THE ROYAL AIR FORCE

ITS ORGANIZATION, DUTIES AND PROSPECTS AS A PROFESSION OR A TRADE

BY
T. STANHOPE SPRIGG
AUTHOR OF "AIR LICENCES"

LONDON
SIR ISAAC PITMAN & SONS, LTD.
1935

SIR ISAAC PITMAN & SONS, LTD.
PITMAN HOUSE, PARKER STREET, KINGSWAY, LONDON, W.C.2
THE PITMAN PRESS, BATH
PITMAN HOUSE, LITTLE COLLINS STREET, MELBOURNE

ASSOCIATED COMPANIES
PITMAN PUBLISHING CORPORATION
2 WEST 45TH STREET, NEW YORK
SIR ISAAC PITMAN & SONS (CANADA), LTD.
(INCORPORATING THE COMMERCIAL TEXT BOOK COMPANY)
PITMAN HOUSE, 381–383 CHURCH STREET, TORONTO

PRINTED IN GREAT BRITAIN
AT THE PITMAN PRESS, BATH

INTRODUCTION

In the course of the next five years the Royal Air Force is to be increased in size by approximately one half, the better to enable it to fulfil its increasing responsibilities in the defence and administration of the British Empire.

A result of this expansion will be not only to afford more rapid promotion to present members of the Service but also to enhance appreciably the prospects of those proposing to adopt the Royal Air Force as their future career.

To the latter this book is intended to serve both as an introduction to the Service—its organization, duties, and prospects as a profession or a trade—and as a guide to the various methods of entry open to commissioned and other ranks.

Grateful acknowledgment is made of the valuable assistance rendered to the author by the Air Ministry, though the views and opinions expressed throughout are those of the author and not of the Air Ministry.

Further, while every care has been taken to ensure that all statements as regards rates of emoluments and conditions of entitlement are correct, it will, of course, be understood that these are subject in all respects to the detailed regulations published under the authority of the Air Council.

T. STANHOPE SPRIGG

LONDON, 1934

CONTENTS

CHAPTER VI

CHAPTER VII

CHAPTER VIII

CHAPTER IX

CHAPTER X

CHAPTER XI

CHAPTER XII

CHAPTER XIII

CHAPTER XIV

APPENDICES*

* Extracted from A.P. 121 and sundry Air Ministry Forms and Pamphlets, and reproduced by courtesy of the Controller, His Majesty's Stationery Office.

ILLUSTRATIONS

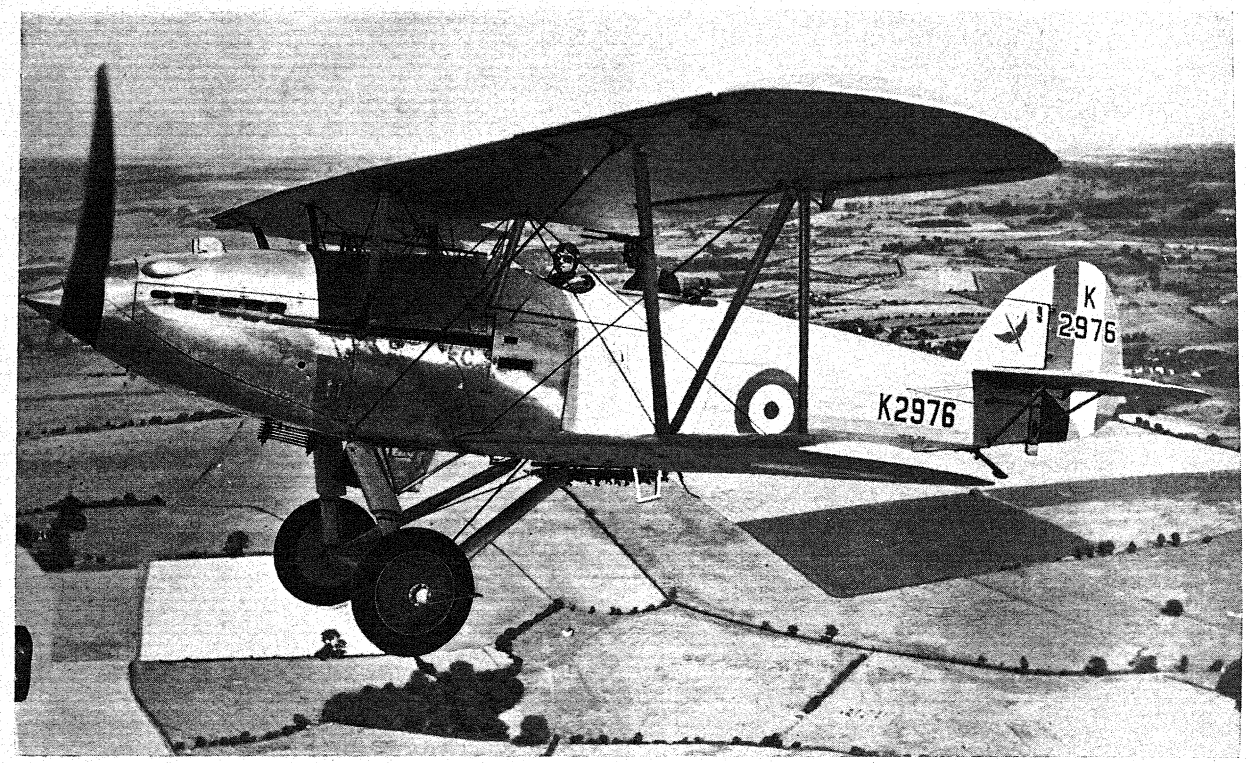


FIG. 1. A TWO-SEATER DAY-BOMBER

This actual machine belongs to one of the Auxiliary Air Force Squadrons, the crest of which is seen painted on the fin.

(Photo: Charles E. Brown)

THE ROYAL AIR FORCE

CHAPTER I

ITS HISTORY AND ORGANIZATION

By the fusion of the Royal Flying Corps and the Royal Naval Air Service towards the end of the Great War there was created a third and independent fighting service, the Royal Air Force, offering an entirely new career in the public service. The youngest of the fighting forces, the Royal Air Force is already the possessor of splendid traditions, and is to-day, for efficiency of personnel and equipment, without equal among the air powers of the world.

In point of size the comparison is less favourable, and from a supreme position at the end of the Great War the Royal Air Force has since dwindled in strength to a standard below that of at least four other great nations. This disparity is now in process of improvement by means of a five-year scheme of expansion, on completion of which the strength of the Royal Air Force, though still appreciably less than even the present air power of at least two other nations, will have been increased by about half its present size.

The Future of Air Power

As for its future, there must be few who, aware of the great advances in aeronautical science and the increasing national responsibilities being laid upon

the air arm, do not recognize as inevitable the further expansion of the Royal Air Force—both in scope and in numbers—and its permanent establishment as the Empire's first and most powerful line of defence. Disarmament, on land, sea, and in the air, is a universal ideal, but the recent history of Geneva serves only to emphasize its idealism and to make still more apparent the necessity for a strong defence in the cause of peace. And in this defence throughout the world air power must surely in future play a predominant part.

The value of aircraft as essential factors in military and naval operations was well demonstrated in the comparatively early days of flying which coincided with the Great War. Since then the vast improvement in the air weapon has increased this value a thousandfold, and there can to-day be envisaged few naval or military engagements in which aircraft would not play a vital, if not a decisive, role. But, apart from such enhancement of the powers of the two older services, the Royal Air Force has of recent years created for itself new spheres of action of even greater importance. Not only is it the only practical means of defence against the air power of other nations, but it has also proved itself eminently suited to the task of keeping the peace in uncivilized or semi-civilized territories, as evidenced by the transfer from the War Office to the Air Ministry of responsibility for the policing of such territories as those of 'Iraq, Palestine, Transjordan, and Aden. The result of this transfer has been to effect a vast saving in money and fighting personnel, and to provide a more efficient and more humane form of control than it had previously been possible to exercise.

These few instances of the wide scope of the duties

of the Air Arm alone suffice to show that even in time of peace the Royal Air Force will always offer an honourable and responsible career and one of increasing opportunities to the young man of individuality, resource, and rapid judgment.

Expansion

Equally significant of the future is the Government's recent decision to expand the Royal Air Force to the extent of half its present strength within a period of five years from 1934 to 1939. Prior to this decision, on 1st January, 1934, the strength of the Royal Air Force amounted to 3334 officers, 25,170 men, 83 cadets, and 1794 apprentices, and some 90 squadrons representing a total of approximately 845 first-line aircraft.

Under the new expansion policy this strength is being increased to 94 squadrons and nearly 900 first-line aircraft by the end of 1934, and to 131 squadrons and 1308 first-line aircraft by the end of 1939. If the Auxiliary Air Force and certain cadre units are included the total is raised to about 1430 aircraft. Of these, the Home Defence Force which, on 1st January, 1934, comprised some 42 squadrons (480 aircraft) will, by 1939, have been raised to 75 squadrons, totalling approximately 850 aircraft. These increases, in turn, will be accompanied in time by the addition of some 800 officers and 5000 other ranks within the five-year period.

The actual process of expansion, involving as it does the recruiting and training of the necessary additional personnel to fly and maintain the new aircraft, and the erection of buildings and aerodromes at which to house them, must necessarily be a gradual one. Already, however, there have been immediate results.

The number of vacancies which are open to short- and medium-service officers has been increased, more airmen are now being selected from the ranks for training as pilots, a larger number of boys is being accepted for apprenticeship training, and a bigger reserve of pilots is also being built up to accompany the expansion of the regular Air Force.

Meanwhile, the gap which must exist between the acceptance of the extra personnel and the completion of their training is being bridged by extensions of service in the case of officers and airmen engaged for limited periods of service, and the re-engagement, in a civilian capacity, of certain classes of skilled tradesmen who had left the Service.

The administration of the Service as a whole, however, remains unaffected by the expansion scheme, and is divided amongst eleven Commands: five at home and six overseas, which are in turn subdivided into areas constituting subordinate commands.

The Home Commands

The largest Home Command is that of the Air Defence of Great Britain, comprising all units and formations of the Home Defence Force, and primarily concerned with the adequate defence of the British Isles from air attack. This Command is divided into three areas and one group, the Western Area, the Central Area, the Fighting Area, and No. 1 Air Defence Group.

The Western and Central Areas administer a number of bombing squadrons, including cadre, or Special Reserve squadrons, as well as those of the regular Air Force. The Fighting Area comprises fighter squadrons, while No. 1 Air Defence Group is mainly concerned with the squadrons of the Auxiliary Air

Force, a non-regular force manned principally by officers and men engaged in civil occupations who serve with the squadrons in their spare time.

Another of the five Home Commands is that of the Coastal Area, which is in charge of the squadrons and flights of the Fleet Air Arm of the Royal Air Force ashore and afloat in home waters, and of the seaplane units stationed in Great Britain.

The Inland Area

The third Home Command is that of the Inland Area which administers Army co-operation squadrons, and is also responsible for the various training schools and depots. The two remaining Home Commands, Cranwell and Halton, are educational establishment commands—and administer the Cranwell Cadet College and two schools for aircraft apprentices. Under the present scheme of training of expansion a total of some thirty-seven new squadrons is to be added to the strength of the Home Command.

For the Royal Air Force overseas there are six separate Commands—the Middle East with headquarters at Cairo, and covering Egypt, the Sudan, Palestine, and Transjordan; the 'Iraq Command with headquarters at Hinaidi, near Baghdad; the India Command with headquarters at New Delhi; and the Mediterranean Command stationed in Malta. There are also the Aden and Far East Commands with headquarters at Aden and Singapore respectively.

A total of twenty-one squadrons of landplanes and three of flying-boats is at present divided among these overseas commands, and included in the strength of the 'Iraq and Middle East Commands are several armoured-car companies which are constantly maintained by the Royal Air Force, and which have on

many occasions proved of great value in desert warfare. The overseas strength will be increased by four squadrons during the present expansion.

Overseas and Fleet Air Arm Units

The personnel of these units of the Royal Air Force serving overseas is drawn from the Royal Air Force at home, and every officer and most airmen may expect to be posted overseas at some time during their period of service. The usual length of overseas service is at least five years, though in the case of short-service commission officers, or airmen approaching the end of their enrolment, the period may be less. In the cases of 'Iraq, the Sudan, Aden, or Singapore the period of service seldom exceeds two to three years.

Yet another branch of the Royal Air Force is that primarily engaged in naval air duties, and known as the Fleet Air Arm. The present strength of this Arm is equivalent to some 15 squadrons (159 aircraft), and is divided among aircraft-carriers both at home and abroad, and those capital ships and cruisers with aircraft accommodation. Under the new five-year expansion scheme the Fleet Air Arm is to be increased by a total of approximately four new squadrons. The personnel of the Fleet Air Arm, the lineal descendant of the old Royal Naval Air Service, comprises officers and men of both the Navy and the Air Force.

Several training centres are maintained by the Royal Air Force, offering facilities for officers and other ranks to acquire knowledge of specialized duties. The majority are administered by the Home Commands, and their scope includes the following subjects: Engineering, Photography, Wireless Telegraphy, Air Pilotage, Flying Instruction, Physical

Training, Air Gunnery, Army Co-operation, Torpedo-bombing, Fleet Spotting, Reconnaissance Duties, Deck-flying, Staff Duties, and Air Fighting (the latter a new course for which a special school is now in process of formation).

Specialization in one or other of these subjects is of importance because promotion in the Royal Air Force, for all ranks, is primarily by selection on individual merit, and not by virtue of seniority alone. For an officer in the General Duties flying branch, in particular, there may come a time when his piloting ability begins to wane, and if he has not by then attained some special qualification to maintain his usefulness to the Service he may well be passed over for promotion.

Openings in The Royal Air Force

The methods of entry into the Royal Air Force, for both commissioned and other ranks, and the various non-regular forces which combine to form the Royal Air Force, are described in detail hereafter. At this stage, therefore, a summary will suffice to afford a comprehensive picture of the openings available in the Service as a whole.

For those who wish to devote their entire career to military aviation, the regular Air Force, as distinct from the auxiliary and cadre squadrons, must be their objective. For officers, the principal methods of entry are through the medium of a university, or through the R.A.F. College at Cranwell, both of which lead to permanent commissions and pensioned retirement.

To a lesser extent entry may be gained into such special branches of the regular Air Force as the Stores, Accountant, Medical, Dental, Chaplains, or Legal branches, though in some of these branches

entry is, in the first place, by means of a short-service commission which may, or may not, subsequently be converted into a permanent commission.

For other ranks the longest possible period of service for which recruits are accepted is twelve years from the age of 18, and this is confined to those who enter as apprentices or boys between the ages of 15 and 17¼. A limited proportion of these entrants may reasonably anticipate re-engagement for a further period of twelve years, after which they will have qualified, by twenty-four years service, for retirement on pension.

Limited Periods of Service

Apart from such permanent and semi-permanent engagements, the regular Air Force is also open to both officers and men for limited periods of service.

For officers, the short-service commission system in the General Duties branch offers direct entry to young men between the ages of 18 and 22, who serve for a period of six years on the active list, and then, save for a minority who may be selected for permanent commissions or for extended service, pass to the Reserve, and return to civil life with a gratuity of £500. This system, it may be noted, offers particular attractions to those who intend subsequently to enter Civil Aviation as qualified and experienced pilots.

In the lower ranks direct entry, without special preliminary training, is open from time to time, as vacancies occur, to certain skilled tradesmen such as carpenters, machine-tool operators, etc., as well as to unskilled men between the ages of 18 and 26 who enter as aircrafthands. The usual period of engagement for skilled men is nine years and for aircrafthands seven years. Extensions of service, up to

the pension-qualifying stage, are sometimes offered to these direct entrants towards the end of their original period of engagement, but, as a general rule, they return to civil life, and the method can by no means be regarded as affording a permanently assured career in the Royal Air Force.

The Non-Regular Forces

Supplementing the regular Air Force are the auxiliary and cadre squadrons, consisting of the Auxiliary Air Force, the Reserve, and the Special Reserve. These forces are all open to direct entry by both officers and men, but employment is of the voluntary "spare time" order rather than a "whole time" job. They afford free instruction as a pilot, and are valuable training grounds for a career in Civil Aviation, whilst for those who do not wish to fly they afford facilities for spare-time training in skilled trades with healthy sport and recreation in congenial company. In most cases officers and men receive remuneration in the form of annual retaining fees or bonuses, as well as payment at Air Force rates when undergoing annual training.

Finally, there are the two University Air Squadrons which, though they form no actual part of the Royal Air Force, are administered by Service personnel, and provide useful stepping-stones for university members to a career in the Royal Air Force either as short-service commissioned officers or with permanent commissions as university graduates.

CHAPTER II

DUTIES AND TRAINING

BEFORE dealing in detail with the various methods of entry into the Royal Air Force, and the opportunities it offers for following a profession or trade, it may be of interest to outline some of the principal duties of Royal Air Force stations, to any one of which the newcomer to the Service may find himself attached.

So wide and varied are the functions of the Royal Air Force that it is not possible, within the limits of this book, to describe them in any detail. Instead, a brief survey of some of the Service's more representative units may afford a general idea of the life and work that the Royal Air Force offers to its members.

The Home Defence Force, which comprises the greater part of the Royal Air Force and excludes only those units stationed overseas or with the Fleet, is distributed among some sixty-six aerodromes and stations in different parts of the country. Some stations are concerned solely with administrative duties; others are training centres, repair depots, experimental stations, or schools of specialist training. Most numerous are those stations serving as bases for the varying types of aircraft which together comprise the first-line equipment of the Royal Air Force, and which are specially designed for such differing duties as fighting, day and night bombing, army co-operation, coastal patrol, and long-range reconnaissance work. Squadrons of aircraft of similar type are attached to each aerodrome, and their peace-time work and training vary according to the duties which they would be called upon to fulfil in time of war.

Fighter Squadrons

The functions of the Fighter Squadrons, of which there is a ring round London for the defence of the metropolis, are to intercept and destroy all enemy raiders approaching England, and to attack and destroy on their homeward journeys such enemy aircraft as may have succeeded in penetrating the defences or may have given up the attempt.

For this purpose they are supplied with high-performance single- or two-seater fighters, the fastest of which, known as interceptor fighters, are capable of a speed in excess of 210 m.p.h. at a height of 15,000 ft. The pilots of these aircraft are equipped with oxygen-breathing apparatus and electrically-heated clothing for use in the cold and rarefied air of the high altitudes at which they normally operate. In the single-seaters the pilots act as their own gunners, and are able to keep in touch with their ground bases by radio-telegraphy. Each squadron comprises nine aircraft, but the normal tactical unit is a flight of three machines which, moving together as a homogeneous whole, is thus able to maintain superiority of fire power and afford mutual support.

The training of pilots of fighter squadrons is divided into two parts, first individual training, followed by collective (i.e. flight and squadron) training. The individual training begins when the pilot is first posted to the squadron from a flying-training school. He practises night flying and air fighting, the latter practice consisting of diving at ground targets and attacking individual aircraft with camera guns that record photographically all "hits" scored on the aircraft attacked. The fighter pilot is also required to study and pass examinations in ground and air training subjects, the chief of which are administration,

airmanship, flying and operational duties, air pilotage (including meteorology), armament, gunnery, bombing, and signalling.

Flight training begins with formation-flying practice and, having become proficient in keeping station with other machines, the pilots go on to air-fighting practices which include attacks on individual aircraft, formations, and converging bombing on ground targets. Finally comes squadron training in which all nine machines practise formation-flying and air-drill, quick get-aways, rapid refuelling and re-arming, timed climbs to a patrol line, interception of aircraft, and attacks on other formations.

Apart from these flying duties, ground-work is constantly in progress on the station to ensure the efficient maintenance of aircraft, engines, armament, wireless and electrical gear, and at a number of fighter aerodromes one squadron is always kept in readiness to take-off, prepared for immediate action at half an hour's notice.

Bombing Squadrons

Aircraft for bombing purposes are subdivided into three classes, Day Bombing, Night Bombing, and Day and Night Bombing. Each class has its own particular type of aeroplane.

The Day Bombers are all single-engined, high-performance two-seaters, specially designed for high-altitude day bombing. The duties of such squadrons in time of war would consist mainly in bombing enemy territory and long-distance reconnaissance.

The training of the crews, consisting of a pilot and a gunner-observer, is carried out progressively, first as individual units, then together as a flight, and, finally, as a squadron. In this training is included

camera-gun work, bombing with practice bombs, photography, map-reading, wireless, formation and cloud flying.

Day and Night Bombers are normally twin-engined machines possessing better defensive and offensive facilities, and carrying greater bomb-loads than day-bombing types. The training of their personnel is identical with that of the Day Bomber squadrons, but includes practice in night flying.

The Night Bombers are also twin-engined craft, but represent a class still larger and of greater load-carrying capacity than the Day and Night Bomber. The functions of these machines are to carry out bombing by night of military and naval bases and points of strategic importance far inside the enemy territory. Each machine is equipped to function primarily as an individual unit, with a crew consisting of pilot, navigator, wireless operator, and gunner. Their normal peace-time training consists of high-altitude bombing practice by day and night, the training of pilots in night-flying and long-distance, cross-country journeys, air gunnery exercise to train the crews in the methods of defending their aircraft from attack, and co-operative tactical exercises with military and naval forces, including anti-aircraft and searchlight exercises.

Coastal Units

Altogether different is the function of the Flying-boat Squadrons whose principal duties, some of which are complementary to those of the Navy, are the protection of our sea communications against commerce raiders and submarines, long-distance reconnaissance flights to guard against surprise attacks on our coasts and harbours, early and rapid reinforcement of overseas units where considerations of neutrality preclude

the use of landplanes, and other air operations of an independent nature.

These duties require a knowledge of navigation by day and night, bomb-dropping, gunnery, photography, and meteorology, in addition to all the technical knowledge required to keep the aircraft and its equipment in efficient order.

The training follows a regular, annual programme. The winter months are normally devoted to individual training comprising lectures, firing at the gunnery range, demonstrations of instruments and equipment, and individual flying training by day and by night. During the spring and summer months exercises are carried out with units of the Fleet, and in the autumn the squadrons visit an armament training camp where their standard of bombing and gunnery is assessed.

These flying-boats are all large, multi-engined aircraft provided with all facilities to enable the crew to live aboard, and are capable of operating as self-contained units away from their bases for long periods. They normally carry two or three pilots, one of whom acts as navigator, two air gunners, one of whom is also an engineer, and a wireless operator. Their usual armament is three or more machine-guns, in addition to a large bomb-load. One of the latest types of flying-boats is also armed with a quick-firing, small calibre gun mounted in the bows and firing a shell of approximately 1½ lb. weight.

