didn't realize at the time that the shell had actually hit us. I thought it had exploded just outside. Anyway, I knew the bang distressed me for thirty-six hours afterwards.

The fighter got to within about a hundred or hundred and fifty yards of the rear turret; then he pulled up like an aircraft pulling out of a dive. He seemed to hang there for a bit, and I put in a few more burst right into the belly of the aircraft. I saw him turn over and then I swung the turret to the second fighter, which had been closing in all this time, firing his four guns. I could see four streams of tracer coming at us. Out of the corner of my eye, I noticed the first fighter go down in flames. He exploded in the air or when he hit the decked outside bay which.

The second aircraft was the one which was flying slightly to port. I missed him with the first three bursts, because I was mistaking his speed, but the fourth burst hit him all right, and after that, I just kept repeating the performance. He was pretty badly, too, and did no further damage to our plane. The navigator got hit in the leg—not badly though—but nobody else was hurt. Then the lights vanished everyone of my kind of fire, and that was the last I saw of him, but the second pilot said to see him go down out of control.

After this, the third enemy fighter came down on us. His climb in to about three hundred yards, but evidently none is close. I got a bit fed up with this, so I had a good long burst in his direction and he dashed off. We didn't see him again.

Altogether, I have done just over twenty raids over Germany, but that was the most exciting one of the lot.

Remarks that get one expelled from the Air Gunners' Union.

Training? No, you see, I'm in an operational squadron now. . . .

You never see anything on those trips, so I always take a book into the turret. . . .

How was I to know there was anything wrong with the crew? The D.F.'s always cheer by the armchair. . . .

I never make a landing burst—we have to dash out over guns. . . .

I couldn't tell the range, as it was a Gander and we'd only practised with one's and 112's.

Well, you see, nobody knew what it was, as we were all having our sandwiches in the time. . . .

That's already sighted the coast, so I won't be the turret. . . .

I didn't bother much about it, as I had R.A.F. messengers on it. . . .

Sometimes I sit and think—and sometimes I put it.