Army Co-operation Squadrons

Another class of squadron is that primarily devoted to co-operation with military forces. These units, known as Army Co-operation Squadrons, are equipped with a medium-performance, single-engined type of aircraft carrying a pilot and an observer, the pilot being

an officer and the observer an airman. Each squadron comprises twelve aircraft and, in addition to the crews of these, various officers and men with specialist knowledge are required to maintain the aircraft and mechanical transport vehicles of the squadron, and the elaborate technical equipment connected with reconnaissance work. The total complement of an army co-operation squadron in wartime actually consists of approximately 23 officers and 153 airmen, including fitters, riggers, drivers, photograhers, wireless operators, and armourers. About thirty-six vehicles of various types are also required by each squadron, and these include photographic and wireless lorries, water-trailers, and vehicles for ammunition, spare parts, rations, and baggage.

The duties of an army co-operation squadron comprise tactical reconnaissance flights in quest of information as to the movements of enemy columns and the disposition of hostile forces. This information, when secured, is either sent by wireless from the aircraft or brought back in the form of air photographs. Other duties of these versatile machines, which may operate either singly or in formations, include night reconnaissance, artillery-spotting, supply-dropping by parachute, and the conveyance of army staff officers.

There is a special R.A.F. training school for army co-operation duties, which is attended both by pilots and army officers. The main object of this school is to train pilots in reconnaissance and intercommunication with all branches of the Army. The syllabus of training includes instruction in map-reading, reconnaissance duties, artillery co-operation, photography, signals between aircraft and ground forces. The course is of twelve weeks' duration, and on completion the

pilots are posted for duty with army co-operation squadrons to apply in practice the theoretical knowledge they have acquired.

Naval Co-operation

As with the Army, Naval requirements are also represented in the organization of the Royal Air Force by a special School of Naval Co-operation. The function of this school is the training of naval officers for observer duties with the Fleet Air Arm. The training course for the naval observers is a specialist one embracing wireless telegraphy, spotting of gun-fire, and air navigation, and is mainly carried out in the air in single-engined float seaplanes attached to the School.

In addition to the School of Naval Co-operation, there are a number of other units and centres of the Royal Air Force concerned with Fleet Air Arm duties. One is a training centre for Fleet Air Arm pilots where a complete course of flying instruction, lasting a year, is given. After preliminary tuition in training-type aircraft, actual Fleet Air Arm types of machines are used, and all pilots carry out landing practice on the deck of an aircraft-carrier under varying conditions of wind and weather. The remainder of the course covers bombing, air firing, wireless, photography, air pilotage, catapult launches, deck-landings, etc.

A separate centre is maintained for the training of pilots and air gunners in the special duties of bombing and torpedo-dropping, in which a torpedo, weighing approximately a ton, is launched against a warship from an aircraft in flight. Here the programme of training includes also the recovery of practice torpedoes by pinnaces and speed-boats manned by expert crews.

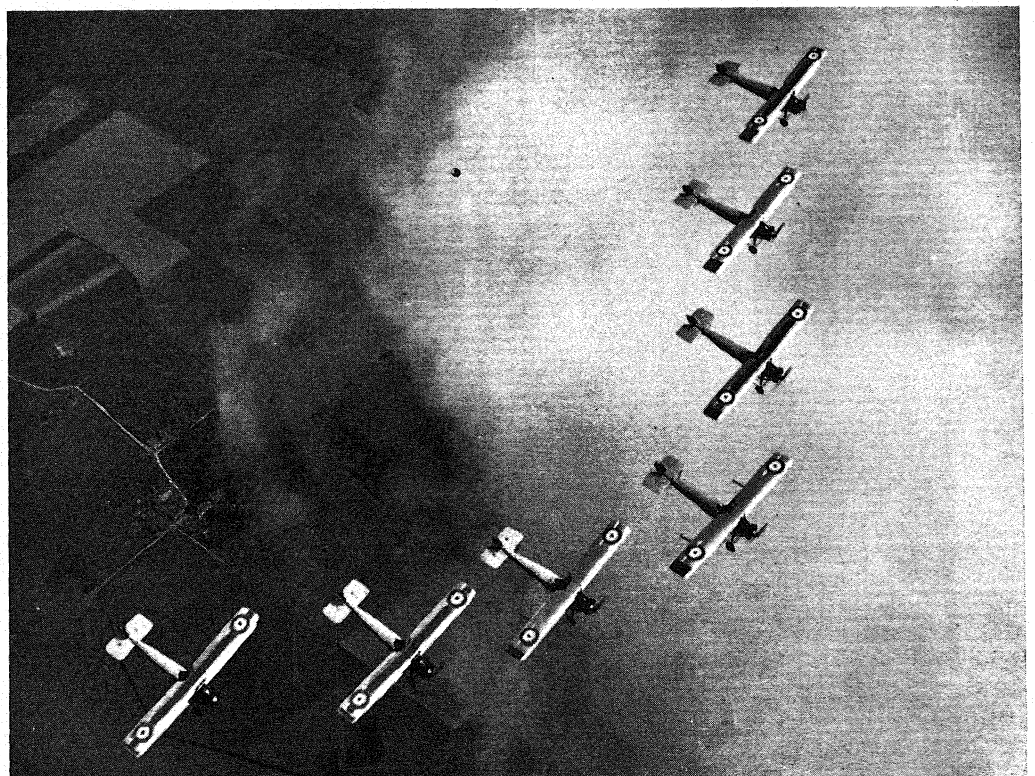


FIG. 2

There are two University Squadrons, Oxford and Cambridge, and this picture was taken at a recent annual camp.

(Photo: Charles E. Brown)

The latter station, among others, serves as a shore-base for the aircraft-carriers and as a centre of training for Fleet Air Arm personnel. Its work includes the advanced training of Fleet Air Arm pilots in deck landing, instrument flying, signalling, height-finding exercises, sleeve-target towing, and a large amount of experimental work in connection with all types of torpedoes.

Flying Training Schools

The training of new pilots forms, of course, a large and important part of the work of the Air Force, and, both at home and on overseas stations, there are a number of schools solely devoted to this purpose. These schools deal with the flying training on land-planes of officers selected for short-service commissions, and of airmen who are to be trained as pilots. The training period lasts just under a year, and is divided into two terms, for elementary and advanced instruction.

At first, instruction is given on aircraft of low power noted for their ease of control. As the pupil becomes more proficient he is allowed to fly standard service types of aircraft, but fitted with dual control so that the instructor who accompanies him can take over control at any time in case of emergency. In addition to the actual handling of aircraft in the air and on the ground, the pupil undergoes courses of instruction in such subjects as the theory of flight, engines, rigging, armament, wireless telegraphy, signalling, photography, service law, administration, and drill.

A flying training school is usually equipped with several flights of aircraft of both elementary and service types, and to cope with their maintenance there is in most cases a station workshop, with both engine

and aircraft repair sections, under a qualified engineer officer.

The instructional staffs of these schools are drawn from graduates of The Central Flying School, maintained in England for the training of flying-instructors. The higher officers of this school also pay periodical visits to flying-training schools at home and abroad to ensure that only the most up-to-date training methods are being employed. Another function of this school is to provide "refresher" courses for officers and airman pilots, who may get out of flying practice on account of ill-health or pressure of other duties.

A separate training school is devoted to the training of pilots for marine aircraft, and provides courses for pilots in seaplanes, amphibians, and flying-boats, as well as in navigation and air pilotage.

Here pilots are accustomed to the handling of flying-boats by a progressive course starting with float seaplanes, in which they practise taking-off from and alighting on water. For the next stage they transfer to amphibians, and, finally, qualify on service type flying-boats. During their course at this school they are also instructed in navigation, visual signalling, and the general maintenance of the various types of aircraft which they fly.

The maintenance and servicing of flying-boats on the water necessitate the use of several specialized types of motor-boats, and the crews for these craft, for the whole of the Air Force, are also trained at this coastal station.

Repair and Engineering Depot

The work of overhauling and repairing aeroplanes, engines, and accessories for all R.A.F. units of the Home Command is centred in The Home Aircraft

Depot. Here, too, is a section responsible for the manufacture of many spare parts required by the engine and aeroplane repair sections, and a well-equipped and up-to-date machine shop. In addition to its other duties this section repairs the Air Force's mechanical transport vehicles, aircraft, instruments, armament, cameras, and many other kinds of equipment.

Here, too, is the base for the testing, packing, and repair of parachutes used throughout the service, and regular classes are conducted for the training of officers and men in their use by means of practice jumps from aircraft attached to the station.

Overseas Units

To deal here with all the many aspects of the daily work of the Royal Air Force is, as has been stated, impossible, nor does space permit of describing the still more varied duties of Air Force units stationed overseas. Though equipped with aircraft identical with those used in the Home Commands their functions may sometimes differ appreciably, and their duties include such varied activities as the quelling of tribal insurrections by bombing raids, the relief and evacuation of Europeans in dangerous areas, the suppression of gun-running and piracy, the operation of mail services, and long-distance transcontinental flights carried out as annual exercises.

This summary of some of the principal functions of the Service should, however, suffice to show the wide scope of the activities of the Royal Air Force, and the many opportunities and vocations that it offers to men of varied abilities and inclinations.

CHAPTER III

THE AIR FORCE AS A CAREER FOR OFFICERS

THOUGH the Royal Air Force is of recent origin in comparison with the older fighting services, it has before it a future of infinite promise, and at the present time probably affords to its officers a profession of wider scope and greater opportunity than is to be found in either of its sister services.

The Royal Air Force, thanks to the careful selection of those responsible for its recruitment, and to the large number of eager applicants, is attracting to itself the finest types of young officers, men of character and ability who see in the Service a new career affording ample scope for an engineering or mechanical bent, and one which also satisfies a natural inclination for travel and adventure.

Permanent Commissions

To such, a permanent commission in the Royal Air Force is their objective, and it can be attained in either of two ways. One is by entry through the Royal Air Force College at Cranwell, open to those between the ages of 17½ and 19½ years. The other method is by direct entry through the medium of a recognized university of which the applicant is a graduate. The age limits for this method of entry are from 20 to 25 years.

These are the only two means by which, at present, a permanent commission can immediately be secured in the General Duties Branch of the Royal Air Force, the branch which provides opportunities for widely

differing types of study and specialized employment, and offers the prospect of attaining to the highest posts in the Service. There are other branches—six in all—in which it is possible to obtain a permanent commission by direct entry, or, in some cases, by selection from a short-service commission after a period of years, but these branches are filled mainly by those with some professional qualification whose interest in flying is of a secondary nature, and they do not offer quite the same scope for promotion to the highest ranks.

These other branches, whose titles are descriptive of their duties, are the Stores Branch, the Accountant Branch, the Medical Branch, the Dental Branch, the Legal Branch, and the Chaplains Branch. Their place in the organization of the Royal Air Force, and the conditions for entry into them, are described in a separate chapter elsewhere and need not be repeated here, as their appeal is limited in comparison with that of the General Duties Branch.

The General Duties Branch

This branch is concerned with the flying, technical, command and general administrative duties of the Royal Air Force, and its officers, in addition to becoming expert pilots, are expected to qualify in some special aspect of the work of the Service. The choice of specialization is a wide one, including aeronautical engineering, signalling, armament, navigation, and air photography. Special courses of study are available for these specialist subjects, and those who qualify in them become eligible for accelerated promotion. Other openings for officers holding permanent commissions are the studying of foreign languages, with a view to carrying out intelligence duties or to

filling posts such as that of Air Attaché to a British Embassy, and entry into the R.A.F. Staff College at Andover, where they are trained to fill the higher staff posts.

Specialization does not, however, necessarily mean a cessation of flying, and the usual service practice is to employ technically-qualified officers alternately on technical and flying duties, so that they do not at any time lose touch with the general work of the Service.

Of paramount importance is the practice of granting permanent commissions in the General Duties Branch only in such numbers as will provide, in the ordinary course of promotion, sufficient officers to fill the higher posts in the Service. Naturally, not every officer can expect promotion to the highest ranks, but the careful regulation of the number of permanent commissions granted does at least ensure that every officer may confidently look forward to a career which will not be limited to the years of his life during which he can expect to be an effective war pilot, but, rather, one which will afford constant scope for steady progress towards the higher administrative ranks until the time comes for him to retire with a pension.

Retiring Ages and Pensions

The minimum period of service qualifying for a retirement on retired pay is twenty years. The compulsory retiring ages vary according to rank, and are 45 in the case of Flight Lieutenants and Squadron Leaders and 48 for Wing Commanders. A Wing Commander retiring at this age would receive retired pay at the rate of £540 a year, a Squadron Leader at the rate of £405, and a Flight Lieutenant at the rate of £360 a year. The present maximum rate of retired pay for higher ranks varies from £1282 10s.

per annum for an Air Chief Marshal to £720 per annum for a Group Captain.[1]

However short their service may have been, permanent officers who are invalided from the Royal Air Force receive retired pay if the disability causing their retirement is due to the conditions of service. They may also receive an addition to retired pay, varying in amount and duration according to the degree and duration of their disablement. If the disablement is not due to the conditions of service, they are eligible for a gratuity, if of the rank of Pilot Officer, or for retired pay if of higher rank. Provision is also made for grants to widows and children, and dependent relatives, of a deceased officer.

Pay and Allowances

As regards remuneration whilst serving, the rates of pay and allowances are on a generous basis, and an unmarried officer of even the lowest rank can live on his pay, and should be able to marry on his pay and allowances by the age of 30. The allowances are for accommodation, fuel, light, rations, and personal attendance, and when these are not provided in kind equivalent cash payments are granted in lieu. At the majority of Royal Air Force stations at home there are special quarters allocated to married officers.

At present rates the total of pay and cash allowances ranges from about £380 per annum for an unmarried Pilot Officer to £2800 a year for a married Air Chief Marshal.[1]

Short-service Commissions

All officers of the Royal Air Force do not, however, hold permanent commissions. In addition to those

[1] The rates of full and retired pay here given are those of the new consolidated rates which have recently been promulgated. For the present, however, slightly lower rates will remain in force.—AUTHOR'S NOTE.

who have entered by the two methods already mentioned, there are a number who enter each year on what are known as Short-service Commissions. These officers enrol for a period of six years only, after which they usually pass to the Reserve, and simultaneously to civil life, with a gratuity.

It might at first be thought that a limited period of engagement of this nature could offer but little inducement to an ambitious young man, and would be more likely to prove a "blind alley" occupation, wasting valuable years of a man's life, than a means of achieving a permanent career.

This would certainly be the case if the short-service commission scheme were to be regarded as a method of securing a permanent commission in the Royal Air Force, because of the fact that a very limited number of these commissions are awarded each year to selected short-service officers. If, on the other hand, the system is regarded as one of the best possible training-grounds for a career in civil aviation, it has much to recommend it as a means of obtaining the necessary flying training cheaply, and of gaining wide and valuable experience unobtainable elsewhere by a civilian.

Civil aviation is expanding rapidly, the need for trained and experienced pilots and executives is growing daily, and now that the once large supply of war-time pilots is nearly absorbed there must henceforth be a steadily increasing demand for men of the type and training of the short-service commission officer.

Apart from this consideration the short-service commission, with its six years of disciplined training, and its ample opportunities for recreation and foreign travel, can hardly fail to have a beneficial effect upon the character-building of the young officer, whatever

the career he may decide to follow upon his return to civil life. He will also receive a substantial gratuity to assist in establishing him in his selected career.

Status and Prospects of Promotion

Short-service commissions are granted to suitable candidates between the ages of 18 and 22, and are for a period of six years, followed by four years' service in the Reserve of Air Force Officers. Service in the Reserve, it should be pointed out, entails only short periods of training and does not preclude one from taking up whole-time civil employment.

Short-service officers undergo a year of preliminary training, and throughout their six years on the active list are employed in the General Duties Branch. They join with the rank of Acting Pilot Officer, and, on completing their training, are on exactly the same footing as regards pay, promotion, and command as an officer holding a permanent commission.

A strictly limited number of short-service officers are selected, each year, by examination, to specialize in various technical duties, with a view to the award of permanent commissions. The number of these, however, is so small—despite the increase resulting from the present expansion scheme—and competition is so keen that, as has been said, to rely upon obtaining one is to invite almost certain disappointment.

Medium-service

Another alternative to retiring at the end of the specified six years of service is to apply for medium-service after having completed three years of the original term. Under this system an officer, if accepted, is re-enrolled for a further period of five years, followed by four years in the Reserve, but it is not a course

to be recommended to anyone who has in prospect the building-up of a civil career. It means that he will return to civil life at any age from 29 to 33, and unless he has financial means of his own, or assured employment, the handicap of age and lack of business experience must necessarily prove a serious one. Medium-service officers, however, receive a much larger gratuity than short-service officers.

Transfers to the Reserve

In the normal course, therefore, a short-service officer, at the end of his sixth year of service, is transferred to the Reserve for a period of four years, and receives a cash gratuity of £500. The gratuity may be less if the officer has at any time suffered a forfeiture of seniority, or if he does not complete his full period of service; but in either case it is calculated at the rate of £100 for each completed year of service after the first. The gratuity after completing both the short- and medium- service engagement amounts normally to £1000.

Every officer, whether holding a permanent or short-service commission, will normally spend a period of his service abroad attached to one of the several Overseas Commands of the Royal Air Force. The usual minimum period of overseas service is five years, though it is often less in the case of short-service officers who are unable to complete this period before the expiry of their term of engagement.

CHAPTER IV

OPPORTUNITIES IN THE RANKS

LIFE in the Royal Air Force has such manifold attractions and advantages for the young man of ambition that it has been possible for the Air Ministry, by setting a high standard for admission, to ensure that only the best possible type of recruit is accepted for service in the ranks.

To these the Royal Air Force offers a manly and healthy life with interesting work, congenial comradeship, good pay and prospects. An airman in the Royal Air Force is provided with food, clothing, and accommodation free of all charge. He has his own dining-rooms, recreation rooms, and libraries, and each station has its own institute where he may purchase tobacco and other luxuries at reduced prices. Sport of every description plays a prominent part in his training, and many stations have their own football, cricket, and hockey teams, tennis-courts and gymnasiums. Boxing and all forms of athletics are encouraged, and inter-station contests are a popular feature of the year's sport.

Every airman normally has an opportunity of going overseas during his period of service—usually for five years—to one or more of the R.A.F. stations in Egypt, India, Palestine, 'Iraq, Aden, Malta, Hong Kong, the Sudan or Singapore. Both at home and abroad he may usually rely upon a month's holiday a year on full pay, in addition to occasional week-end leaves.

Opportunities for Promotion

From the start of his career he is given every assistance to qualify for promotion to either non-commissioned or commissioned rank, or to become an airman-pilot. There are also ample educational facilities for a man to learn a useful trade, or to acquire further knowledge and experience in his own particular one.

At the end of his period of service, according to its length, he will either receive a pension on discharge after long service or a gratuity, the latter amounting to £100 in the case of ex-aircraft apprentices who join the Reserve after twelve years' man's service. A considerable number of men who serve for nine or twelve years will, on return to civil life, be highly-skilled tradesmen able to command a good wage in civil employment.

Air Force Trades

Airmen are classified in five principal trade groups, each covering different classes of Service work and carrying different rates of pay. Group I, the highest paid class, comprises the trades of fitter, fitter (armourer), fitter (torpedo), instrument maker, machine-tool setter and operator, metal-worker, and wireless-operator mechanic.

Group II consists of armoured-car crew, armourer, carpenter, photographer, wireless-operator, and the small trade of rigger (airship).

In Group III there are the trades of cook and butcher, fabric worker, motor-boat crew, and storekeeper.

Group IV, the administrative group, comprises clerks for general duties and for pay and store accounting, while Group V is a non-technical class made up of aircrafthands (i) for general duties, (ii)

for duty as physical-training instructors or as Service policemen, (iii) for those under training for technical duties in Group III and (iv) fitter's mates, motor-vehicle drivers, hospital or dental orderlies, and musicians. There are also separate Medical and Dental branches with three groups for such duties as pharmacist, trained nurse, dental mechanic, dispenser, masseur, nursing, and dental orderly, etc. The varying rates of pay for these trade groups are shown in a table in Appendix IV.

Methods of Entry

The ranks of the Royal Air Force are recruited by two principal methods: by the direct entry of men from civil life, and by aircraft apprentices, apprentice clerks, and boys who undergo special courses of training before being sent to service units for duty.

The direct-entry method is becoming increasingly limited, as it is now the policy of the Air Ministry to look more and more to the apprentice and boy entrant classes to fill peace-time vacancies as skilled tradesmen in the ranks, and to confine direct entry to occasional vacancies in certain skilled trades which cannot be filled from existing ranks. A number of unskilled men are, however, still recruited each year by entry as aircrafthands for general duties, or for training in the less skilled trades.

As a general guide the present practice in recruitment is that all fitters, the largest class in the Service, instrument makers and wireless-operator mechanics are drawn exclusively from trained aircraft apprentices. The trades of armourer, photographer, and wireless operator are to be filled by the newly-introduced boy entrants after a similar, but shorter, period of training to that given to aircraft apprentices.

Direct Entries from Civil Life

Aircrafthands, comprising unskilled men accepted by direct entry from civil life and those already serving, perform general duties and are eligible for training in the work of armoured-car crews, cooks and butchers, fabric workers, fitter's mates, motor-boat crews, storekeepers, physical-training instructors, motor-vehicle drivers, and Service police. For the trades of fitter (torpedo), machine-tool setter and operator, metal-worker and carpenter, skilled tradesmen are recruited from civil life. A number of direct entrants from civil life are also accepted for certain clerical duties to supplement the ranks of specially-trained apprentice clerks.

Fuller details of these various methods of entry, their prospects and conditions of service, are given in subsequent chapters of this book.

CHAPTER V

PERMANENT COMMISSIONS *VIA* THE R.A.F. COLLEGE

THE main channel of entry into the commissioned ranks of the Royal Air Force with a permanent commission is through the Royal Air Force College at Cranwell. This college fulfils a similar function for the Royal Air Force as do Woolwich and Sandhurst for the Army and Dartmouth for the Navy, and is intended solely for those who wish to make the Royal Air Force their permanent profession.

Entry is mainly by competitive examination, and is open to suitable candidates between $17\frac{1}{2}$ and $19\frac{1}{2}$ years of age. The fees for the two years' training course are within the capacity of those of moderate means and, having successfully passed out at the end of their two years' training course, cadets are given permanent commissions with a rate of pay sufficient to enable them to become self-supporting from the outset.

The inclusive cost of the two years' training course at Cranwell is, at the maximum, £300. There are, however, a number of prize and special cadetships and scholarships available, carrying pecuniary advantages which reduce considerably the total cost of the training course. Details of these cadetships and methods of entry at reduced fees are given hereafter.

The Royal Air Force College

The college at Cranwell, with its adjacent aerodrome and buildings, occupies an area of some six square miles, and is situated on a plateau about

twelve miles north-east of Grantham in the county of Lincolnshire. The college is under the control of a Commandant, with the rank of Air Vice-Marshal, and the usual number of cadets in residence is approximately 100. The organization comprises a college headquarters, a cadet wing, and an airman's wing. The cadet wing consists of the cadet squadrons and their officers, and here is given the whole of the necessary instruction in flying, service, and general educational subjects. The course is of two years' duration, each year being divided into two terms: the Spring Term lasting from about the middle of January to about the middle of July, and the Autumn Term from about the middle of September to about the middle of December. About ten weeks leave is given during each year, usually the last fortnight in April, four weeks in August, and four weeks at Christmas.

Course of Training

Training is by no means confined to learning to fly or to service subjects—though every cadet qualifies as a pilot under the safe supervision of expert instructors—but is based on a curriculum of general, scientific, and professional subjects designed to link up the school life which the cadet has left with the commissioned rank that he is shortly to hold. Thus, the subjects that form the course of studies include, in the first year, English language and literature, general ethnology, applied mathematics, including mechanics and draughtsmanship, elementary physics, history of the R.A.F., theory of flight, air pilotage, map reading, Air Force law and administration, hygiene and sanitation, workshops and engines, wireless telegraphy, practical flying, drill and physical training.

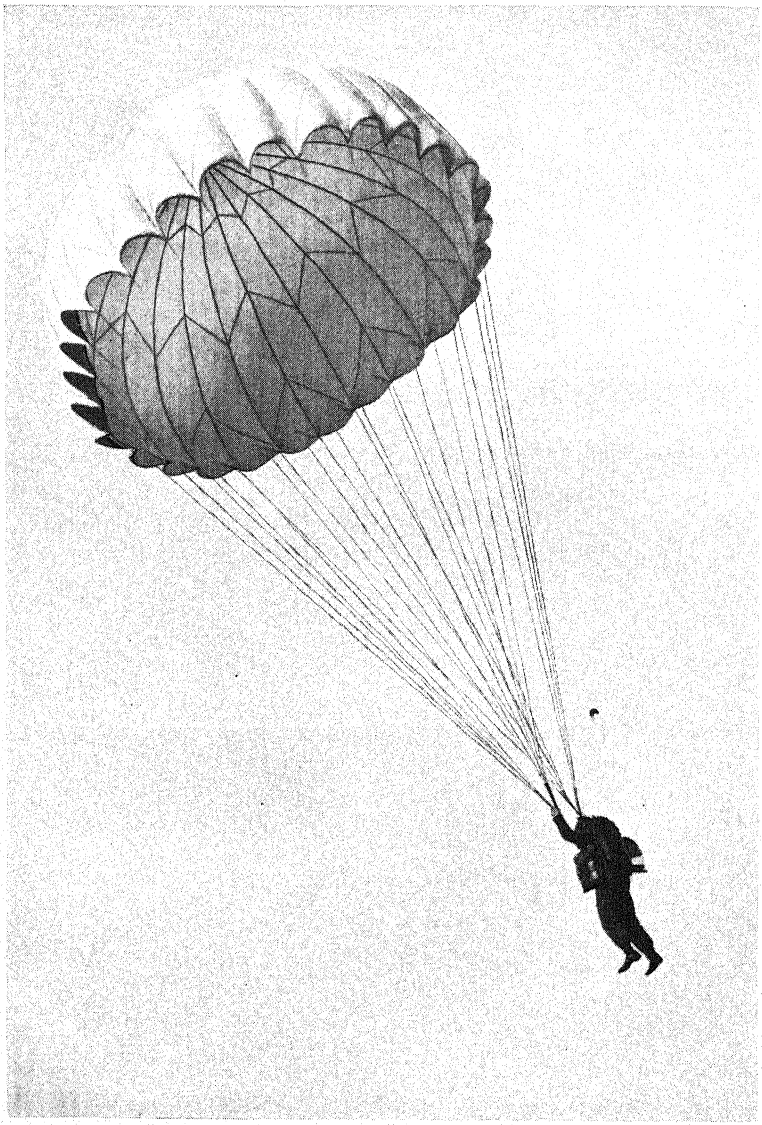


FIG. 3

Since its adoption a few years ago the parachute, has been instrumental in saving a great number of lives.

(*Photo: Charles E. Brown*)

During the second year the course includes theoretical and practical instruction in internal combustion engines, aerodynamics, rigging, advanced work in the wood and metal workshops, armament, practical flying, air pilotage, airmanship, meteorology, and the strategy and tactics of warfare.

Examinations are held from time to time during the course, and cadets are awarded marks for their work during the terms. The total number of marks gained at the end of the course determines the cadet's place in order of merit when passing out for appointment to a commission. Should a cadet fail to obtain the qualifying minimum of 55 per cent. in a terminal examination he is liable to "lose a term," in which case he will have to attend an extra term at the college before again becoming eligible to pass out for appointment to the Service.

A typical morning in the life of the college begins at 6.30 a.m. in the summer. By 8.30 breakfast, followed by a colour-hoisting parade and prayers, is over, and until 9.15 a drill parade is held. Class-work, flying-training, workshop or armament instruction and drill may occupy the rest of the morning—with a half-hour break—up to 12.30. Wednesdays and Saturdays are half holidays.

Sport and Recreation

There are exceptional facilities for sport and recreation, both of which play an important part in the cadet's life and training. Four afternoons a week are devoted to exercises of various kinds, and the sports facilities available include football—both Rugby and Association, cricket, hockey, squash-rackets, fives, tennis, golf, and swimming in the college's own swimming bath. Cranwell also has its own pack of beagles;

fox-hunting and riding are encouraged, and athletics of every kind are the source of keen annual competition. The station has its own theatre for cinema and concert entertainments, and runs an excellent magazine of its own.

Pay of Cadets

Cadets wear uniform at all times except when on leave, and receive pay at the rate of 6s. 6d. a day from the date of joining. This sum is usually found sufficient to enable them to meet all personal expenses while at the college. From their pay is deducted the cost of messing, washing, sports, library, and other incidental charges, the balance being credited to the cadet and issued to him periodically in cash.

In cases of sickness or injury cadets receive expert medical and surgical attention, without charge if the disability is directly attributable to a flying accident on duty. In such cases they are also entitled to sick leave up to a maximum of twelve months on full pay. If the illness is not attributable to the service a charge is made for medical attention, and sick pay is granted up to a maximum of only three months. Compensation is also paid in the event of permanent or partial disablement incurred as the result of an accident when engaged in flying on duty and entailing removal from the College.

Award of Commissions

A passing-out examination is held at the end of the course, and those who are successful are granted permanent commissions and posted to the General Duties Branch of the Royal Air Force with the rank of Pilot Officer. The General Duties Branch is concerned with

the flying, technical, command, and general administrative work of the Royal Air Force, and provides opportunity for widely differing types of study and specialized employment. From the outset the pay of officers, even in the lowest ranks, is adequate to enable them to be independent of financial aid, whilst they have before them a permanent and pensionable career in a young and growing service, with the prospects of reaching the highest posts that are available.

Conditions and Methods of Entry

All candidates for admission to the college must be unmarried British subjects of pure European descent, between the ages of 17½ and 19½ years, and the sons of parents both of whom are British subjects. They must hold either a School Certificate "A" or "B," or produce evidence of having reached a similar educational standard. (See Appendix I.)

Finally, they must successfully pass a medical examination by a R.A.F. medical board, a selection committee, and a written entrance examination.

The Medical Examination

A very high standard of physical and mental fitness is required of candidates, and the examination is conducted in London by officers of the Royal Air Force Central Medical Board. It includes an interrogatory and psychological examination—to ascertain the candidate's suitability for flying duties from a medical standpoint—medical and surgical examinations, and examinations of the eyes, ears, nose, throat, and teeth.[1]

Prior Medical Examination

To lessen the chances of subsequent disappointment, it is advisable that the candidate should undergo a

[1] Full details of this Examination are contained in Appendix IV of Air Publication 121, obtainable, price 1s. net, from H.M.S.O., or any bookseller.

preliminary medical examination prior to filing his application for a cadetship. This preliminary examination can either be made by the candidate's own doctor in accordance with the Air Ministry's requirements,[1] or, preferably, it may be made by the R.A.F. Medical Board. If the latter course is adopted the examination may be undergone at any time during the two years prior to the application for a cadetship. It is held in London on Mondays, Wednesdays, and Fridays, and a fee of three guineas is charged. This fee should be enclosed with the letter of application addressed to the Secretary, the Air Ministry, London, W.C.2. The candidate will then be notified of the time and place at which he is to attend for examination, and although success at this preliminary examination does not necessarily mean that the candidate will be equally successful when he finally presents himself for the medical examination proper, it does provide the best possible assurance of his probable attainment to the requisite high standards of physical fitness.

The Selection Committee

The selection of candidates is made by an Interview Board of the Civil Service Commission, at Burlington Gardens, London, W.1. This interview is of an oral character, its object being to ascertain the candidate's general character, knowledge, and standard of education, and to ensure that he is of a suitable type for holding a commission in the Royal Air Force. A total of 250 marks is awarded as a result of this interview, and a candidate, to be approved, must gain a minimum of 50.

The interview may precede the written entrance examination in the case of candidates taking the

[1] Full details of this Examination are contained in Appendix IV of Air Publication 121, obtainable, price 1s. net, from H.M.S.O., or any bookseller

latter in or near London, but will follow it when the written examination is being taken at more distant centres. In the latter case, however, it is usually possible so to arrange the interview, medical examination, and other oral tests that only one visit to London is necessary.

The Entrance Examination

The Royal Air Force Entrance Examination is conducted by the Civil Service Commissioners, and is held twice a year in London, and in certain provincial centres from time to time. The examination begins, as a rule, on the fourth Tuesday in June for entry to the college in September, and on the third Tuesday in November for entry in January. Notice of forthcoming examinations is given in the daily Press together with the closing date for applications, which is usually about two months prior to the examination date.

To enter, a candidate has to apply by letter to The Secretary, The Civil Service Commission, Burlington Gardens, London, W.1., for the necessary printed form of application for admission to the examination. This form must be filled up in the candidate's own handwriting and returned, as soon as possible, to the same address. The fee, which need not be sent with the application form, is £4 if the examination is to be taken in London, and £5 if taken at any other centre, the latter amount being in addition to any local fee that may be payable to the college or school authorities.

Incidentally, a candidate for the R.A.F. College at this examination may also if he wishes, and without extra charge, sit at the same time for a cadetship in the Royal Navy, the Royal Military College at Sandhurst, the Royal Military Academy at Woolwich,

r for a first appointment in the Royal Marines, pro-ided, of course, that he complies with the age and ther conditions laid down by the Admiralty and the Var Office. The one examination covers all cate-ories, and it is only necessary for the candidate, prior the examination, to state his order of preference. hus, he may for example, say that if he is not among e first twenty competitors for the R.A.F. College he sires to be accepted for the Royal Military Academy.

Upon receipt of the candidate's completed applica-on form the Civil Service Commissioners will next ll for a birth or baptismal certificate—to verify his e—and a school certificate as previously mentioned. ubsequently, they will also supply a form for com-etion by the headmaster of the applicant's school. hen these formalities have all been satisfactorily mpleted, and the candidate has successfully passed e medical board and interview committee, he will e advised of his acceptance as a candidate for the ext entrance examination.

The subjects of this examination, and the maximum umber of marks obtainable for each, are as follow—

PART I

English, 150; General Knowledge, 150; Interview and Record, 250; One of the following: Modern Language, General History, Elementary Mathematics, or Everyday Science.

PART II

Latin, 300; Greek, 300; French, 300; German, 300; Modern History, 300; Lower Mathematics, 300; Higher Mathematics, 300; Physics-plus-Chemistry, 300; Biology, 300; Navigation, 300.

Candidates may not offer more than three subjects in Part II.[1]

[1] For further details of the Examination reference should be made to Air Publication 121, obtainable from H.M.S.O., or any bookseller.

At least 30 per cent. of the total maximum number of marks available must be obtained to secure a "pass" in this written examination.

Fees and Cost of Training

The total maximum cost of the two years' training course at the Cadet College is, in the ordinary way, £300. This is made up of an annual fee of £100, payable in two equal half-yearly instalments in advance, a payment of £80 prior to first joining, and a further payment of £20 prior to the start of the third term, the two latter amounts being in respect of the cost of uniform and the initial purchase of books.

Reduced Charges

In certain circumstances the standard fees may be reduced or remitted, in which cases the college status of the cadet concerned is identical in every respect with that of one for whom the full rate is being paid. The conditions in which these exceptions are made are as follow—

1. If the Air Council are satisfied that the means of the parents of a suitable candidate are such as to warrant the concession, they may, in a very limited number of cases, agree to a reduction of the annual fee from £100 to £75. In this event the total maximum cost to the parents for the two years' course would be £250, i.e. two annual fees of £75 in addition to the two sums of £80 and £20 already referred to for the purchase of uniform and books.

2. *Prize Cadetships.* Six prize cadetships to the College are awarded at each entrance examination, and are intended to afford financial assistance to cadets of good ability whose parents may not be in affluent

circumstances. In such cases the annual fee is reduced from £100 to £20, and the necessary uniform and books are supplied free of charge up to a total value of £100.

3. *Scholarships.* Assistance in defraying the expenses of training at the College may also be obtained through the medium of scholarships, two classes of which, the "Lord Wakefield" Scholarship and the "Victoria League" Scholarship, are at present available.

The "Lord Wakefield" Scholarship is intended to assist the sons of parents or guardians in reduced circumstances, and is awarded to the candidate who gains the highest number of marks at the entrance examination. Two of these scholarships are awarded annually, one at each half-yearly examination. Each is of the value of £75 and is tenable for one year.

The "Victoria League" Scholarship is open to eligible candidates for the R.A.F. College whose fathers are British subjects of European descent and normally resident in the Union of South Africa. One scholarship is offered for competition each alternate year for the September entry to the College. It is of an annual value of approximately £100 and is tenable for two years.

4. *Officers and Men of the Fighting Services.* Reduced annual fees, varying from £20 to £60, are also accepted in the case of the sons of certain officers and men of the fighting services. The reductions vary according to the rank of the officer or man, whether he is still living or died in service, and upon the financial circumstances of his family. Details of these reductions may be obtained on application to the Secretary of the Air Ministry, or on reference to Air Ministry Publication No. 121.[1] In these cases, though the

[1] Obtainable, price 1s., from H.M.S.O., or from any bookseller.

annual fees may be reduced, the charge of £100 for uniform and books remains unaffected. The total cost of the two years' training under these special conditions therefore varies from £140 to £220, according to circumstances.

5. *King's Cadetships.* For King's Cadets the cost of training at the College is nil, the annual fees being remitted, and uniform and books provided free of charge, up to a total value of £100. A limited number only of these cadetships is available, and vacancies are open for competition among accepted candidates who pass highest at the entrance examination. To be eligible candidates must be the sons of officers of the Royal Navy, Royal Marines, the British Army, the Royal Air Force, or the permanent fighting forces of India, or of one of the Dominions or Colonies, who have fallen in action, or have died of wounds received in action, or of disease contracted on service abroad, or have been killed as a result of a flying accident whilst on duty, and who have left their families in circumstances so reduced as to render financial assistance necessary.

To compete for a King's Cadetship candidates must have previously been nominated by the Secretary of State for Air. Claims are considered twice a year, and must be made on a special form which may be obtained on application to the Secretary, the Air Ministry, London, W.C.2.

6. *Honorary King's Cadetships.* These cadetships carry no pecuniary advantages and are open only to candidates who are—

(i) The sons of officers of the Royal Navy, Royal Marines, British Army, or Royal Air Force who "have fallen in action, or died of wounds received in action, or from illness brought on by fatigue, privation, or

exposure incident to active operations in the field before an enemy within six months of the onset of the illness, or have been killed as a result of a flying accident," or

(ii) The sons of officers of the Royal Air Force who "have attained the substantive rank of Squadron Leader or above, and have performed long and distinguished service."

The method of nomination for these cadetships is identical with that for King's Cadetships, and they are awarded to those eligible candidates who succeed in qualifying at the entrance examination.

It should be noted that parents who wish their sons to be considered for these reduced-fee concessions are required to submit an application not later than the closing date for receiving applications for admission to the entrance examination for which it is proposed the candidate should enter. The appropriate form upon which to make application may be obtained free of charge from the Secretary, the Air Ministry.

Other Methods of Entry

From the Dominions and Colonies. A limited number of nominations to cadetships is made by the Air Council from among candidates belonging to families established and resident in the Dominions, Colonies, and Protectorates. Application in connection with these has to be made to the Government of the overseas territory, and such candidates are excused from competing in the entrance examination, and may pass both the Medical Examination and an Interview Selection Committee in their own country.

Royal Naval Officers, Midshipmen, and Cadets. Any of the above may be nominated by the Lords Commissioners of the Admiralty to compete at the R.A.F.

Entrance Examination without being in possession of a school certificate, provided that they have an educational qualification of a similar nature and are within the prescribed age limits of $17\frac{1}{2}$ and $19\frac{1}{2}$ years. A candidate who is no longer serving in the Navy may also be nominated, providing that he ceased to serve within one year of the date of the entrance examination for which he is to compete.

CHAPTER VI

PERMANENT COMMISSIONS *VIA* THE UNIVERSITIES

As an alternative to entry through the R.A.F. College at Cranwell, permanent commissions in the Royal Air Force may also be obtained by nomination from the Air Council on the recommendation of any recognized university of Great Britain and Northern Ireland.

About seventeen vacancies a year are generally available under this system, twelve of which are known as "open" vacancies, and five as "limited" vacancies. The "limited" class of vacancy is confined to engineering students with an honours degree, who may be required, on acceptance and after three years' general flying service, to specialize in either aeronautical engineering or in armament.

"Open" vacancies are available to all candidates irrespective of the subject of their academic studies. If accepted they will, after about three years of general flying service, be eligible to be selected for specialization either in aeronautical engineering, signalling, armament, photography, or air navigation.

Specialist Officers

Both classes in effect are designed for the production of specialist officers, who, having acquired the necessary specialist qualifications, are then eligible for more rapid promotion in rank than the non-specialist regular officer. At the same time they are equally eligible with non-specialist officers for selection for the higher

administrative and flying posts, and for staff appointments.

Officers entering under this scheme are first posted to a training unit for a course of instruction lasting about eleven months, or less in the case of those who were formerly members of a University Air Squadron or of the Royal Air Force Reserve. On joining they are given permanent commissions as Pilot Officers with twelve months seniority,[1] but are regarded as being strictly on probation and liable to termination of their commission until they have successfully completed the training course.

From the outset they receive the usual pay and allowances to which their rank entitles them, and are subject to the same conditions as regards retirement, retired pay, gratuities, widows' pensions, disablement gratuities, etc., as for other officers holding permanent commissions in the Service.

Promotion to the rank of Flying Officer follows the passing of the usual promotion examination which, in their case, may be taken after only six months' actual service. Promotion to the rank of Flight Lieutenant will normally take place after four years' service as a Flying Officer.

Promotion to Squadron Leader's rank is by seniority, but accelerated by antedates so as to give more rapid promotion to those who are recommended as exceptionally suitable, or who have acquired specialist, staff, or some other special service qualification. Thereafter, promotion is by selection.

Qualifications of Nomination

Candidates who are recommended for entry *via* the universities must be unmarried British subjects of pure

[1] Candidates who have graduated with first or second-class honours may be granted an additional six months' seniority, making eighteen months in all.

European descent and the sons of British parents. They must be between the ages of 20 and 25, have completed three years residence by the end of the university year in which they are recommended, and must have passed an examination qualifying them for a degree at the university.

They must be physically fit, and will be required to pass both a medical examination and a selection committee.

How to Apply for Nomination

The candidate should obtain from the Secretary of the Air Ministry copies of Forms Nos. 732 and 733. The former he should himself complete, whilst the latter, the form of recommendation, has to be completed by the authorities of his university. Both forms are then returned to the Secretary of the Air Ministry at Adastral House, London, W.C.2, and, in due course, the candidate will be invited to attend at the Air Ministry for medical examination and for interview by a Central Selection Committee.

In the case of applications from Oxford, Cambridge, and London Universities the candidate will previously have been interviewed by a board assembled by the university and including a representative of the Air Ministry.

The Central Selection Committee meets at the Air Ministry twice a year, in the first week of August and in the first week of January, and appointments to commissions usually take place about October or March.

The medical examination is made by the Royal Air Force Central Medical Establishment at 3 and 4 Clements Inn, London, W.C.2, and is usually arranged to coincide with the candidate's appearance before

the selection committee, so that only one visit to London is necessary.

The standards of physical fitness required by this medical board are very high, and the examination is identical with that for candidates for entry *via* the R.A.F. College. To avoid disappointment university candidates are strongly recommended to undergo a preliminary examination, as suggested on page 36, before even applying for nomination to a commission.

CHAPTER VII

COMMISSIONS IN THE STORES ACCOUNTANT, MEDICAL, DENTAL, LEGAL AND CHAPLAINS BRANCHES

In addition to the General Duties Branch, which is concerned with the flying, technical, command, and general administrative duties of the Royal Air Force, there are a number of other branches providing opportunities for varied forms of professional and specialized work. In all cases they offer interesting and progressive employment, and in many a permanent and pensionable career.

As it is not necessary for officers in these branches to qualify as pilots—though they may have to fly as passengers if their duties demand it—the standards of physical fitness required, though high, are not so severe as those necessary for a commission in the General Duties Branch.

These additional branches of the Service are—

1. The Stores Branch.
2. The Accountant Branch.
3. The Medical Branch.
4. The Dental Branch.
5. The Legal Branch.
6. The Chaplains Branch.

Their organization, duties, and methods of entry are separately described in brief hereafter, but in all cases, without exception, candidates are required to pass a medical examination, and must be British subjects of pure European descent and the sons of parents

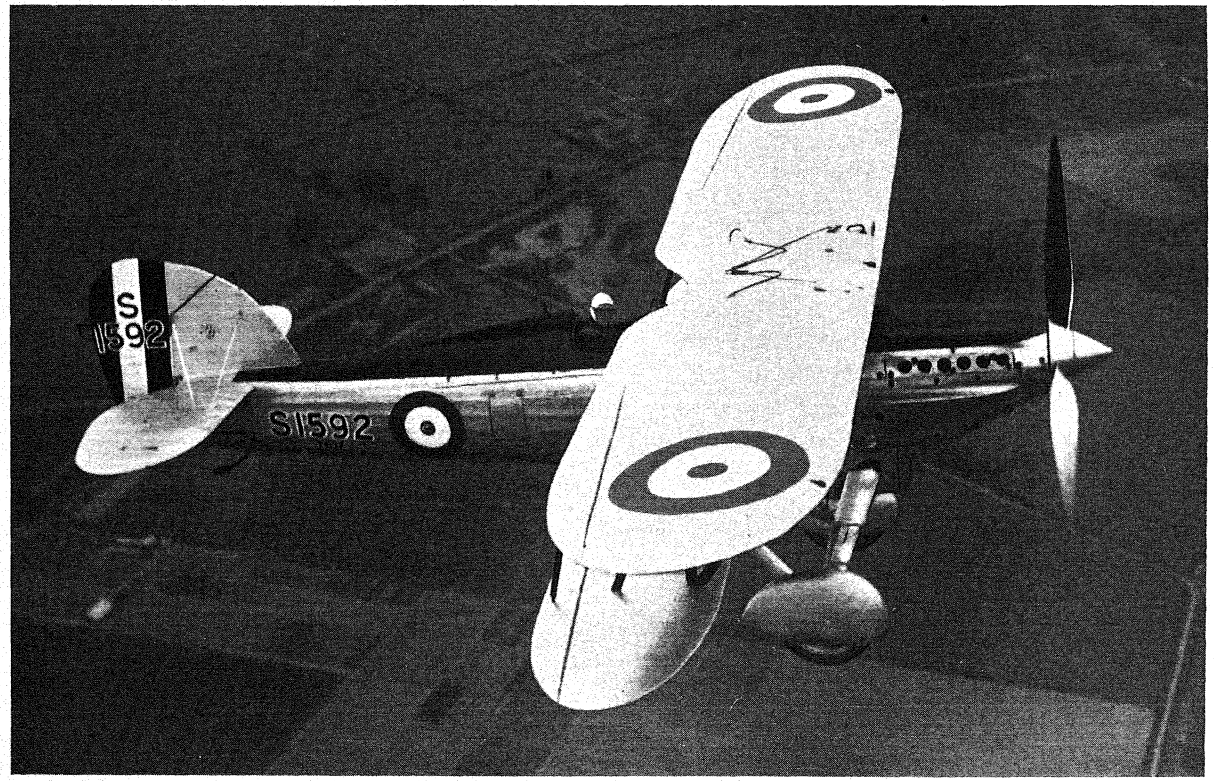


FIG. 4. A TYPICAL SINGLE-SEATER FIGHTER
Fighter Squadrons are all in Home Commands.
(*Photo: Charles E. Brown*)

both of whom are also British subjects. In each branch, too, successful candidates on appointment to commissions receive a grant of £50 towards the cost of the necessary uniform and equipment.

The Stores Branch

This branch is concerned with the care and issue of the numerous classes of stores, equipment, and material used in the Royal Air Force. The range of stores is a wide one, including as it does not only perishable goods and clothing for the use of officers and men, but also complete aircraft and engines and such accessories as petrol, oil, spares, armament, bombs, etc. The work of this branch, and the scale upon which it is conducted, is such as to offer great opportunities to officers of the right type to develop organizing and administrative qualities of a high order.

Entry into the Stores Branch is normally by competition to fill vacancies as they arise. Announcements of these are made in the Press from time to time, and applications from candidates should be made on the Air Ministry Form No. 1230. Candidates must be between the ages of 23 and 25, and have had not less than five years practical experience in business or industry. They should also be in possession of School Certificate A or B, or some other approved educational qualification. (See Appendix I.)

From among the eligible candidates the Air Council then nominates a limited number for interview, followed by a written, competitive examination in arithmetic, general knowledge, and English.

Successful candidates are, subject to medical fitness, appointed to the Stores Branch and gazetted to permanent commissions as Pilot Officers. Promotion to the rank of Flying Officer follows a year

later, and to the rank of Flight Lieutenant after six years' service as a Flying Officer. Thereafter, promotion is by selection.

The rates of pay, including allowances, vary from about £330 per annum for an unmarried Pilot Officer to £600 for a married Flight Lieutenant, and £1125 for a married Group Captain, the highest rank attainable in this Branch.

The Accountant Branch

Accountancy in the Royal Air Force is decentralized to units and, under this system, the accountant officer of a unit is responsible on the one hand to his Commanding Officer, and on the other to the Director of Accounts at the Air Ministry. R.A.F. units may either be self-accounting ones to which a single junior officer is posted in charge, or several small units may be grouped together in charge of a senior officer who is assisted by several juniors. Accountant officers, therefore, have the opportunity of early appointment to independent positions, whilst the great value and variety of the Royal Air Force's equipment indicate the importance and responsibility attaching to the work of its Accountant Branch.

Entry is by competition to fill vacancies as they arise, and these are announced by the Air Ministry in the daily Press. Application to take part in the competitive examination has to be made on Air Ministry Form No. 1074, and candidates, to be eligible, must be between the ages of 22 and 26 and, in addition to theoretical qualifications, must also have had a wide practical experience of accountancy.

From the available candidates the Air Ministry nominates a limited number for interview, followed by a written examination. The latter deals with

English, general knowledge, book-keeping, and accountancy, and is of the same standard as that of the final examination of the Institute of Chartered Accountants and of the Society of Incorporated Accountants and Auditors.

Successful candidates are, subject to medical fitness, appointed to the Accountant Branch and gazetted to permanent commissions with the rank of Pilot Officer. Promotion to Flying Officer follows twelve months later and to the rank of Flight Lieutenant after six years service as a Flying Officer. Thereafter, promotion is by selection.

The rates of pay for accountant officers, inclusive of allowances, when issuable, range from about £365 a year for a Pilot Officer to about £1125 per annum for a married Group Captain.[1]

The Medical Branch

For medical men the Royal Air Force offers a career which should prove both attractive and interesting. The duties of a medical officer in the Service include not only the prevention and treatment of those ordinary ailments to which the personnel of any fighting service are subject, but also the special study of the mental and physical strains imposed upon the airman in varied circumstances and climates. Further, since promotion to the higher ranks is by selection, and as a certain proportion of the higher ranks are reserved for purely scientific, as opposed to administrative, appointments, it will be seen that there are excellent prospects for young doctors with ability and interest in scientific research, as well as for those with special talents for administration.

In addition, ample opportunity for general surgical

[1] For details of emoluments see Air Ministry Pamphlet 18, price 2d., H.M.S.O., or any bookseller.

and medical work is to be found in the various R.A.F. hospitals, while medical officers desirous of maintaining and increasing their professional efficiency may arrange to attend, on full pay, periodical courses of instruction at either civil or service medical centres.

The method of entry is, in the first place, by means of the grant of a short-service commission for a period of three years on the active list, followed by four years' service with the Reserve. This active-list period is extensible, in approved cases, to five years. As and when vacancies occur in the permanent establishment of the medical branch selections for permanent commissions are made from amongst those holding short-service commissions. This selection is usually made during the course of the second or third year of service, and the number of short-service commissions is so regulated that, in practice, every entrant has a 50-per cent. chance of selection for a permanent commission. Those who do not desire, or are not selected for transfer to the permanent list, receive gratuities of £400 for three years' service or £1000 for five years.

Medical officers are given the rank of Flying Officer on joining, and are on precisely the same footing, for the purposes of rank and command, as permanent medical officers of the Royal Air Force. Promotion to the rank of Flight Lieutenant follows after one year's service, and those holding permanent commissions will normally be promoted to the rank of Squadron Leader after ten years' total service, though this period may be reduced for officers holding specialist qualifications.

The rates of pay and allowances are good, and, with allowances, when issuable, the total emoluments vary from £585 per annum for a married Flying Officer to about £650 per annum for a married

Flight Lieutenant (£540 if unmarried), rising to £1035 for a married Squadron Leader after six years as such, and £2065 for an Air Vice-Marshal.

Candidates for appointment to the Medical Branch must be under 28 years of age, fully qualified to practice medicine and surgery, and registered under the Medical Act. They are also required to pass an R.A.F. medical board and a selection committee presided over by the Director of Medical Services.

Applications for appointment should be made on the Air Ministry Form No. 1007, obtainable on application to the Secretary of the Air Ministry, London, W.C.2.

The Dental Branch

Dental officers form a separate branch of the Royal Air Force, but are administered as part of the Medical Service. The total establishment of officers, both permanent and short-service, of the Dental Branch is, at present, twenty-seven.

Entry is by means of a short-service commission for a period of three years which, in approved cases, may be extended to a total period of ten years. In each case service on the active list is followed by four years' service in the Reserve. A limited number of permanent commissions is granted to short-service officers, by selection, as and when vacancies occur.

Successful candidates join with the rank of Flying Officer, and are eligible for promotion to the rank of Flight Lieutenant after two years' service, and, in the case of those holding a permanent commission, to the rank of Squadron Leader after ten years' service. The scale of pay, together with allowances, when issuable, affords remuneration at the rate of about £517 per annum for a married Flying Officer (£445 single);

£588 (£479 single) for a Flight Lieutenant; £755 (£681 single) for a Squadron Leader, on promotion, and £1218 for a married Wing Commander after four years' service as such.

Candidates for appointment must, usually, be under 28 years of age, fully qualified, and must possess the degree or licence in dental surgery of a British university or recognized licensing body. They must also be registered under the Dentists or Medical Acts during the whole period of their service. Applications should be made on the Air Ministry Form No. 1007, which is obtainable free of charge on application to the Secretary of the Air Ministry in London.

The Legal Branch

The normal establishment of the Legal Branch consists of one Wing Commander, two Squadron Leaders, and a Flight Lieutenant, who are posted either to the office of the Judge Advocate-General, or to the staff of the Air Officer Commanding Middle East, for Egypt and Palestine.

The duties of this branch include advice in connection with the convening and conduct of courts martial and prosecution in intricate cases, advice and assistance upon legal matters in connection with courts of inquiry, such as those involving the investigation of public and service accounts, and the conduct of periodical courses of instruction in the administration of Air Force law.

Vacancies in the Legal Branch are very few and are advertised on occurrence in the Press. To be eligible, candidates have to be between the ages of 32 and 37, either barristers or solicitors, and possessed of considerable experience in practice, preferably in Criminal or Common Law practice. Permanent commissions

carrying the rank of Flight Lieutenant are granted to successful applicants.

The Chaplains Branch

In the Royal Air Force the Chaplains Branch is administered by the Air Member for Personnel, and the normal establishment is as follows—

Sect	Permanent Commissions	Short-service Commissions
Church of England	14	7
Roman Catholic	3	2
Methodist	3	1
Presbyterian	2	1
United Board	2	—

Chaplains, on entry, are appointed to short-service commissions for a period of three years, which may subsequently be extended to a total of six years, after which, in either case, they retire with a gratuity. Permanent commissions are granted by selection from chaplains on short-service who can complete twenty years' service counting for retirement on retired pay before the age of 60. They are normally granted the relative rank of Squadron Leader from the outset, though this bears no relation to their remuneration which varies from £506 per annum for a married chaplain (£396 single) on entry to £1125 (£1066 single) after thirty years' service on the active list. In order to be eligible for a permanent commission a chaplain on entry must be under 30 years of age. Chaplains holding permanent commissions retire at 50 or such later age, not exceeding 60, as may be decided by the Air Ministry, and receive a pension provided they have completed twenty years' service.

CHAPTER VIII

SHORT-SERVICE COMMISSIONS

(General Duties Branch)

THE Short-Service Commission scheme has been devised to fill a certain number of junior posts on the active list and to provide a reserve of experienced officers who, after training in the Royal Air Force, return to civil life, but remain available for service in case of emergency.

Under this scheme officers are appointed to the active list of the Royal Air Force for six years and, during that period, are on exactly the same basis as regards pay and promotion as permanent officers of the Royal Air Force. At the end of their six years' service they are, normally, transferred to the Reserve for four years, and receive a gratuity on their returning to civil life.

Permanent Commissions and Medium-service

A small number of short-service officers are selected annually for appointment to medium-service commissions, whereby they continue on the active list for a further five years, making eleven years in all, before returning to civil life and passing to the Reserve.

In addition, a strictly limited number of permanent commissions is awarded annually to short-service officers. These are allocated to those officers who specialize in aeronautical engineering, signals, or armament, or to those who are recommended as specially suitable by their commanding officers, and who are successful in passing the necessary qualifying examination.

The number of appointments to both permanent commissions and medium-service is, however, so few that no short-service officer, however efficient he may prove to be, should rely upon selection for either. The short-service commission system is essentially a scheme whereby an officer serves for six years only, and then transfers to a reserve organization whose conditions of service are such that they do not interfere with the civil life or occupations of members. To regard the short-service commission as a method of attaining a permanent commission is to incur a very great risk of disappointment and altogether to misinterpret the object of the system.

The majority of short-service officers hold commissions in the General Duties Branch, which is concerned with the flying, technical, and general administrative work of the Royal Air Force. There are other branches for Stores, Accountant, Legal, Medical, Dental, and Chaplain duties which are described elsewhere in this book, and in all save the first three short-service commissions are available.

Qualifications of Candidates

Candidates for short-service commissions in the General Duties Branch must be between the ages of 18 and 22, unmarried, and of pure European descent. They must be British subjects, and the sons of parents both of whom are also British subjects. Physical fitness is essential, and the candidate should also be in possession of a School Certificate A or B obtained by passing one of the various examinations which are detailed in Appendix I. Special consideration is, however, given to applications from candidates who have reached the School Certificate standard but are not actually in possession of the certificate.

Successful candidates join the Service with the rank of Acting Pilot Officer, and are confirmed in their appointment when they have satisfactorily passed a twelve months' probationary period. For the first fortnight they undergo preliminary training at the R.A.F. Depot at Uxbridge, and are then posted to one of the several flying-training schools of the Royal Air Force to qualify as pilots. Subsequent training includes instruction in aeronautical, military, and technical subjects, and occupies from eight to twelve months.

At the end of the training period, and subject to satisfactory reports on his ability, he is promoted to the rank of Pilot Officer and posted to a unit for regular duty. Thereafter he is on an identical basis, for the purposes of rank and command, as permanent officers of the Royal Air Force.

Promotion to Flying Officer

Promotion to the rank of Flying Officer may come after a further year's service, when the Pilot Officer becomes eligible to sit for his promotion examination. If he is successful his promotion will usually take effect some eighteen to twenty-one months from the time of the confirmation of his appointment as Pilot Officer, the actual date depending upon the marks he obtained when passing out from the flying-training school. Considerable importance is attached to the officer's abilities as a pilot, and those who obtain exceptionally high marks at the flying-training school may even be exempted from the promotion examination for Flying Officer.

During his period of service on the active list the short-service officer may be called upon to serve in connection with any type of aircraft or duty and in

any part of the world, either ashore or afloat. He is allowed leave on full pay up to sixty-one days in a year, and this may be taken at any time, when service requirements permit, either in part or as a whole. If he is serving abroad he may accumulate leave up to a maximum of six months, ninety-one days of which may be taken on his return home at the end of his service abroad.

Pay and Allowances

The rates of pay and allowances are given in detail in Appendix II, and will be seen to vary from a total of £332 per annum for an Acting Pilot Officer to £496 per annum for an unmarried Flying Officer, which is, incidentally, probably the highest substantive rank to which the short-service officer will normally attain during his six years' service on the active list.

Living expenses in the Service are not high, and officers should experience no great difficulty in living on their pay from the outset. Provision is made for the payment of pensions and gratuities to the widows and dependent relatives of officers who lose their lives as the result of injuries or illness directly attributable to Air Force service whilst on the active list or in the Reserve. Similarly, an officer who is invalided from the active list or from the Reserve under similar conditions is entitled to retired pay according to his rank and the degree of his disability.

Uniform—both service and mess dress—has to be provided by the officer on joining, and an allowance of £50 is made towards the cost of this in the case of those without previous service as an officer in H.M. Forces. Full details of the articles of equipment required, and the procedure under which they should

be obtained, are supplied to the candidates on their appointment.

Transfer to the Reserve

On conclusion of six years' service on the active list the short-service officer will, normally, be transferred to the Reserve with his then existing rank for a minimum period of four years. The conditions of service in the Reserve are fully described in Chapter XI, and are such as to present no obstacle to the officer's return to civil life and his engagement in a civilian occupation.

His pay, except for a retaining fee of £25 per annum from the Reserve, ceases on the expiry of his six years on the active list, but to assist him in taking up a civilian career he is paid a gratuity at the rate of £100 for each completed year of service after the first. The maximum amount of gratuity for an officer who has completed the full period of six years is, therefore, £500, though it may possibly be less if he has had to forfeit seniority during his service on the active list as the result of a court martial or summary trial under the Air Force Act.

In addition, the Air Ministry, through such means as the R.A.F. Educational Service and by contact with employers, provides facilities for ex-officers to find, and to equip themselves for, civil careers.

The short-service commission scheme is, it is true, often criticized as a "dead end" occupation which returns a man to civil life with a six-year handicap in comparison with his contemporaries, and with few qualifications for employment save his ability as a pilot. Such criticism is ill-founded, since it overlooks not only the cash gratuity, but also the fact that during their period of service officers have exceptional

facilities for studying, by means of courses of instruction, branches of engineering and science that will provide them with valuable experience and qualifications for engagement in civil life. Naturally, much depends on individual character and ability, but it is the experience of the Air Ministry that short-service officers obtain positions in civil life without any great difficulty, whilst the rapid development of civil aviation is each year providing increasing scope for those officers who may wish to continue their careers in aviation.

How to Apply for a Commission

Applications for short-service commissions should be made on Air Ministry Form No. 696,[1] which should be completed in the candidate's own handwriting and then returned to The Secretary, The Air Ministry, Adastral House, Kingsway, London, W.C.2.

Candidates are informed whether their applications have been approved or not, and approved candidates are requested to appear before a Selection Committee and to undergo examination by the R.A.F. Medical Board. Details of the standards of physical fitness required by this board are given on the application form referred to above.[2]

Both the medical examination and the interview with the selection committee take place in London, and both are normally held on the same day.

[1] Obtainable gratis on application to The Secretary, the Air Ministry, Kingsway, London, W.C.2.

[2] See also Air Ministry Pamphlet 13, obtainable from H.M.S.O., or from any bookseller.

CHAPTER IX

DIRECT ENTRY AND AIRCRAFT APPRENTICES

(Other Ranks)

As has been previously mentioned, the principal methods of entry into the ranks of the Royal Air Force are by means of apprenticeship, either as aircraft apprentices or apprentice clerks, or by entry into the newly-constituted class of boy entrants.

Direct entry from civil life, the remaining alternative method, is nowadays confined to certain skilled trades and to the periodical enlistment of a small number of unskilled men for general duties, for training in specialized work or in certain of the less skilled trades.

Direct Entry of Men

The trades open to direct entry are those of fitter (torpedo), metal-worker, machine-tool operator and setter, carpenter, and clerk. Unskilled men are enrolled as aircrafthands for general duties and also for training in such duties as those of fitters' mates, motor-vehicle drivers, storekeepers, physical-training instructors, Service police, and to form the crews of armoured cars and motor-boats used in the Service.

Those who wish to enter directly into the Service without a preliminary apprenticeship must be single men between the ages of 18 and 26. They are required to enrol for a period of nine years if entered in a skilled trade, and for seven years in the case of unskilled aircrafthands. In the latter case the period

of service is extended to nine years on completing some form of specialized or trade training.

The rates of pay vary from 2s. to 3s. 6d. a day on joining, according to the trade group, with a marriage allowance for a wife, and an addition for each child under 14, for married men over 26 years of age. (See Scale of Pay in Appendix IV.)

Promotion depends upon trade proficiency, educational qualifications, zeal, and general good conduct, and the man normally returns to civil employment at the end of his period of service. A limited number of men who show unusual efficiency in a trade may, if there is a vacancy in that particular branch, be allowed to re-engage to complete a total of twenty-four years' service. They then become eligible for a life pension on discharge at the end of their twenty-four years' service.

The majority of untrained aircrafthands who are accepted for direct entry are taught a trade or some specialized duty which, in most cases, enhances their prospects of obtaining employment in civil life on the expiry of their period of enlistment. Applications for direct enlistment in any of the categories described above should be made at any R.A.F. station or direct to the London Recruiting Depot, at Gwydyr House, Whitehall, London, S.W.1.

Entry as an Aircraft Apprentice

Aircraft apprentices—as distinct from apprentice clerks and boy entrants, who are dealt with later—are accepted by the Royal Air Force between the ages of 15 and 17, and enrol for twelve years' regular air force service from the age of 18, i.e. until they reach the age of 30.

On entry, they receive a thorough apprenticeship

training in a skilled trade at the R.A.F. training establishments at Halton, in Buckinghamshire, or Cranwell, in Lincolnshire. The training period varies according to the trade, but is seldom of less than three years' duration.

Choice of Trades

The trade to which he is apprenticed depends upon the needs of the Service, but consideration is given whenever possible to the boy's own choice, or to his aptitude as shown after a short period of training. The principal trades in which the apprentices are trained are those of fitter, instrument maker, and wireless-operator mechanic.

The fitter trade represents the largest class of skilled men in the Royal Air Force, and includes a new class of tradesmen, known as fitter, grade 2, who are responsible for the maintenance of aircraft and engines and who are recruited exclusively from ex-apprentices. The first period of the fitter's training course is devoted to acquiring the necessary knowledge and skill, and the second to applying them in the running maintenance of engines and the rigging and maintenance of metal aircraft. A small number of apprentices who complete the first part of the course with credit may, if they wish, then specialize in a subdivision of the fitter's trade dealing primarily with armament.

Those accepted for the trade of wireless-operator mechanic are trained in the installation, maintenance, and repair of electrical and wireless apparatus, and also in the operation of transmitting and receiving sets.

The trade of instrument maker involves training in the maintenance and repair of all types of instruments,

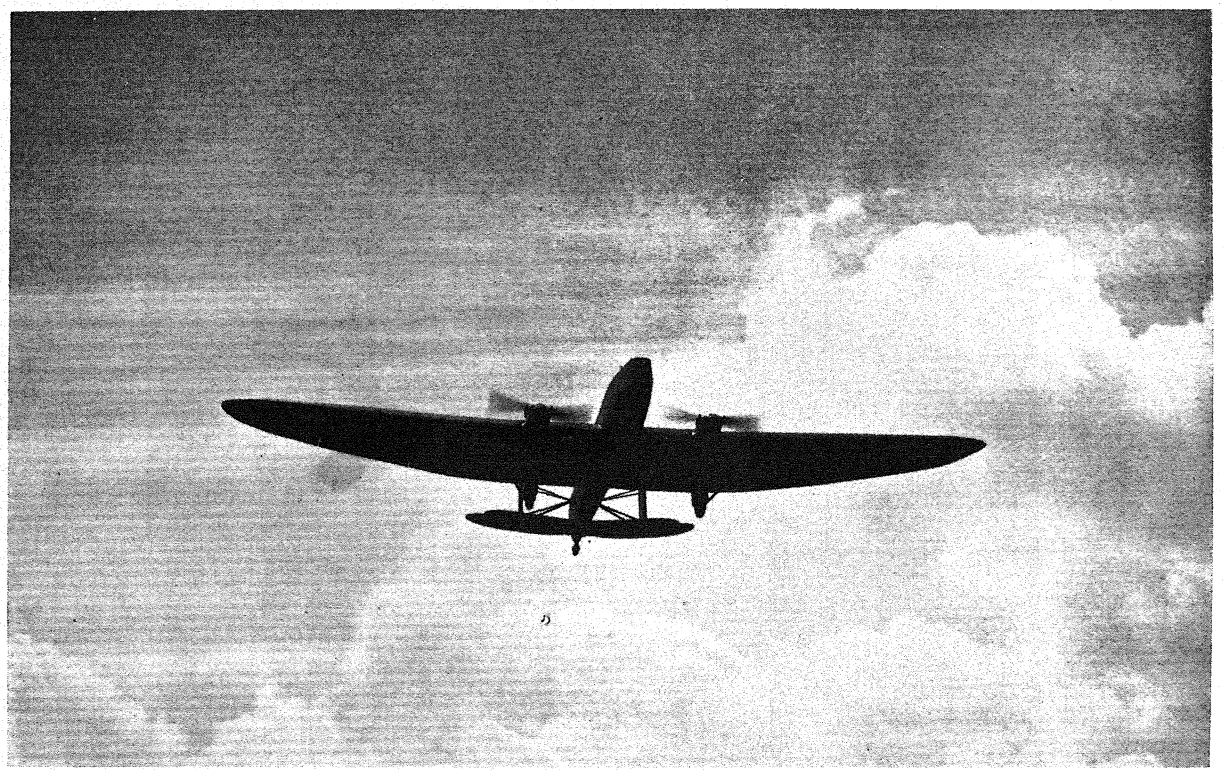


FIG. 5. ONE OF THE LATEST TYPES OF HEAVY-BOMBER AEROPLANE FOR NIGHT OPERATIONS

(Photo: Charles E. Brown)

bomb-sights, and cameras as used in the Service, and apprentices in this trade, on completion of their course, are posted to Royal Air Force units, where they work under skilled supervision until they are fully qualified to undertake all the duties of their trade.

Welfare of Apprentices

In addition to his training as a skilled tradesman, the apprentice's general and technical education is continued in such subjects as English, practical mathematics, mechanical drawing, and engineering science. He is provided with a free outfit and housed and fed without charge. In addition he receives pay at the rate of 1s. a day during the first and second years, and 1s. 6d. a day thereafter until the completion of his training period.

Apprentices are accommodated in their own quarters separately from the men, and are under the charge of specially selected non-commissioned officers. Their health and general welfare are the subjects of constant and careful supervision, special attention being given to physical training, games, and athletics. Regular holidays are given: three weeks in the summer, two weeks at Christmas, and one week at Easter. Occasional week-end leave is also granted in special circumstances.

Joining the Service

On completing his training, the apprentice is posted to a unit for duty in the trade for which he has been trained, and thereupon begins his normal Air Force service at the full rate of pay for his classification. The latter may be that of Leading Aircraftman, Aircraftman first-class, or Aircraftman second-class,

according to the marks he obtained at the passing-out examination which is held at the end of the training period.

Thereafter he is eligible for promotion, by selection on merit of work or good conduct, to non-commissioned rank and should, with average ability, be able to reach the rank of sergeant before the end of the period for which he enlisted.

Learning to Fly

For those who wish to learn to fly, opportunities are afforded to volunteer for training as airman-pilots. Applicants are selected during their third year at a service unit, and receive thorough practical and theoretical training and a special flying allowance of 2s. a day. When qualified as pilots they are promoted to the paid rank of sergeant and, though employed on full flying duties, do not lose touch with the technical trade in which they have been trained as apprentices. After six years' flying service they usually revert to their former duties, but still retain their rank and are given facilities to keep in flying training for a certain period, receiving a bounty of £10 a year while remaining in training. Ex-apprentices are also eligible for employment as air observers. (See Chapter IX.)

Award of Commissions

A certain number of permanent commissions for flying duties are granted each year to exceptionally efficient airman-pilots, and permanent commissions for technical duties are also granted annually to a few selected airmen who have attained the rank of Warrant Officer. Earlier opportunities are afforded by the grant of cadetships at the Royal Air Force

College, Cranwell, to apprentices selected by the Air Council as being particularly suitable. These apprentices are chosen after completing their three years' apprenticeship course. They incur no expense at the College, all the necessary fees, cost of uniform, books, etc., being defrayed from public funds, and they follow the full normal course of training until gazetted as Pilot Officers with permanent commissions.

Period of Service

The attainment of commissioned rank is, however, confined to a few airmen, and in the ordinary course the ex-apprentice, on completion of his twelve years' service, is discharged at the age of 30 with a gratuity. If he is an airman in a Group I trade, and is willing to enlist in the Royal Air Force Reserve (a spare-time occupation) for four years, he receives a gratuity of £100 at the age of 30. If he is in a lower trade group, or does not wish to join the Reserve, he returns to civil life with a gratuity at the rate of £1 for each year's service, with a maximum of £12.

A limited number of airmen, on reaching the age of 27, are selected each year for re-engagement on the expiry of their original twelve-year period of service. In such cases they are usually re-engaged for a further period of twelve years so as to enable them to complete twenty-four years' service from the age of 18, and thus to qualify for a pension on discharge.

How to Enter as an Apprentice

Candidates for aircraft apprenticeships must be British subjects of pure European descent, and the sons of British subjects. They must be between the ages of 15 and 17, and should have received a good general education.

Physical fitness is particularly important, as all

candidates have to pass a strict medical examination before being finally accepted. Frequent causes of medical rejection are defective eyesight, bad teeth, poor general physique, defects of the feet such as flat foot, hammer toe, etc., enlarged or septic tonsils, and failure to have been vaccinated. It is therefore very advisable, in order to avoid expense and subsequent disappointment, for boys to be examined by their own doctor before making application for apprenticeship. They should also remember to draw the doctor's attention to the standards of physical fitness required of aircraft apprentices as detailed in Appendix I of Air Ministry Pamphlet 15.[1]

There are two systems of entry as an Aircraft Apprentice: by competitive examination and by direct entry, but in both cases candidates must first obtain a nomination certifying them to be specially suitable as regards character, educational standard, and physical fitness. These nominations can only be made by the approved nominating authorities,[2] but when, in exceptional circumstances, a candidate is unable to secure nomination from any of these authorities, he may apply direct to the Air Ministry stating the full circumstances of his case and asking for special consideration.

[1] Obtainable gratis on application to The Secretary, The Air Ministry (A.E.), Victory House, Kingsway, London, W.C.2.

[2] Application for nomination should usually be made to the Local Educational Authority through the Headmaster of the school attended, or lately attended by the candidate. Other Nominating Authorities are: (2) Advisory Committees for juvenile employment (under the Ministry of Labour); (3) The Governing Bodies of approved schools which are neither aided nor maintained by a local education authority; (4) The Council of the Boy Scouts Association (if the candidate is a boy scout); (5) The County Territorial Force Association and the British National Cadet Association (if the candidate is a member of a cadet unit); (6) The Ministry of Education for Northern Ireland (if the candidate is resident in Northern Ireland); (7) The Commanding Officer of a Royal Air Force Station abroad (for the sons of British residents, including Service personnel); (8) The Governments of Canada, Australia, New Zealand, and South Africa (for residents in these Dominions).

Nominations have to be made on special Air Ministry forms, Nos. 699 and 699A, which are supplied only to the nominating authorities. The choice of forms depends upon which of the two methods of entry the candidate proposes to attempt.

Direct Entry

The direct entry method (Form 699A) dispenses with the necessity for undergoing a competitive examination, and is open to candidates holding an approved first school certificate (see Appendix I), and who have obtained "credit" in mathematics and in one of the following science subjects: physics, chemistry, physics-with-chemistry, mechanics, and metallurgy. A small number of vacancies are offered each year to such selected candidates who, instead of sitting for the competitive examination, are required only to appear before a selection committee. Those who are not successful under this system of entry are given the opportunity either of waiting for the next half-yearly entry or of sitting for the competitive examination.

Entry by Competitive Examination

The competitive examination method (Form 699) is primarily for those who do not hold the necessary first school certificate. The examination is conducted twice yearly at numerous centres on the first Tuesday in June and the first Tuesday in November for entry as an apprentice in the following September and January respectively. Nominations must reach the Air Ministry not later than the first Tuesday in May for the June examination, and by the first Tuesday in October for the November examination.

The examination itself is conducted by the local

nominating authority, who notifies candidates of the time and place at which it will be held. It occupies one day only and deals with mathematics, science, a general paper, and English composition.[1]

From among those who obtain the highest marks in the whole examination the Air Council select the number required to fill the available vacancies, and in due course successful candidates receive directions for joining the training centre together with a free railway warrant for the journey. Within fourteen days of arrival they are medically examined, and any who are found to be unfit are returned to their homes.

For those who successfully pass the medical board their life in the Royal Air Force has started, and the Service will be their home and their career for the next thirteen years at least. From now onwards their future progress depends upon their own ability and good conduct, and it is for them to take advantage of the many opportunities that lie before them for the attainment of a permanent career in the Royal Air Force, and promotion that may lead them to some of the highest ranks in the Service.

An Alternative Method of Entry

Those candidates who cannot be accepted as a result of the competitive examination, owing to the limited number of vacancies, have still open to them an alternative method of entry—through the Boy Entrant scheme which has recently been introduced and which is similar, in many ways, to the apprentice system of entry.

[1] Fuller details of the subjects of this examination are contained on page 10 of the Air Ministry Pamphlet No. 15, obtainable on application to The Secretary, Air Ministry, London, W.C.2; from H.M.S.O., or any bookseller.

This scheme is fully described in the following chapter, and aircraft apprentice candidates who have sat for the competitive examination without securing a vacancy may, if they appear suitable, be invited to attend for interview and medical examination with the view to being accepted as Boy Entrants.

CHAPTER X

BOY ENTRANTS AND APPRENTICE CLERKS

THE Boy Entrant scheme is a recent introduction, and has been devised as an alternative to the longer apprenticeship system. It is intended for the training of armourers, photographers, and wireless-operators required by the Service.

It is not open to direct entry in the sense that one may apply for enrolment as a Boy Entrant, but is confined to those who have sat for the competitive examinations for Aircraft Apprentices and Apprentice Clerks, and to whom it has not been possible to offer vacancies as apprentices. Selected candidates, usually the older ones, receive individual invitations from the Air Ministry to apply for consideration under the boy entrant scheme.

The conditions of entry as regards age, nationality, and physical fitness are identical with those for aircraft apprentices and apprentice clerks.

Period of Engagement

Boys who take advantage of this invitation and who, after an interview and a medical examination, are accepted for entry under the scheme, are enrolled for a period of nine years' service from the age of 18, i.e. until they are 27 years old. They may then return to civil life with a gratuity of £9 and the advantage of having acquired a skilled trade, or, in cases of special ability, they may be allowed to re-engage for fifteen years' further service and so qualify for a pension on

discharge after completing twenty-four years' service from the age of 18.

On entering, boys are sent to one of three R.A.F. establishments for a course of training, which usually occupies at least a year. The training given is of both a technical and a general service character, and the boys attain a high standard of practical skill in their allotted trades. They may be trained—according to their choice, ability, and the requirements of the Service—as armourers, photographers, or wireless-operators.

Armourers are concerned with the care, maintenance, and overhaul of all rifles, machine-guns, gun-gears, bomb armament and their equipment as used in the Service. Boys selected for this trade undergo their training at the R.A.F. Air Armament School situated at Eastchurch in Kent.

Photographers deal with the various service aspects of photography, and are primarily concerned with the upkeep of cameras and the making, developing, and storing of prints and negatives. Training for this trade is given at the R.A.F. School of Photography at South Farnborough, Hants.

Wireless-operators are trained at the Electrical and Wireless School at Cranwell, Lincs., and are concerned with the operation of the various types of wireless apparatus used in the Service, and with the making of minor repairs and adjustments.

Welfare and Training

Throughout their training period the health and general welfare of the boys are well looked after. They have their own accommodation separately from the men, are given ample opportunities for games and exercise, and receive home leave from time to time.

They are provided with a free outfit and are lodged and fed free of charge, as well as receiving pay at the rate of 9d. a day.

A passing-out examination is held at the end of the training period, and according to the marks he obtains the boy is classified either as a First- or Second-class Aircraftman, and posted to a unit for duty in his particular trade. Later, he has to pass certain educational and trade tests for re-classification as Leading Aircraftman, and thereafter promotion to non-commissioned rank is by selection on individual merit.

Observer Duties

All three trades filled by boy entrants, by the nature of their duties, afford considerable opportunities for experience in the air as a passenger, and it is the Air Ministry's intention to draw from airmen entered as boys the bulk of the observers required by the Service. Ex-boy entrants recommended for these posts will usually be selected during their seventh year of service, provided they are willing to re-engage to complete twenty-four years' total service. They will be given a short course of training, promoted to corporal, and thereafter employed on such observer duties as aerial gunnery, signalling, navigation, photography, and look-out, until they have completed eighteen years' service or have been promoted to Flight Sergeant. Whilst serving as observers they draw additional pay at the rate of 1s. 6d. a day.

Ex-boy entrants who wish to become pilots may also be considered for such duties during their third year of service after training. Those selected are given a thorough course of flying instruction and, on qualifying, are promoted to the rank of Sergeant with

special pay, and are employed on flying duties for six years. Meanwhile they keep in touch with their trade, and at the end of the six years revert to it though still retaining their rank as Sergeants and the pay of that rank in their basic trades.

A very small number of permanent commissions is granted each year to airman-pilots and warrant officers, and those entering the Service as boys are eligible for these equally with other airmen.

Apprentice Clerks

For those who are not particularly anxious to learn a skilled engineering trade, or to learn to fly, and are more interested in the administrative side of the Service, the Apprentice Clerk scheme of the Royal Air Force may offer an attractive alternative to the aircraft-apprenticeship or boy entrant systems.

Those accepted for apprenticeship training as clerks receive an eighteen months' course of instruction in clerical duties, including typewriting, shorthand, book-keeping, practical office work, etc., as well as continuing their general education.

They undergo early training at the R.A.F. Record Office at Ruislip, Middlesex, though their subsequent training may be carried out at other home stations, as necessary. Whilst under instruction, apprentice clerks receive similar supervision, and the same care and attention, as aircraft apprentices. They have their own quarters, ample facilities for games, exercise, and physical training, and are provided with free board, lodging, and clothing, as well as pay at the rate of 1s. a day for the first year and 1s. 6d. a day for the next six months. The arrangement for holidays is also the same as that for aircraft apprentices.

At the end of the eighteen months' training period the apprentice clerk sits for his passing-out examination, and upon the marks he then obtains depends the rank with which he will enter the Service proper for ordinary duties as a clerk, and also the rate of pay to which he will be entitled. The highest passing-out rank attainable is that of Leading Aircraftman, the lowest that of Second-class Aircraftman.

Clerical duties in the Royal Air Force are divided into the sub-classifications of General Duties and Accounting, but the rates of pay are the same for both classifications. They are shown in detail under Group IV in Appendix IV. In addition to this pay, clothing, rations, and accommodation—or allowances in place of them—are provided. In certain cases, too, a marriage allowance on attaining the age of 26 is payable.

Flying Facilities

Entry as an apprentice clerk does not mean that the boy is debarred from ever becoming a service pilot. Actually, an opportunity is given to all apprentice clerks to volunteer for training as airman-pilots, and those selected, during their third year at a service unit, are taught to fly and promoted, on qualification, to the rank of Sergeant. In this capacity they receive pay at the rate of 10s. a day. Usually they return to clerical duties after six years' flying service, but are enabled to keep in flying training for a certain period, and receive a special bounty of £10 a year while remaining in training.

Facilities for obtaining permanent commissions in the General Duties Branch are similar to those open to aircraft apprentices, and a small number of permanent commissions are also granted annually in the

Stores or Accountant Branches to airmen who have attained the rank of Warrant Officer.

How to Enter as an Apprentice Clerk

Candidates must be British subjects of pure European descent, and the sons of British parents. They must be physically fit and between the ages of 15½ and 17¼ years. They must have had a good general education and be in possession of a School Certificate A or B obtained by passing one of the examinations detailed in Appendix I.

The only method of entry is by selection, which is made once every three months by the Air Ministry. Application should be made on the Air Ministry Form No. 1334, and should be accompanied by a recommendation from the headmaster of the candidate's school and by the necessary school certificate. These applications have to reach the Air Ministry by the 1st January, 1st April, 1st July, and 1st October respectively for entries during those months.

Those whom the Air Ministry considers to be suitable will be invited to attend at the Record Office at Ruislip for an interview by a selection board, followed by a brief educational test if considered necessary. The medical examination will also be made at the same time, and successful candidates will be enlisted as Apprentice Clerks forthwith. Candidates for whom no vacancies are available may be invited to apply for entry into the Royal Air Force under the Boy Entrant scheme already described.

The successful candidates for these apprenticeships are enrolled for a total of twelve years' regular Air Force service from the age of 18 in addition to their apprenticeship period. After completing nine years from the age of 18 they may, if they wish, apply for

re-engagement to complete a total of twenty-four years' service and so qualify for a pension on discharge.

The number allowed thus to re-engage is, however, limited by the requirements of the Service, and by the necessity for re-engaging only those who can be provided with an adequate career.

CHAPTER XI

THE ROYAL AIR FORCE RESERVE

THE Air Force Reserve, as its name implies, is an organization consisting of trained officers and men upon which the Royal Air Force could call in event of national emergency to supplement its ranks on active service.

Its personnel comprises officers and men engaged in civil occupations and without previous experience in the Air Force, as well as those who, after service with the Air Force, either as short- or medium-service officers or as airmen, have been transferred or appointed to the Reserve. Its organization and conditions of service are such that members are enabled to learn to fly and keep in training without interference with their civil employment. They receive retaining fees or reserve flying pay, and, when undergoing training, are also entitled to pay and allowances.

The system of direct entry from civil life has recently been placed on a new and broader basis with the object of building up a bigger reserve of pilots to accompany the present expansion of the Air Force. The former method of commissioning officers for flying duties direct from civil life has been almost entirely suspended, and in its place a scheme introduced whereby civilian candidates enlist in the first place as airman-pilots, and are later eligible for selection for commissioned rank. Direct entry into commissioned rank is now confined to ex-members of the University Air Squadrons in possession of a certificate

of proficiency and to qualified doctors for the medical branch.

Flying Training

The flying training of the Reserve is carried out on light aircraft of the De Havilland "Moth," Avro Cadet, and Blackburn "B.2" Trainer type, and comprises practice in aerobatics, blind flying, camera-gun work, and photography, together with a good proportion of cross-country flying. It is designed to keep pilots up to date on the most modern and manoeuvrable types of light aircraft, and so enable them to requalify, if necessary, on modern high-performance service machines with a minimum of further instruction.

Selected pilots are permitted to carry out special flying instructors' and instrument-flying courses in place of the ordinary annual training, both valuable concessions for members whose civil employment may be in commercial aviation. Technical training is not neglected, and a week's course of ground instruction is given concurrently with the flying training period each year.

There is a flying-boat section of the Reserve whose pilots are trained on Saro "Cutty Sark" aircraft at the civil flying school at Hamble, near Southampton. The instructors here, as at all other Reserve flying-training schools, are themselves members of the Reserve and, in most cases, have qualified as instructors while on the active list.

Attachment to R.A.F. Units

Officers of Class A of the Reserve, that is, those with previous Service experience, may if they wish be attached temporarily each year to Royal Air Force

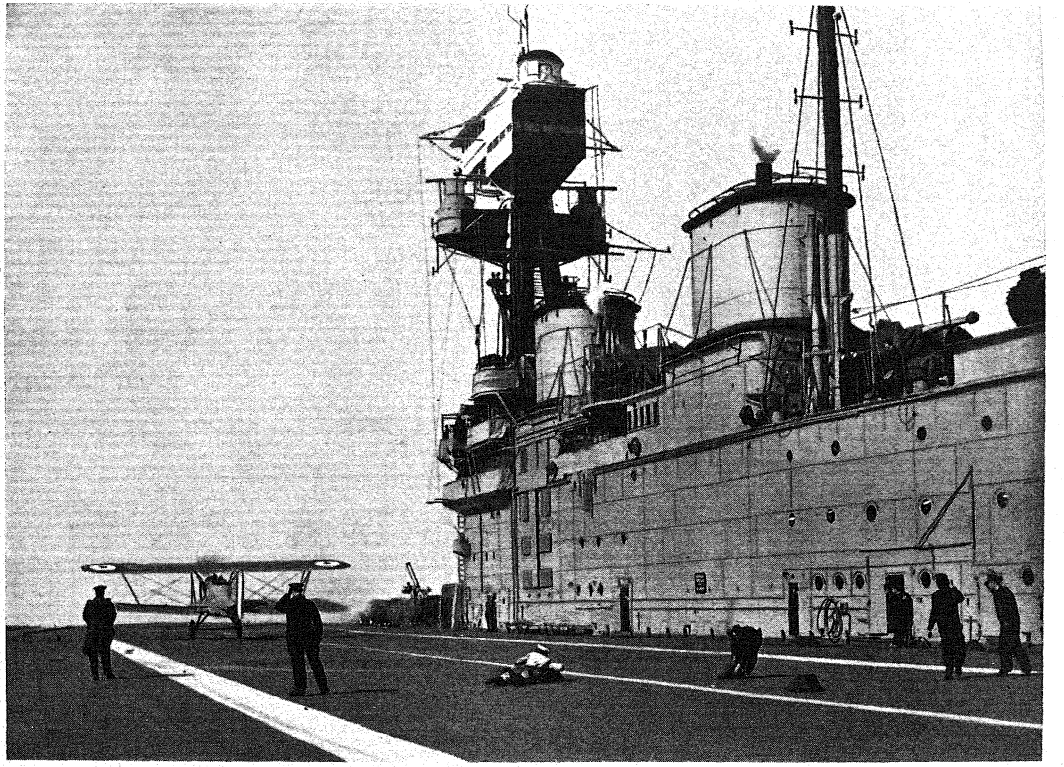


FIG. 6

Service with the Fleet Air Arm is novel and interesting, providing opportunities for service in the Mediterranean and the Far East.

units of the type at which they served while on the active list. Thus, an officer who served in an Army co-operation squadron while in the regular Air Force may be attached to an Army co-operation squadron, and an officer who served with the Fleet Air Arm to an aircraft-carrier or shore base. The object of this attachment is to keep the officer in touch with developments in the tactics and operational theory of the unit since he left the active list, and so facilitate his early absorption in the event of mobilization.

Officers of Class AA—those without previous Service experience—are obliged to attend a ground attachment each year, the object in their case being to afford practical experience of Royal Air Force organization, and to give them an insight into the operational side of the Service. Ground attachments do not occupy more than six days, and the total length of the annual training, both flying and ground, does not exceed twenty-four days.

Organization of the Reserve

The general lines upon which the Reserve is organized are as follow—

THE RESERVE OF AIR FORCE OFFICERS

Class A (*Flying Duties*): Consisting of officers with previous experience as pilots in the regular Air Force.

Class AA (*Flying Duties*): Officers without previous service in the R.A.F. (Until August, 1934, all civilian entrants for flying duties were appointed directly to this class. It is, however, now recruited only from ex-members of University Air Squadrons and from members of Class F selected for advancement to commissioned rank.)

Class B (*Technical Duties*): Consisting of officers for technical duties with previous service in the following specialized branches of the R.A.F.: Engineering, Signals, Photography, Armament, Stores, and Meteorology.

Class BB (*Technical Duties*): Consisting of civilian entrants who possess the necessary qualifications to carry out technical duties in one of the categories detailed above. (Recruitment to this class is at present suspended.)

Class C.: Consisting of officers for other duties, officers who are unfit or unable to train or who are temporarily unfit, etc.

Class D.: Medical and dental officers with previous service in the R.A.F.

Class DD: Qualified doctors without previous service in the R.A.F.

THE GENERAL RESERVE

Class E: comprising the Reserve of airmen of all trades with and without previous service in the R.A.F.

Class F (*Flying Duties*): consisting of those entered direct from civil life as airman-pilots with the rank of sergeant.

Short- and Medium-service Officers

At the end of his period of service on the active list a short- or medium-service officer is transferred to the Reserve in his existing rank. If physically fit for flying he is placed in Class A of the Reserve. Should he be temporarily unfit at the time, or unable for any other reason to carry out the necessary flying training, he is placed in Class C. The initial minimum period of service in all classes is four years, at the end of which it is possible, with the consent of the Air Council, to re-engage for further periods of not more than four years at a time until the retiring age is reached.

Training Requirements

Class A. Officers in Class A have to carry out not less than twenty hours' flying training every year. This is normally done at one of the four Reserve flying schools at Hamble, Hatfield, Bristol, or Brough, and has to be completed within twenty days, preferably, but not necessarily, in one period. Officers in this class of the Reserve may also be required from time to time to attend a short course of ground

instruction, which, together with the flying training, does not exceed twenty-four days, at a Royal Air Force unit in order to keep their knowledge of Service practice up to date.

When undergoing this annual training they receive pay and allowances at the same rates as unmarried regular officers of the same rank and branch of the Royal Air Force. The retaining fee paid varies in the case of present officers according to the date of their original commission in the Reserve, but the annual retaining fee now paid to new officers in Class A is £25.

Class B. For officers in Class B the annual training consists of a technical course lasting not more than twelve working days in any one year. The usual rates of pay and allowances are granted during this period, and an annual retaining fee of £15 is paid to new officers.

Classes C and D. Officers in these classes may in certain circumstances be permitted to undergo a voluntary course of training lasting not more than twelve days. No retaining fees are paid in these classes.

The training of officers in Classes AA, BB, and DD, and the basis of remuneration are similar to that described for Classes A, B, and D respectively.

Entries from Civil Life

Civilians who wish to join the Reserve for flying duties, and who are suitable, are now enlisted as airman-pilots in Class F of the Reserve which is subdivided into two sections—

Section 1 is for those who are already qualified pilots with not less than twenty-five hours' flying experience and who hold either an "A" or "B" Pilot's Licence; and

Section 2 is for those who are as yet untrained but who wish

In both sections candidates join for a period of five years. After completing three years' service, during which they will do about 100 hours' flying, those who have qualified for a "certificate of proficiency" in their Service duties may be considered for promotion to commissioned rank. Selection is made on a strictly competitive basis, and the commissions are awarded only to those pilots who have shown the greatest keenness and ability.

Entry as Airman-Pilots

On enlistment, airman-pilots in Section 1 are at once promoted to the rank of Sergeant Pilot. Those in Section 2 are similarly promoted to the rank of Sergeant, but have to wait for promotion to Sergeant Pilot until they have satisfactorily completed their preliminary flying-training course.

This preliminary course, from which entrants in Section 1 are exempt, consists of a fortnight's ground instruction followed by an *ab initio* course of fifty hours' flying training, both of which have to be completed in not more than ninety-one days and within six months of the date of enlistment. The ground course begins on a fixed date during the spring or summer, and has to be completed before the flying course is started. The flying course, which airman-pilots may expect, with good weather, to complete in about seven weeks, is taken continuously, apart from short periods of leave of about two to three days at a time. Permission to break the course may, however, be obtained if there are good grounds of excuse, though this permission is not normally given until an airman-pilot has completed at least one month's attendance (excluding the ground course), or until he has completed a minimum of ten hours' solo flying. Airman-pilots

however, bound to begin their flying training immediately after the ground course, and may, if they prefer, fix other dates which are convenient to themselves and to the flying school to which they have been attached.

Training Requirements

During the second six months of their service airman-pilots of Section 2 are required to complete not less than ten hours' solo flying within a maximum period of ten days.

In Section 1 airman-pilots, in their first year of service, have to complete at least twenty hours' flying. This training has, usually, to be carried out over a continuous period of not more than twenty days, though here again in exceptional circumstances permission may usually be obtained to break the course and to renew it later in the year.

Training during the second and subsequent years for airman-pilots of both sections consists of carrying out not less than twenty hours' flying a year. This training should preferably be carried out in one period of not more than twenty days, though where, for private or business reasons, this is not possible it may be divided into four separate periods spread over the year. Total exemption in alternate years may also be claimed by a member who is able to produce satisfactory evidence—such as his log books—of sufficient recent practical flying on suitable types of aircraft.

All training, both preliminary and annual, is given at civil flying schools at Hatfield (London), Hamble (Southampton), Bristol, and Brough (East Yorks), and, as far as possible, account is taken of the locality of the airman-pilot's residence in allocating him to

Pay and Allowances (Class F)

Airman-pilots of the Reserve receive Reserve pay and Flying Reserve pay. Reserve pay is at the rate of £13 10s. a year, and Flying Reserve pay is at the rate of £10 a year, both payable quarterly in arrear.

In addition, daily pay at the rate of 8s. 6d. a day for a Sergeant and 11s. 6d. a day for a Sergeant Pilot is granted during the period of the annual training at a civil flying school. Thus, assuming the annual training occupies the maximum period of twenty days, the annual remuneration of a Sergeant Pilot in the Reserve would total £35.

A special additional allowance of 2s. a day is made to airman-pilots in Section 2 whilst they are undergoing their preliminary training course, and extra allowances are also granted to airman-pilots of both sections for the payment of travelling expenses to and from the flying school, for accommodation and messing when these facilities are not available at the training centre, and for married airman-pilots over 26 years of age.

No grant is made in respect of flying kit, as airman-pilots do not have to wear uniform while under training at civil schools, and the necessary flying kit is provided on loan.

Liabilities

Apart from his annual training obligations, an airman-pilot in the Air Force Reserve is also liable to be called up for duty in aid of the civil power—as in the event of some national emergency and in defence of the British Isles against actual or apprehended attack. Further, unlike members of the Auxiliary Air Force, whose liability is confined to service from bases in the United Kingdom, the personnel of the Reserve

liable, when called up for active service, to be ordered to fly outside the limits of the British Isles, and to become, in fact, a part of the regular Air Force for the time being.

Qualifications for Airman-Pilots

Candidates for enlistment as airman-pilots must be British subjects of pure European descent and the sons of British subjects. They must be at least 18 years of age, but must not have attained the age of 28 for entry into Section 1, or the age of 25 for entry into Section 2. They should also be reasonably certain of being resident in the United Kingdom for a period of at least five years.

Physical fitness is of the greatest importance, and all provisionally-selected candidates have to undergo a searching medical and surgical examination before the Central Medical Board of the Royal Air Force. Candidates would therefore be well advised to consult their own doctor first of all as to their physical fitness in accordance with the medical standards shown in Appendix I of the Air Ministry pamphlet No. 56.[1]

How to Apply for Enlistment

Application for enlistment as an airman-pilot has to be made on Form 1384,[1] in which there is provision for the completion of certificates as to the candidate's educational qualifications and character. The first certificate has to be signed by the headmaster of the candidate's school or college, and the second by two responsible persons, not relatives, who have known him for a considerable period.

The completed form should then be returned to The

[1] Obtainable free of charge on application to The Secretary, The Air Ministry, Kingsway, London, W.C.2.

Secretary, The Air Ministry, London, W.C.2, and candidates who, from their application forms, appear to be suitable for entry will be invited to appear for interview before a selection board at the Air Ministry. Approved candidates—except holders of current Class B pilot's licences who are normally excused—then undergo medical examination before being finally approved and accepted. Training as pilots, in the case of entrants in Section 2, begins on fixed dates in the spring and summer months.

Ex-apprentice Tradesmen in the Reserve

For the rest, the Reserve is made up of airmen of all trades, the majority of whom have previously seen service in the Royal Air Force on regular engagements. On the expiry of these, airmen are, if they wish and vacancies exist, re-enlisted in Class E of the Reserve, which includes also those ex-apprentice tradesmen of the Royal Air Force who, having served as airmen in a Group 1 trade, are discharged on completing the twelve years of their original engagement. These ex-apprentices then have the option either of retiring altogether with a maximum gratuity of £12, or of enlisting in the Reserve with a gratuity of £100.

Those who accept the latter alternative enrol in Class E for four years, and for the first three years are excused from ordinary Reserve training. In the fourth and last year they are liable to be called up for training for a period of twelve days at the most, and receive pay for that year. The present rate of this pay is 9d. a day, and it is payable in four quarterly amounts in arrear.

CHAPTER XII

THE SPECIAL RESERVE

THE Special Reserve of the Royal Air Force consists of certain cadre squadrons, manned partly by non-regular officers and airmen, and raised and maintained in selected localities within the British Isles. These squadrons form an essential part of the organization for the air defence of Great Britain.

Each squadron is located at an aerodrome near the town from which its non-regular personnel has been recruited, and conditions of service have been made as elastic as possible so that officers may join without interference with their civil life or occupations. Approximately, two-thirds of the strength of a single-engined bomber squadron, and one-half of a twin-engined bomber squadron, is made up of Special Reserve personnel living in the neighbourhood of the aerodrome. The remainder consists of officers and men of the regular Air Force, including the commanding officer.

Functions of the Special Reserve

In a time of national emergency, members of the Special Reserve are liable to be called upon for permanent service in the air defence of Great Britain in conjunction with the regular Air Force. Normally, however, the requirements of service are such that the Special Reserve may be regarded as a "spare-time" occupation for both non-regular officers and men. No remuneration is paid to the volunteer personnel in the ordinary way, though both pay and

allowances are granted during the specified periods of whole-time training which have to be carried out each year. Non-regular members are eligible for compensation in the event of disability, and their dependants for pension and gratuity in the event of the death of a member, directly attributable to the conditions of service. In the case of commissioned ranks, special grants are also available towards the cost of the necessary uniform and equipment.

Strength and Location

The Special Reserve at present comprises five squadrons, and the types of aircraft with which they are equipped, and the location of their aerodromes, are as follows—

Squadron	Type	Location of Aerodrome
No. 500 (County of Kent)	Twin-engine bomber	Manston, near Ramsgate
No. 501 (City of Bristol)	Single-engine bomber	Filton, near Bristol
No. 502 (Ulster)	Twin-engine bomber	Aldergrove, Co. Antrim
No. 503 (County of Lincoln)	Twin-engine bomber	Waddington, near Lincoln
No. 504 (County of Nottingham)	Single-engine bomber	Hucknall, Nottingham

Training Methods

It will be seen that the Special Reserve consists entirely of bombing squadrons, two being day-bomber units equipped with single-engined, day-bomber aircraft, and the remaining three being night-bomber units flying larger, twin-engined types of aircraft. Their duties in time of war would include the bombing of enemy territory, long-distance reconnaissance, and, in the case of night-bombers, the carrying-out of

bombing raids on strategic points far inside the enemy territory.

Training in these squadrons includes, therefore, formation flying, camera-gun work, bombing practice, wireless signalling, photography, and cross-country flying by day and by night. Special attention is devoted to the attainment of a high standard of efficiency in bombing and defensive gunnery.

Commissioned Ranks

Candidates for commissions in the Special Reserve must—

(i) Be between 18 and 25 years of age.[1]

(ii) Be of pure European descent, a British subject, and the sons of parents both of whom are British subjects.

(iii) Be pronounced physically fit for flying by a Royal Air Force medical board.

(iv) Be of good character and education, and able to produce evidence to this effect.

Accepted candidates who have not had previous experience in the Air Force are entered in the Special Reserve with the rank of Pilot Officer on probation, and are confirmed in their appointment after they have attained the necessary standard of proficiency in flying and other duties. They become eligible for promotion to the rank of Flying Officer at any time after completing eighteen months' satisfactory service, subsequent promotion being by selection from among officers who have passed the appropriate promotion tests.

The initial period of service for which officers enrol is five years, reckoned from the date of confirmation,

[1] The Air Council may, however, at their discretion, give special consideration to any candidate who is over the age limit at the time of his application.

after which service may be extended in approved cases for further periods each of not more than five years, until the prescribed age limit is reached. This limit is 40 years in the case of Flying Officers and Flight Lieutenants, and 45 years for Squadron Leaders.

On his appointment on probation an officer has to undergo a period of initial flying training in order to qualify as a pilot. This training occupies, at the most, a period of six months, and may be carried out either continuously or intermittently within a period of one year, whichever is the more convenient method for the officer concerned. Those who are already qualified pilots on joining are, of course, exempt from this flying-training period, but have to carry out such training as will enable them to pass certain tests of flying skill.[1]

Annual Training of Officers

After qualifying as a pilot, officers are liable each year for—

(i) Fourteen days of unit training with the squadron.

(ii) Twenty instructional parades, and

(iii) The completion of at least twenty-four hours' solo flying.

The time of the unit training is usually fixed to coincide with the normal holiday season, and is spent at a regular Air Force aerodrome. The instructional parades are spread out over the year and, for the greater part, are held at week-ends or in the evening, either at the squadron's aerodrome or at its town headquarters. Ample opportunities for the twenty-four hours of solo flying are afforded during the course of the year in the evenings and at week-ends.

During the first two years of his service the new

[1] For details see Air Ministry Pamphlet No. 2, obtainable from the Air Ministry, London, W.C.2; H.M.S.O., or any bookseller.

Pilot Officer has also to attend a short course in air armament. This course occupies twelve days and may be taken, if preferred, in two separate periods of six days each.

Pay and Allowances

While taking part in the fourteen days' unit training each year, or when attending approved whole-time courses of instruction, officers receive pay and allowances at the current rates laid down for unmarried officers of the same rank in the regular Air Force. The rates of pay vary from 14s. 4d. a day for a Pilot Officer to 32s. 4d. a day for a Squadron Leader, and are given in full, together with the scale of allowances, in Appendix II.

Pay and allowances are also granted for periodical flying each year—in addition to the unit training period—up to a maximum of ten days a year. In the case of first-year pilots undergoing their initial flying training the maximum period for which pay and allowances may be claimed is extended to 183 days. In this latter case the officer who does not complete the course in one continuous period does not become eligible for current pay, but, on graduating as a pilot, he receives a grant equal to the pay of his rank for each day of attendance up to the maximum of 183 days.

When on duty officers wear the regulation Royal Air Force service dress, and a grant of £40 is made on joining for the purchase of the uniform and necessary equipment.

During the training periods officers are eligible for free medical attendance, and in the event of illness directly attributable to their service work they are entitled to receive sick pay for a limited period. Provision is also made for the payment of compensation

if an officer has to be invalided out of the Reserve as a result of injury or illness directly attributable to his service. In such cases retired pay is granted, calculated according to the rank and degree of disability.

How to Apply for a Commission

Candidates for commission should obtain Form No. 1381,[1] and forward it, together with a copy of their birth certificate, to the commanding officer of the squadron which they wish to join. Included in this form are two certificates attesting to the educational and moral character of the applicant. The former should be signed by the headmaster of the applicant's school or college, and the latter by a responsible person, such as a doctor, solicitor, or family friend—but not a relative—who has known the applicant for a considerable time.

To avoid disappointment, and waste of time and money in unnecessary travelling, a candidate would be well advised to undergo medical examination by his own doctor before applying for a commission, in order to ensure, as far as possible, that he will not eventually be rejected by the R.A.F. Medical Board through his failure to come up to their very high standards of fitness.

Entry of Other Ranks

For enlistment as an airman, an intending recruit must be over 18 years of age and under 38. The initial period of engagement is for two, three, or four years, after which re-engagements are allowed for one, two, three, and four years at a time.

Members of the Special Reserve generally accept

[1] Obtainable, gratis, on application to The Secretary, The Air Ministry, Kingsway, London, W.C.2.

a liability, in the event of war, to be called upon to serve with the Royal Air Force outside the confines of the United Kingdom, but with this exception the conditions of service, annual training, rates of pay, etc., are practically identical with those of the Auxiliary Air Force described in detail in the following chapter.

Applications for enlistment in the ranks of the Special Reserve of the Royal Air Force should be made, in the first place, either in person or by letter, to the commanding officer of the squadron which the recruit wishes to join.

CHAPTER XIII

THE AUXILIARY AIR FORCE

THE Auxiliary Air Force is a territorial organization raised and maintained by County Joint Associations in which both the Army and the Air Force are represented. It consists of a number of squadrons each located at an aerodrome in the vicinity of the town from which its volunteer personnel is recruited.

The personnel of the Auxiliary Air Force squadrons is comprised, for the greater part, of non-regular, volunteer officers and men, though in each squadron there is a nucleus of regular Air Force personnel, including the Adjutant and Assistant Adjutant, and some forty regular airmen, most of whom are skilled craftsmen and instructors of the volunteer personnel. The commanding officer of each squadron is, however, an Auxiliary Air Force officer.

Conditions of Service

Conditions of service in these squadrons are such that, for the volunteer personnel, it is possible, and usual, for both officers and men to belong to the Auxiliary Air Force without interference with their civil life and occupations, the necessary training being carried out in the volunteer's spare time at week-ends, in the evenings, and during the annual holiday season.

Since service is voluntary, Auxiliary Air Force officers and airmen do not normally receive pay except during the annual whole-time training period and when carrying out whole-time courses of instruction, and in the case of commissioned ranks when carrying out periodical flying training. In these circumstances

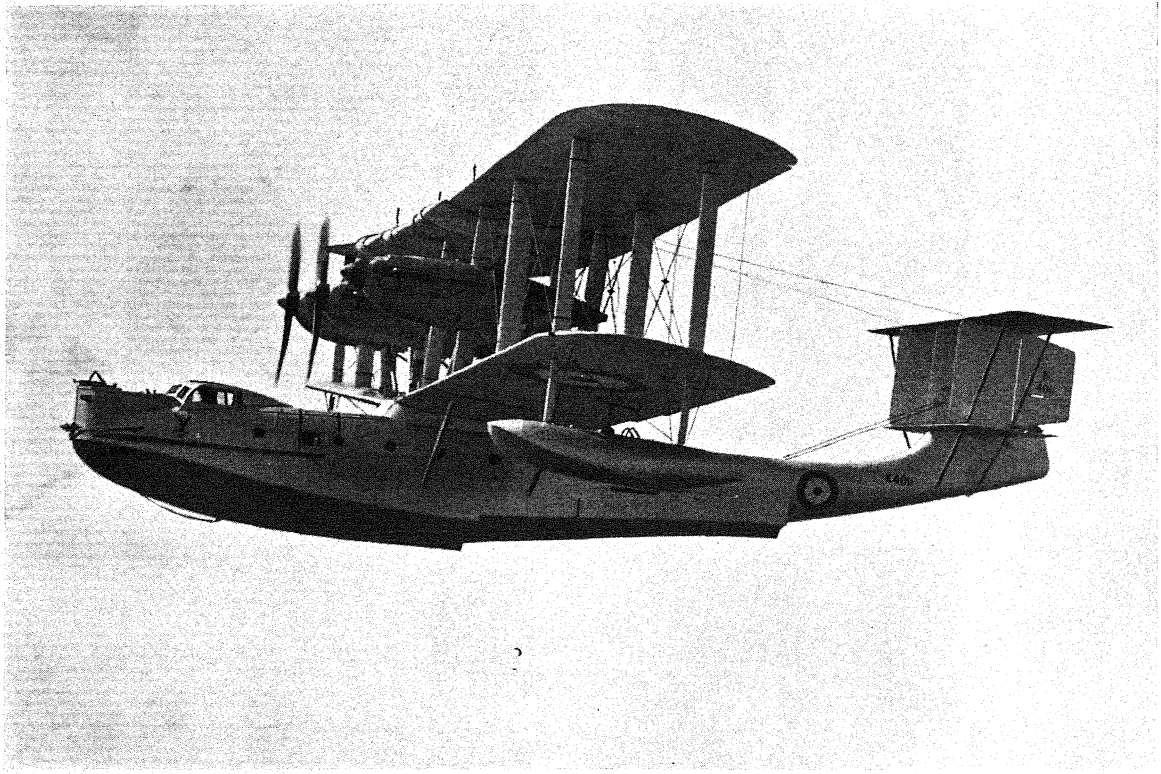


FIG. 7. A MODERN R.A.F. THREE-ENGINED FLYING-BOAT, THE "PERTH" CLASS
Flying-boat squadrons are stationed at Malta, the Persian Gulf, and Singapore. Long-distance cruises take place annually.

pay and allowances are granted at the current rates for unmarried officers and airmen of the same rank in the Royal Air Force. Provision is also made for the payment of compensation in the event of disability or death of non-regular members directly attributable to the conditions of their service in the Auxiliary Air Force.

Fighter and Bomber Squadrons

The present strength of the Auxiliary Air Force amounts to eight squadrons, and until 1934 all units were equipped with day-bombing types of aircraft, and their duties, in time of war, constituted the carrying-out of bombing raids from bases in Great Britain. This policy has since been changed to some extent, and the three Metropolitan units, Nos. 600, 601, and 604 Squadrons, are now fighter squadrons, and form a part of the air defence system of London. The remaining five squadrons continue as day-bomber units.

The location of the Auxiliary Air Force squadrons, and of their respective County Joint Associations and headquarters, is given in the Table on page 98.

Equipment and Training

The three fighter squadrons are either equipped, or in process of equipment, with fast, two-seater types of fighting aircraft. Their function in time of war would be to defend London from the attacks of enemy aircraft, by day and by night, by intercepting and engaging the raiders before they could reach the metropolis.

The two-seater fighter has two fixed machine-guns firing through the propeller, as in the single-seater fighter, but it has also a gun over the second cockpit

LOCATION OF AUXILIARY AIR FORCE SQUADRONS

Squadron	Location		Type	Name and address of the County Joint Association concerned
	Aerodrome	Headquarters		
600	Hendon	Finsbury Barracks. E.C.1	Single Engine 2-seater Fighter	City of London Territorial Army and Air Force Association, Finsbury Barracks, City Road, E.C.1.
601	Hendon	54 Kensington Park Road, W.11	do.	County of London Territorial Army and Air Force Association, Duke of York's Headquarters, Chelsea, S.W.3.
602	Abbotsinch, Paisley	49 Coplaw St., Glasgow, S.2.	Single Engine Day Bomber	City of Glasgow Territorial Army and Air Force Association, 201 West George Street, Glasgow.
603	Turnhouse	25 Learmonth Terrace, Edinburgh	do.	City of Edinburgh Territorial Army and Air Force Association, 8 Wemyss Place, Edinburgh.
604	Hendon	Heathbrow, North End Road, Hampstead, N.W.3	Single Engine 2-seater Fighter	County of Middlesex Territorial Army and Air Force Association, 66 Victoria Street, S.W.1.
605	Castle Bromwich	—	Single Engine Day Bomber	County of Warwick Territorial Army and Air Force Association, 46 High St., Warwick.
607	Usworth	—	do.	County of Durham Territorial Army and Air Force Association, Old Elvet, Durham.
608	Thornaby	—	do.	North Riding of Yorkshire Territorial Army and Air Force Association, Territorial Buildings, Thirsk Road, Northallerton.

behind the pilot which can be trained in almost any direction, thereby making it a very formidable fighting machine. The tactics imposed upon this type of machine consequently differ appreciably from those of a single-seater fighter, and an intensive specialized training of both pilot and gunner-observer is necessary.

The method of training employed in the fighter squadrons of the Auxiliary Air Force follows closely on the general lines of training for regular fighter squadrons, which have been described in an earlier chapter. Individual training of pilot and gunner is followed by collective training as a flight and later with the squadron as a whole. A wide range of subjects is covered by the training course, including night-flying and air fighting, gunnery practice on ground and air targets, converging bombing, wireless signalling, formation flying, air drill, and practice patrols.

The five bombing squadrons of the Auxiliary Air Force involve altogether different training since their duties, in time of war, would consist mainly in bombing enemy territory and in long-distance reconnaissance. They are equipped with day-bomber types, single-engined, high-performance two-seaters specially designed for high-altitude bombing. Like the two-seater fighters they carry a pilot and a gunner-observer, though in their case the guns are for defensive rather than offensive purposes. Their training comprises camera-gun work, bombing with practice bombs, photography, map-reading, wireless signalling, formation- and cloud-flying.

There is an operational as well as a training side to the Auxiliary units. Not only do they train officers to fly as service pilots and airmen to qualify as skilled tradesmen, but they also, as a part of the Home Defence Force, participate in the annual air exercises, and, in recent years, have taken part in the Royal Air Force display at Hendon with conspicuous success.

Commissioned Ranks

It is necessary for candidates for commissioned rank in the Auxiliary Air Force to be British subjects of

pure European descent, and the sons of parents both of whom are British subjects. They must be not less than 18 nor more than 25 years of age for commissions as Pilot Officer.[1] They must also be physically fit for flying, and before acceptance have to pass an examination before a medical board of the Royal Air Force.

Although possession of a pilot's licence, either of Class A or B, is an essential qualification for a commission in the flying branch of the Auxiliary Air Force, it is not necessary for a candidate to be a qualified pilot at the time of applying for his commission. Previously, such candidates could have their names recorded, and became eligible for a commission as soon as they had learnt to fly at a civil flying school, the cost of their training being subsequently refunded to them by the Air Ministry. Now, however, the majority of non-certificated candidates, if suitable in other respects and physically fit, are taught to fly without charge at the squadron to which they wish to be attached. The training is given on light aircraft by squadron instructors, and the candidate commissioned on reaching the requisite stage of piloting efficiency.

In addition to the Flying Duties Branch, the Auxiliary Air Force includes also Accountant, Medical, and Chaplains Branches, in all of which a limited number of commissions are available to suitably-qualified civilian candidates.

Period of Service

The minimum initial period of service for officers in the Auxiliary Force is for five years from the date

[1] The Air Council may, however, give special consideration to any candidate who is over the age limit at the time of making application.

of appointment. Thereafter, service may be extended for further periods not exceeding five years until the age limit is reached. This limit is 40 in the case of Flying Officers and Flight Lieutenants and 45 for Squadron Leaders.

Alternatively, officers who have completed their original engagements, but who are prevented by any reason from re-engaging for a further five years on the active list, may transfer to the Auxiliary Air Force Reserve of Officers. The object of this Reserve, which was formed in 1933, is to enable such officers to maintain their connection with the Service and keep themselves in flying practice so far as their individual circumstances permit. They may join the Reserve for four-year periods, and carry out their annual training with the squadron to which they were formerly attached. This training consists in the completion of a minimum of fifteen hours' flying a year, and attendance at certain ground training courses.

Promotion and Annual Training

New officers in the Auxiliary Air Force are commissioned in the rank of Pilot Officer, and are eligible for promotion to Flying Officer's rank at any time after satisfactorily completing their first eighteen months' service. Subsequent promotion is by selection from among officers of the squadron who have passed the requisite promotion tests.

The training consists of periodical flying practice, drill, and instructional parades, and a period of whole-time training each year with the squadron in camp. The extent and intensiveness of the training are left, to a great extent, to the individual officer's inclination and opportunities, though there are

certain minimum annual requirements, obligatory for every officer. These are—

(i) The completion of at least twenty-four hours' solo flying.

(ii) Attendance at six drill parades, fifteen general and six instructional parades.

(iii) The carrying-out of ground-gunnery practice, and

(iv) Attendance for whole-time training with the squadron for a period of not less than eight nor more than fifteen days.

The twenty-four hours' solo flying is exclusive of any flying that may be carried out during the annual training camp (iv), or in connection with courses of instruction, special training, and such week-end camps as may be arranged from time to time. It may, however, be distributed over the whole year and, in practice, is easily carried out in the course of occasional week-end and evening flying. All such flying is, of course, without cost to the officer, and is carried out on the squadron's aircraft at the expense of public funds.

The drills and instructional parades ((ii) and (iii) above) consist of one hour's actual instruction for each drill or parade, and any number of parades up to three may be performed, if desired, in one day.

The annual whole-time training period (iv) is the time spent in camp each year at a regular Air Force aerodrome and is fixed to coincide with the holiday season in order to cause the least possible inconvenience to the non-regular personnel.

During his first year of service an officer must, in addition to the training detailed above, carry out the following extra duties—

(i) Four extra drill parades, making ten in all for the full year.

(ii) Four extra instructional parades, making ten in all for the full year.

(iii) A course of air armament in either his first or second year of service.

Pay and Allowances

No pay or allowances are given for attendance at drill or instructional parades, but officers, when carrying out annual whole-time training, approved whole-time courses of instruction and periodical flying receive pay and allowances—up to a maximum of ten days a year for periodical flying—at the current rates obtaining for unmarried officers of the same rank and branch in the regular Air Force. A scale of these rates and allowances is given in Appendix II.

A grant of £40 for the purchase of the regulation Royal Air Force service dress uniform and equipment is made to officers on appointment.

Provision is also made in the regulations for the payment of compensation in the event of disablement or death directly attributable to the conditions of service, but all officers, on joining, are strongly recommended by the Air Council to consider the advisability of effecting private insurance to supplement the compensation that might become payable from official sources, or to cover contingencies in which no official compensation would be payable.

How to Apply for a Commission

A candidate for a commission in the Auxiliary Air Force should first, in order to save himself disappointment and unnecessary trouble and expense, submit to a thorough medical examination by his own doctor and obtain from him a certificate of complete physical fitness. He is then assured, as far as is possible, against

rejection at a later stage by the Royal Air Force Medical Board on the grounds of physical unfitness.

A copy of the Air Ministry Form No. 1442[1] should then be obtained and completed, including Parts D and E which have to be signed, one by the headmaster of the candidate's school, and the other by a responsible person who has known the candidate for a considerable period. These certificates attest to the educational and moral standards of the candidate.

The completed form should then be sent to the officer commanding the Auxiliary Squadron to which the applicant wishes to be appointed. Arrangements will in due course be made for a personal interview with the commanding officer, and later for an examination before a medical board of the Royal Air Force in London.

Non-commissioned Ranks

The Auxiliary Air Force is also open to men who wish to enlist either as tradesmen (such as fitters, armourers, etc.), clerks, or as aircrafthands. Conditions of service are similar to those for commissioned rank in that they do not interfere with the man's civil occupation, the necessary training being carried out at week-ends, in the evenings, and, once a year, in a holiday camp of from eight to fifteen days' duration.

Men, on joining the Auxiliary Air Force, are liable to be called up for active service with the Royal Air Force in the British Isles in the event of war or any other similar national emergency. Normally, however, their obligations are confined to annual training comprising instructional parades, drills, annual training, and, in some cases, special courses of instruction.

[1] Obtainable, gratis, on application to The Secretary, The Air Ministry, Kingsway, London, W.C.2.

Training Requirements

In the first year of service an airman is required to attend twenty-five instructional parades, ten drill parades, and the annual camp. Of these only the annual camp is a "whole-time" occupation, an instructional or drill parade lasting only one hour, and being held in the evenings or at week-ends either at the squadron's town headquarters or at the aerodrome.

In the second and subsequent years of service, obligatory training consists of fifteen instructional and six drill parades a year, in addition to the annual camp. Voluntary training in the form of week-end camps or additional parades may be carried out as desired.

Pay, Allowances, and Bounties

No remuneration is paid for attendance at instructional or drill parades, but during the annual training-camp period, or when specially called up for duty, airmen draw pay and allowances at the same rates as airmen of the regular Air Force. (See Appendix IV.) Travelling expenses to and from the annual camp are also defrayed, as well as any cost incurred in attending the instructional or drill parades.

In addition, airmen receive bounties for each training year completed at the rate of £2 10s. a year, provided they perform fifteen instructional and six drill parades and attend the annual camp for the full fifteen days. They also receive 1s. for each instructional parade in excess of the obligatory number up to a maximum of twenty-five in all, i.e. an additional bounty of 10s. maximum.

All airmen are provided with the necessary uniform and equipment free of charge, and, in the majority of cases, the squadron's town headquarters is well

equipped with recreational facilities for the use of the men.

How to Join the Auxiliary Air Force

Intending recruits must be between the ages of 18 and 38 years, physically fit, and able to pass a medical examination. They must be British subjects of pure European descent, and the sons of British subjects. If accepted, they are engaged for a period of four years, after which they may apply for re-engagement for one two, three, or four years at a time.

Should an airman desire his discharge before the end of his current term of service—as in the event of his civil employment necessitating a move from the vicinity of the squadron—he may obtain it by giving three months notice of his intention to leave, and paying a certain sum that will not exceed £5 at the most.

Applications for enlistment should be made to the headquarters of the nearest unit (see page 98), when the necessary application form will be supplied for completion.

CHAPTER XIV

THE UNIVERSITY AIR SQUADRONS

THE University Air Squadrons are civilian organizations which have been formed to encourage interest in flying, and to promote and maintain a liaison with the universities in technical and research problems affecting aviation.

They do not form any actual part of the Air Force either regular or non-regular, but are, nevertheless, run in close co-operation with the regular Air Force which supplies the chief instructor, instructors, aircraft, equipment, and the bulk of the necessary funds for each squadron's maintenance. They come within the scope of this book because membership of a university squadron can prove of great assistance to those who wish to take up aviation as a career either in a civilian capacity or in the Royal Air Force, or even for those who may subsequently wish to join one of the non-regular air forces such as the Auxiliary Air Force, the Reserve, or Special Reserve. In the Air Force Reserve, for example, direct commissions for flying duties from civil life are now restricted to ex-members of university air squadrons.

Obligations of Membership

There are at present squadrons at Oxford and Cambridge Universities, each with its own headquarters and with facilities for the flying training of its members at nearby Royal Air Force stations. At Oxford the Royal Air Force station is at Abingdon, and that of the Cambridge squadron at Duxford.

The number of flying members of a squadron is limited, and the chief obligations of membership are the performance of specified flying training, attendance at courses of ground instruction, an annual period of training at a Royal Air Force station, and the payment of an annual subscription.

Each squadron is under the command and administration of a chief instructor, who is an officer of the regular Air Force, and is assisted by other instructors who are also regular Air Force personnel.

Only members of the university are eligible to join, and candidates for flying membership have to pass a selection committee at the university and a medical examination, which may be carried out by their own doctor and the fee later refunded by the Air Ministry. Membership automatically terminates upon completion of the member's period of residence at the university, though it is also terminable earlier at any time by the chief instructor, the member himself, his parents, or tutor.

System of Training

The training given is divided into two parts, ground instruction, comprising courses in term-time at the squadron's headquarters, and flying instruction, which is given during term-time and also at the annual camp during the long vacation.

The ground instructional courses, which are normally given in the evening, deal with airmanship, theory of flight, engines, rigging, air pilotage, and other technical subjects such as gunnery, radio, air photography, etc.

Flying instruction during term-time is given at the Royal Air Force training flight's headquarters on dual-control type aircraft, and no member is allowed

to fly solo during the term unless he is already a fully qualified pilot. Non-qualified members, before they may fly solo, must wait for the annual camp when the training flight is moved from its normal aerodrome and attached to a Royal Air Force unit. Members are attached to the camp in groups of twenty-five at a time, and may not remain for a longer period than fourteen days.

Certificates of Proficiency

After a member has attended at least one annual camp, completed fifteen hours' flying (of which at least three hours must have been solo), and passed an examination in ground-training courses, he is granted a certificate of proficiency issued by the Air Ministry. This certificate carries with it several useful advantages for any holder who is proposing to enter the Royal Air Force.

If, for example, he has applied for and been appointed to a permanent commission, he may be allowed to join a flying-training school at the start of the second term provided that he has carried out twenty-five hours' solo flying, or half-way through the first term if he has only carried out ten hours' solo flying.

Advantages of Membership

Should he decide to apply for a short-service commission he would be entitled to one year's concession in the matter of age, and could, therefore, apply at any time prior to his twenty-third birthday instead of, as would otherwise be the case, his twenty-second birthday. Again, if he is appointed to a commission in the Reserve or Special Reserve he is excused the usual period of probation, and, if appointed to the

Auxiliary Air Force, may be allowed during his first year's service to substitute the instructional parades laid down for the second and subsequent years in place of the more arduous duties laid down for the first year.

Members of the university air squadrons carry out all their training, both during term-time and at the annual camp, in civilian clothes. There is no remuneration for service, but certain allowances are payable in respect of members' travelling and messing expenses.[1] Medical attendance is provided without charge when the squadron is undergoing its annual training with an Air Force unit, and there is also a compensation scheme, administered from public funds, for members who may become medically unfit as a direct result of injury sustained during authorized flying while on duty.

Application for membership of the university squadrons has to be made on the special forms for this purpose, which are obtainable from the chief instructors of the two squadrons.

[1] See Air Publication 1401, price 4d., obtainable from H.M.S.O., or any bookseller.

APPENDIX I

SCHOOL CERTIFICATES OF R.A.F. CANDIDATES

THE possession of a school certificate A or B, obtained by passing one of the following examinations, is, normally, required of candidates for entry into the R.A.F. College as a Cadet, for Aircraft Apprentices (Direct Entry), and for Apprentice Clerks.

(*a*) The School Certificate Examination of the Oxford and Cambridge Schools Examination Board.

(*b*) The School Certificate Examination of the Oxford Delegacy for Local Examinations.

(*c*) The School Certificate Examination of the Cambridge Local Examinations Syndicate.

(*d*) The School Certificate Examination of the University of Bristol.

(*e*) The School Certificate Examination of the University of Durham.

(*f*) The General School Examination of the University of London.

(*g*) The School Certificate Examination of the Northern Universities Joint Matriculation Board.

(*h*) The School Certificate Examination of the Central Welsh Board.

In place of any of these examinations, any other examination which, in the opinion of the Air Council, is of equivalent or higher standard may be accepted.

CADETSHIP AND SHORT-SERVICE COMMISSION CANDIDATES

In place of School Certificate A or B (see above) candidates for a Cadetship or a Short-service Commission may produce evidence of having passed the Matriculation Examination of London University or any other examination which is of equivalent or higher standard. Further, a candidate educated in Scotland or Northern Ireland may, in place of School Certificate A or B, produce a certificate from the Scottish Education Department or the Ministry of Education for Northern Ireland

showing that he has attained a standard equivalent to that of the School Certificate of the Oxford and Cambridge Schools Examination Board. A candidate educated in the Dominions or elsewhere overseas must produce satisfactory evidence of having attained a suitable standard.

In exceptional cases, where it is proved that a candidate has been prevented by unavoidable causes from obtaining a School Certificate or its equivalent, the authorities may, at their discretion, accept the candidate provided they are satisfied that his general education is up to the standard required to obtain such a certificate.

APPRENTICES

One of the following certificates will also be accepted in the case of Aircraft Apprentices and Apprentice Clerks in lieu of those detailed above—

(*a*) The Day School Certificate (Higher) of the Scottish Education Department. Candidates for Aircraft Apprenticeships presenting this certificate will be required to have passed in Mathematics (Arithmetic, Geometry, and Algebra), Science (Pure or Applied), and in Technical Subjects (Bench-work, Technical drawing and Mechanics), and to have remained in full-time attendance in school up to the term ending not more than a year before the relevant entry of Aircraft Apprentices takes place, i.e. January or August.

(*b*) The Junior Certificate of the Ministry of Education for Northern Ireland. Candidates for Aircraft Apprenticeships presenting this Certificate will be required to have obtained "credit" in Mathematics and in Experimental Science.

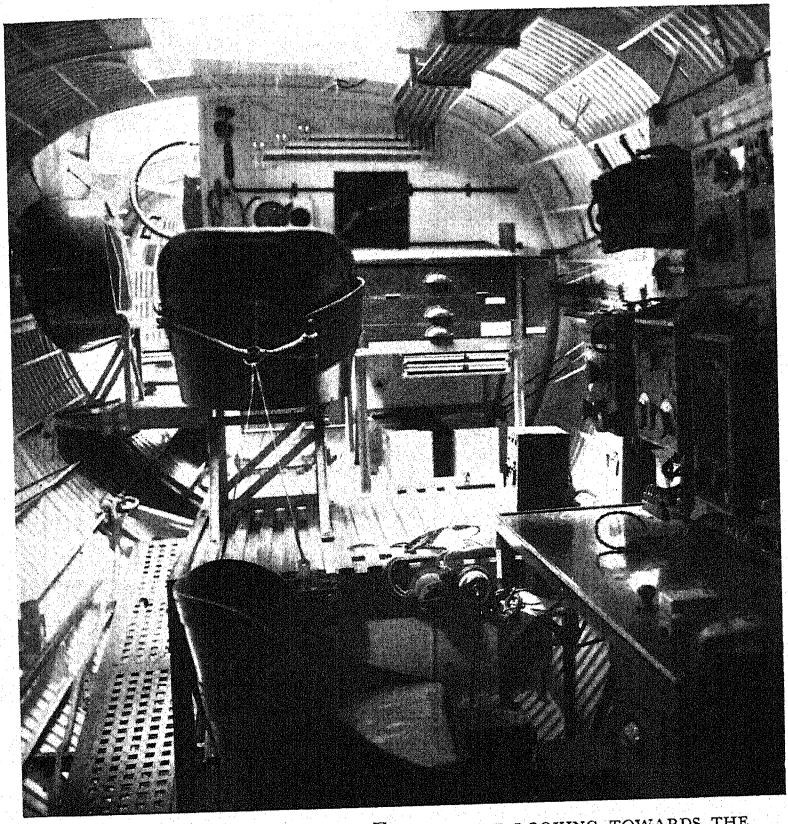


FIG. 8. THE INTERIOR OF A FLYING-BOAT LOOKING TOWARDS THE PILOT'S COCKPIT, PART OF WHICH CAN BE SEEN IN THE TOP LEFT-HAND CORNER

In the centre is the navigator's table, and in the foreground the wireless operator's table and instruments.

(R.A.F. Official: Crown Copyright Reserved)

APPENDIX II

RATES OF PAY AND ALLOWANCES OF OFFICERS IN THE GENERAL DUTIES BRANCH

(PERMANENT, SHORT-SERVICE COMMISSIONS AND MEDIUM SERVICE)

NOTE. The rates of pay shown below are current rates. New consolidated rates, representing a fractional increase on current rates, have recently been promulgated, but for the present current rates will remain in force.

Rank	Pay		Cash allowances at home rates in lieu of quarters, rations and servant, if not available in kind (per annum)[1]		Pay plus allowances (per annum)	
	Daily rate	Per annum (current rate)				
	Current		Married	Unmarried	Married	Unmarried
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Acting Pilot Officer	– 11 8	212 18 4	– – –	118 12 6	– – –	331 10 10
Pilot Officer	– 14 4	261 11 8	– – –	118 12 6	– – –	380 4 2
Flying Officer	– 18 –	328 10 –	190 2 1	118 12 6	518 12 1	447 2 6
Do. after 2 years as such	1 – 8	377 3 4	190 2 1	118 12 6	567 5 5	495 15 10
Flight Lieutenant	1 3 4	425 16 8	228 2 6	118 12 6	653 19 2	544 9 2
Do. after 2 years as such	1 5 2	459 5 10	228 2 6	118 12 6	687 8 4	577 18 4
Squadron Leader	1 10 8	559 13 4	231 3 4	156 12 11	790 16 8	716 6 3
Do. after 5 years as such	1 12 4	590 1 8	231 3 4	156 12 11	821 5 –	746 14 7
Wing Commander	1 16 –	657 –	234 4 2	185 10 10	891 4 2	842 10 10
Rising by 10 annual increments to	2 5 –	821 5 –	234 4 2	185 10 10	1055 9 2	1006 15 10
Group Captain	2 9 6	903 7 6	305 13 9	246 7 6	1209 1 3	1149 15 –
Rising by increments after 2, 4, and 6 years to	2 17 8	1052 8 4	305 13 9	246 7 6	1358 2 1	1298 15 10
Air Commodore	2 18 –	1058 10 –	361 19 2	307 4 2	1420 9 2	1365 14 2
Air Vice-Marshal	4 10 –	1642 10 –	422 15 10	368 – 10	2065 5 10	2010 10 10
Air Marshal	5 4 10	1913 4 2	520 2 6	465 7 6	2433 6 8	2378 11 8
Air Chief Marshal	6 2 5	2234 2 1	584 – –	524 13 9	2818 2 1	2758 15 10

[1] These allowances are issued only when accommodation, fuel and light, rations and personal attendance are not available in kind. Normally, provision in kind is available for junior officers. "Married" rates of allowances are payable only to married officers who have reached the age of 30 or the rank of Squadron Leader. A colonial allowance is granted in certain commands abroad.

APPENDIX III

RATES OF OFFICERS' RETIRED PAY

THE rates of retired pay for officers below the rank of Group Captain set out below are standard rates. Current rates are approximately 10 per cent less than standard rates. New consolidated rates have recently been promulgated, but for the present the existing current rates will remain in force.

Age on retirement	Standard yearly rate of retired pay	Years of service	Addition for each extra year of service[1]
	£		£
40	300	17	15
41	337	17	15
42	375	18	15
43	412	18	15
44	450	19	15
45	487	19	15
46	525	20	15
47	562	20	15
48	600	21	15
49	637	21	15
50	675	22	15
51	697	22	22
52	720	23	22
53	742	23	22
54	765	24	22
55	790	24	22

[1] Limited to five years.

The maximum standard rates of retired pay, and the compulsory retiring ages are as follow—

Rank.	Maximum standard yearly rate of retired pay.	Compulsory retiring age.
	£	
Wing Commander . . .	600	48
Squadron Leader . . .	450	45
Flight Lieutenant (and ranks below)	400	45

APPENDIX IV

RATES OF PAY AND TRADE GROUPS FOR AIRMEN, AIRCRAFT APPRENTICES APPRENTICE CLERKS, AND BOY ENTRANTS

DAILY RATES OF PAY

Rank	Group I	Group II	Group III	Group IV	Group V	Medical and Dental Branch		
						Group A	Group B	Group C
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Aircraftman, Second-class.	3 6	3 3	2 6	3 –	2 –	3 3	3 –	2 9
Aircraftman, Second-class (over one year) . .	—	—	—	—	2 6	—	—	—
Aircraftman, Second-class (over three years) . .	—	—	—	—	—	4 3	4 –	3 9
Aircraftman, First-class .	4 3	4 –	3 3	3 9	2 9	3 9	3 6	3 3
Aircraftman, First-class (over three years) . .	—	—	—	—	—	4 9	4 6	4 3
Leading-Aircraftman .	5 6	5 –	4 –	4 6	3 3	4 3	4 –	3 9
Leading-Aircraftman (over three years) . . .	6 –	5 6	4 6	5 –	3 9	5 3	5 –	4 9
Corporal	7 6	6 6	5 –	5 6	4 3	5 6	5 3	5 –
Corporal (over two years) .	—	—	—	—	—	6 3	6 –	5 9
Corporal (over four years).	8 –	7 –	5 6	6 –	4 9	—	—	—
Sergeant	9 6	8 6	6 6	7 –	6 –	7 3	7 –	6 9
Sergeant (over two years) .	—	—	—	—	—	8 –	8 –	8 –
Sergeant (over four years).	10 –	9 0	7 –	7 6	6 6	—	—	—
Sergeant (pilot) . .	12 6	11 6	9 6	10 –	—	—	—	—
Sergeant (pilot) (over four years)	13 6	12 6	10 6	11 –	—	—	—	—
Flight Sergeant . .	11 6	10 –	8 –	8 6	7 6	9 6	9 6	9 6
Flight Sergeant (over four years)	12 –	10 6	8 6	9 –	8 –	—	—	—
Flight Sergeant (pilot) .	15 –	13 6	11 6	12 –	—	—	—	—
Flight Sergeant (pilot) (over four years) . .	15 6	14 –	12 –	12 6	—	—	—	—
Warrant Officer . .	14 –	12 6	11 –	11 6	11 –	13 6	13 6	13 6
Warrant Officer (over five years) . . .	16 6	15 –	13 6	14 –	13 6	—	—	—

	First Year.	Second Year	Afterwards[1]
	s. d.	*s. d.*	*s. d.*
Aircraft Apprentices .	1 0	1 0	1 6
Apprentice Clerks .	1 0	—	1 6

DURING TRAINING—

	s. d.	*s. d.*
Boy Entrants . .	9	1 0

[1] That is until the Aircraft Apprentice has both attained the age of 18 years and been posted to a unit for duty as an Aircraftman after the completion of training; or, in the case of an Apprentice Clerk or Boy Entrant, until he is classified as an Aircraftman.

TRADE GROUPS

(With Key showing Method of Recruitment)

TECHNICAL—Group I

Fitter[1]
Fitter (armourer)[1]
Fitter (torpedo)[3]
Hydrogen Worker (First-class)
Instrument Maker[1]
Machine Tool Setter and Operator[3]
Metal Worker[3]
Wireless Operator (Mechanic)[1]

TECHNICAL—Group II

Armoured-car Crew[4]
Armourer[2]
Carpenter[3]
Photographer[2]
Rigger (airship)
Wireless Operator[2]

TECHNICAL—Group III

Cook and Butcher[4]
Fabric Worker[4]
Hydrogen Worker (Second-class)
Motor-boat Crew[4]
Storekeeper[4]

ADMINISTRATIVE—Group IV

Clerk (General duties)
Clerk (Pay accounting) [1] and [3]
Clerk (Store accounting)

NON-TECHNICAL—Group V

Aircrafthand (General duties)
Aircrafthand (Physical-training Instructor)[4]
Aircrafthand (Service police)[4]
Aircrafthand (under training for technical trades)
Driver (petrol)[4]
Fitter's Mates[4]
Hospital or Dental Orderly
Musician

Group V also includes—

Aircrafthand (for training as Dental Orderly)
Aircrafthand (for training as Hospital Orderly)

MEDICAL AND DENTAL BRANCH—Group A

Pharmacist
Trained Nurse

MEDICAL AND DENTAL BRANCH—Group B

Dental Mechanic
Dispenser
Hospital Cook
Laboratory Assistant
Masseur
Operating Room Assistant
Radiographer

MEDICAL AND DENTAL BRANCH—Group C

Mental Nursing Orderly
Nursing Orderly
Sanitary Assistant
Special Treatment Orderly
Dental Clerk Orderly

[1] Entered as Apprentices.
[2] Will be recruited from Boy Entrants.
[3] Skilled recruits.
[4] Trained aircrafthands.

APPENDIX V

RATES OF PENSIONS FOR AIRMEN

To qualify for a service pension an airman must normally serve for twenty-four years with the Regular Air Force. A reduced pension may, however, be granted to an airman who is allowed to take his discharge prematurely after twenty years' such service. The necessary period of service having been completed the rate of pension is assessed according to qualifying and not total service.

The present rates of pension, which are uniform for all trades, are based on a weekly rate for each complete year of qualifying service and proportionally for broken periods and are as follows—

	Weekly Rate
	s. *d.*
For each year as Aircraftman	8
,, ,, Corporal	11½
,, ,, Sergeant	1 3
,, ,, Flight Sergeant	1 6½
,, ,, Warrant Officer	2 1½

Subject to good character as a pensioner an additional pension of 5d. a day is granted on attaining the age of 55.

If after twenty-four years' service an airman is permitted to continue to serve, the qualifying service beyond the twenty-four years counts for increased pension, subject to fixed maximum rates for each rank.

TRADE GROUPS

(With Key showing Method of Recruitment)

TECHNICAL—Group I

Fitter[1]
Fitter (armourer)[1]
Fitter (torpedo)[3]
Hydrogen Worker (First-class)
Instrument Maker[1]
Machine Tool Setter and Operator[3]
Metal Worker[3]
Wireless Operator (Mechanic)[1]

TECHNICAL—Group II

Armoured-car Crew[4]
Armourer[2]
Carpenter[3]
Photographer[2]
Rigger (airship)
Wireless Operator[2]

TECHNICAL—Group III

Cook and Butcher[4]
Fabric Worker[4]
Hydrogen Worker (Second-class)
Motor-boat Crew[4]
Storekeeper[4]

ADMINISTRATIVE—Group IV

Clerk (General duties)
Clerk (Pay accounting) } [1] and [3]
Clerk (Store accounting)

NON-TECHNICAL—Group V

Aircrafthand (General duties)
Aircrafthand (Physical-training Instructor)[4]
Aircrafthand (Service police)[4]
Aircrafthand (under training for technical trades)
Driver (petrol)[4]
Fitter's Mates[4]
Hospital or Dental Orderly
Musician

Group V also includes—

Aircrafthand (for training as Dental Orderly)
Aircrafthand (for training as Hospital Orderly)

MEDICAL AND DENTAL BRANCH—Group A

Pharmacist
Trained Nurse

MEDICAL AND DENTAL BRANCH—Group B

Dental Mechanic
Dispenser
Hospital Cook
Laboratory Assistant
Masseur
Operating Room Assistant
Radiographer

MEDICAL AND DENTAL BRANCH—Group C

Mental Nursing Orderly
Nursing Orderly
Sanitary Assistant
Special Treatment Orderly
Dental Clerk Orderly

[1] Entered as Apprentices.
[2] Will be recruited from Boy Entrants.
[3] Skilled recruits.
[4] Trained aircrafthands.

APPENDIX V

RATES OF PENSIONS FOR AIRMEN

To qualify for a service pension an airman must normally serve for twenty-four years with the Regular Air Force. A reduced pension may, however, be granted to an airman who is allowed to take his discharge prematurely after twenty years' such service. The necessary period of service having been completed the rate of pension is assessed according to qualifying and not total service.

The present rates of pension, which are uniform for all trades, are based on a weekly rate for each complete year of qualifying service and proportionally for broken periods and are as follows—

	Weekly Rate s.	d.
For each year as Aircraftman		8
,, ,, Corporal		11½
,, ,, Sergeant	1	3
,, ,, Flight Sergeant	1	6½
,, ,, Warrant Officer	2	1½

Subject to good character as a pensioner an additional pension of 5d. a day is granted on attaining the age of 55.

If after twenty-four years' service an airman is permitted to continue to serve, the qualifying service beyond the twenty-four years counts for increased pension, subject to fixed maximum rates for each rank.

APPENDIX VI

AIR FORCE RANKS

With Their Naval and Military Equivalents

Air Force Ranks	Naval Ranks	Army Ranks
Marshal of the Royal Air Force	Admiral of the Fleet	Field-Marshal
Air Chief Marshal	Admiral	General
Air Marshal	Vice-Admiral	Lieut.-General
Air Vice-Marshal	Rear-Admiral	Major-General
Air Commodore	Commodore, first- and second-class	Brigadier
Group Captain	Captain	Colonel
Wing Commander	Commander	Lieut.-Colonel
Squadron Leader	Lieut.-Commander	Major
Flight Lieutenant	Lieutenant	Captain
Flying Officer	Sub-Lieutenant	Lieutenant
Pilot Officer Acting Pilot Officer (but junior to Navy and Army ranks)	Acting Sub-Lieutenant, Commissioned Officer from warrant rank	Second Lieutenant
No equivalent	Warrant-Officer (but senior to Army ranks) Midshipman (but junior to Army ranks)	† Conductor, Royal Army Ordnance Corps; † Master Gunner, first-class; † first-class Staff Sergeant Major
Warrant Officer	No equivalent	All Warrant-Officers, class I, except those marked † above.
Warrant Officer, second-class[1]	No equivalent	Warrant Officer, class II
Flight Sergeant	Chief Petty Officer	Squadron Quartermaster; Corporal (Household Cavalry), or Squadron, Battery, Troop, or Company Quartermaster Sergeant; Colour Sergeant; Staff Corporal (Household Cavalry) or Staff Sergeant
Sergeant	Petty Officer II	Corporal-of-Horse (Household Cavalry) or Sergeant
Corporal	Leading Seaman (but junior to Army ranks)	Corporal; Bombadier
Leading-Aircraftman; Aircraftman, first-class; Aircraftman, second-class	Able Seaman; Ordinary Seaman	Trooper, Gunner, Sapper, Signalman, Driver, Guardsman, Rifleman, Fusilier, or Private

[1] This rank is now obsolecent.

INDEX

PRINTED IN GREAT BRITAIN AT THE PITMAN PRESS, BATH
C4—(Ae.11)

PITMAN'S BOOKS

on

AVIATION

and

AERONAUTICAL ENGINEERING

PITMAN

PITMAN'S BOOKS ON AVIATION
AND
AERONAUTICAL ENGINEERING

LIST OF TITLES

AEROBATICS

AERO-ENGINES

AERONAUTICS (Definitions and Formulae for Students)

AIR AND AVIATION LAW

AIR ANNUAL OF THE BRITISH EMPIRE, THE

AIRCRAFT PERFORMANCE TESTING

AIR LICENCES

AIRMANSHIP

AIRMAN'S YEAR BOOK, THE

AIR NAVIGATION FOR THE PRIVATE OWNER

AIRSENSE

AUTOGIRO AND HOW TO FLY IT, THE

AUTOGIRO, THE BOOK OF THE

AUTOMOBILE AND AIRCRAFT ENGINES

BRITAIN'S AIR PERIL

ELECTRICAL AND WIRELESS EQUIPMENT OF AIRCRAFT (Ground Engineers' Textbooks)

FLYING AS A CAREER

GLIDING AND MOTORLESS FLIGHT

GROUND ENGINEERS' TEXTBOOKS

HANDBOOK OF AERONAUTICS

INSPECTION OF AIRCRAFT AFTER OVERHAUL (Ground Engineers' Textbooks)

INSTRUMENTS (Ground Engineers' Textbooks)

INTRODUCTION TO AERONAUTICAL ENGINEERING SERIES

LEARNING TO FLY

LIGHT AERO ENGINES

MARINE AIRCRAFT DESIGN

MATERIALS OF AIRCRAFT CONSTRUCTION

MECHANICS OF FLIGHT (Introduction to Aeronautical Engineering)

METAL AIRCRAFT CONSTRUCTION

MODERN AIRCRAFT

PARACHUTES FOR AIRMEN

PILOT'S "A" LICENCE

PROPERTIES AND STRENGTH OF MATERIALS (Introduction to Aeronautical Engineering)

RAFTALES

RIGGING, MAINTENANCE AND INSPECTION OF AIRCRAFT (Ground Engineers' Textbooks)

ROYAL AIR FORCE, THE

STRESSES IN AEROPLANE STRUCTURES

STRUCTURES (Introduction to Aeronautical Engineering)

TWO-CYCLE ENGINE, THE

Descriptive folders of individual books can be obtained post free from the Publishers.

SIR ISAAC PITMAN & SONS, LTD., PITMAN HOUSE, PARKER ST., KINGSWAY, LONDON, W.C.2
BATH MELBOURNE

ASSOCIATED COMPANIES

Pitman Publishing Corporation, New York

Sir Isaac Pitman & Sons (Canada), Ltd., Toronto (Incorporating The Commercial Text Book Company)

Wholesale Agents for India: A. H. WHEELER & CO., BOMBAY, CALCUTTA, AND ALLAHABAD

FIVE COMPLETE AND PRACTICAL HANDBOOKS OF INSTRUCTION

GROUND ENGINEERS' TEXTBOOKS

A SERIES OF FIVE BOOKS COVERING THE REQUIREMENTS OF THE GROUND ENGINEERS' LICENCES

THIS is a series of handbooks specially compiled for the instruction of ground engineers and others who require a sound knowledge of the care and maintenance of aircraft. The various volumes comprising the complete Series cover in full the requirements of the different Ground Engineers' Licences and provide a wealth of practical information of assistance to the engineer in the ordinary routine of his work.

AERO-ENGINES

By R. F. BARLOW and A. N. BARRETT. Covering the Ground Engineers' "C" and "D" Licences. 68 pp. 3s. 6d. net.

INSTRUMENTS

By R. W. SLOLEY, M.A., B.Sc. Covering Category "X" Licence. 92 pp. 5s. net.

ELECTRICAL AND WIRELESS EQUIPMENT OF AIRCRAFT

By S. G. WYBROW, A.M.I.E.E., A.M.I.M.E. "X" Licence. 132 pp. 6s. net.

INSPECTION OF AIRCRAFT AFTER OVERHAUL

By S. J. NORTON, A.M.Inst.C.E., A.F.R.Ae.S. Covering the "B" Licence. 92 pp. 3s. 6d. net.

THE RIGGING, MAINTENANCE, AND INSPECTION OF AIRCRAFT

By W. J. C. SPELLER. Covering the "A" Licence. 130 pp. 5s. net.

The Air Ministry, whilst accepting no responsibility for the contents of these books, recognizes them as textbooks that should prove to be of value to intending applicants for Ground Engineers' Licences.

SPECIALLY RECOMMENDED FOR STUDENTS DRAUGHTSMEN, APPRENTICES, AND GROUND ENGINEERS

AN INTRODUCTION TO AERONAUTICAL ENGINEERING

This series of introductory textbooks deals with the theory underlying modern practice in aeronautical engineering in a way that will appeal to ground engineers, draughtsmen, students, and mechanically-minded aeroplane owners. It avoids the use of higher mathematics throughout, and gives a complete understanding of every detail in a straightforward and direct manner. Together, the volumes form a complete course, or, separately, each is a valuable introduction to the advanced study in the special branch of the subject with which it deals.

Volume I. MECHANICS OF FLIGHT

By A. C. KERMODE, B.A., A.F.R.Ae.S., 222 pp., illustrated. 8s. 6d. net. Second Edition.

Volume II. STRUCTURES

By J. D. HADDON, B.Sc., A.F.R.Ae.S., 150 pp., illustrated. 6s. net. Second Edition.

Volume III. PROPERTIES AND STRENGTH OF MATERIALS

By J. D. HADDON, B.Sc., A.F.R.Ae.S., 188 pp., illustrated. Second Edition. 8s. 6d. net.

Each volume in demy 8vo, cloth ink.

JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY: "Can be thoroughly recommended, and every student who gives it adequate attention should be well grounded in the subjects dealt with."

ROYAL AIR FORCE JOURNAL, HALTON: "We would strongly recommend this series to Service Aircraftsmen."

AN AUTHORITATIVE WORK FOR EVERYONE CONCERNED WITH AERONAUTICAL DESIGN

SECOND EDITION IN TWO VOLUMES

HANDBOOK OF AERONAUTICS

PUBLISHED UNDER THE AUTHORITY OF THE ROYAL AERONAUTICAL SOCIETY

This Work is a standard source of authoritative technical information among aircraft manufacturers and designers all over the world. It is published in two complete volumes comprising together over 1110 pages and many hundreds of illustrations. The Work is compiled by leading specialist authorities and is right up to date with the latest practical thought and development in the aircraft industry. Every aircraft manufacturer, designer, and engineer should have the volumes for instruction and reference.

Technical Editor

CAPT. J. LAURENCE PRITCHARD, Hon. F.R.Ae.S

Contributors

Capt. F. ENTWISTLE, B.Sc.

F. C. JOHANSEN, Esq., M.Sc., A.M.I.Mech.E., F.R.Ae.S.

R. C. KEMP, Esq.

M. LANGLEY, Esq., A.M.I.N.A., A.M.I.Ae.E.

C. H. LATIMER NEEDHAM, Esq., M.Sc.(Eng.), Lond., F.R.Ae.S.

Capt. R. N. LIPTROT, O.B.E., B.A., A.F.R.Ae.S., M.I.Ae.E.

Lieut.-Col. H. W. S. OUTRAM, C.B.E., A.R.S.M., A.F.R.Ae.S., A.M.I.E.E.

Capt. J. LAURENCE PRITCHARD, Hon.F.R.Ae.S.

E. F. RELF, Esq., A.R.C.S., F.R.Ae.S.

C. J. STEWART, Esq., O.B.E., F.R.Ae.S., M.I.M.E.

ANDREW SWAN, Esq., B.Sc., A.M.I.C.E., A.F.R.Ae.S.

VOLUME I

Aerodynamics—Performance—Construction—Materials—Meteorology—Instruments—Wireless—Air Survey and Photography—Design—Design and Construction of Gliders and Sailplanes—General—Index.

Med. 8vo, 722 pp. 25s. net.

VOLUME II

(AERO ENGINES. By A. SWAN, B.Sc., A.M.I.C.E., A.F.R.Ae.S.).

Design Data—Performance Data—Design and Stress Calculations—Supercharging—Carburettors and Intake Systems—Cooling—Ignition—Fuels—Lubricating Oils and Oil Systems—Exhaust Systems and Silencing—Engine Heaters and Starting—Testing—Compression Ignition Engines—Airscrews.

Med. 8vo, 430 pp. 15s. net.

FOR EVERYDAY REFERENCE

A HANDBOOK OF POPULAR INTEREST AND PRACTICAL USE

THE AIRMAN'S YEAR BOOK

Edited by

SQUADRON-LEADER C. G. BURGE, O.B.E., A.R.Ae.S.I., A.Inst.T.

Published Under the Authority of the Royal Aero Club of the United Kingdom

This is the airman's everyday reference to information, statistics, and facts required for general interest or practical use. The Contents include information on record flying achievements, flying contests, touring, foreign air travel restrictions, application for licences, and all the hundred and one other matters that airmen and air enthusiasts should have at their fingertips. It is an essential part of their equipment.

CONTENTS

Complete with Calendars

Medium 8vo. 146 pp.

3/6 net

JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY: "The book should be extremely useful as a work of reference, for it includes in one volume much information which has hitherto been scattered in different publications."

SCOTTISH FLYER: "The very thing wanted by the civil pilot who is really interested in Aviation."

THE COMPLETE GUIDE

TO ALL MATTERS CONCERNING IMPERIAL AVIATION

THE AIR ANNUAL OF THE BRITISH EMPIRE

Edited by

SQUADRON-LEADER C. G. BURGE, O.B.E., A.R.Ae.S.I., A.Inst.T.

This well known encyclopaedia provides important and interesting information relating to the progress, development, and activities of British Empire Aviation. It is of great practical value to all who follow the course of aviation from a professional or a general point of view. A complete section, compiled by specialist authorities, is devoted to technical developments in the latest design and construction of British aircraft and engines. There are also important sections on civil and military aviation. Every year sees new features and the very latest facts and statistics added to this authoritative Annual.

PRINCIPAL CONTENTS

CIVIL AVIATION
SERVICE AVIATION
THE BRITISH AIRCRAFT INDUSTRY
AERO ENGINES AND COMPONENTS
AIRCRAFT
DESIGN AND CONSTRUCTION
EUROPEAN AIR FLEETS
WIRELESS EQUIPMENT
AIR SURVEY AND PHOTOGRAPHIC EQUIPMENT
AIRCRAFT COMPONENTS
AIRWAYS AND AIRPORTS
AERO CLUBS
AIRWAY AND AERODROME LIGHTING
CARRIAGE BY AIR
GREAT BRITISH FLIGHTS
GENERAL REFERENCE SECTION

862 pp. **21s. net** **Illustrated**

JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY: "One of the most useful aeronautical reference works published."

THE DAILY TELEGRAPH: "A reliable reference and a work of absorbing interest."

THE DAILY MAIL: "Packed with useful matter, this work will be found indispensable."

"Easily the best book on the subject."
—says THE SPECTATOR.

LEARNING TO FLY

By
FRANK A. SWOFFER, M.B.E.

This is one of the best-known and widely-adopted books on the handling of an aeroplane and the elements of flying technique. It is not only a valuable supplement for all who are taking courses in flying instruction, but it also provides a useful source of reference to details of engine maintenance and working for the experienced pilot. It is extremely popular among air enthusiasts who wish to find out in an interesting manner all they can about aeroplanes.

CONTENTS

Illustrated with Diagrams and Action Drawings

Crown 8vo, cloth, 158 pp.

7/6 net

THIRD EDITION

"Probably the most complete exposition of the methods of teaching that are practised in the British Light Aero Clubs."—MORNING POST.

"Should be read by all who propose to take instruction."—FLIGHT.

"An excellent book for the beginner."—AEROPLANE.

"A book that can be understood by everyone."—TIMES.

BOOKS FOR READERS WHO PROPOSE TO TAKE UP FLYING AS A PROFESSION

FLYING AS A CAREER

By
OLIVER STEWART, M.C., A.F.C.

Air enthusiasts who wish to find out all they can about the life and work of airmen should read this book. It contains all the information they need ; including full and authoritative details of remuneration, duties, professional status, prospects, and descriptions of every sort of post offered by aviation, whether on the ground or flying staffs. It is an indispensable guide for parents choosing careers for their children, as well as for readers who want to know how to apply and qualify for positions. 94 pp. Second Edition.

FLIGHT : "We owe Major Stewart a very sincere debt of gratitude. . . . The arrangement of the book is admirable and the facts are accurate."

JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY : "A most useful book."

3/6 NET

THE ROYAL AIR FORCE

By
T. STANHOPE SPRIGG

This book deals with every branch of the Royal Air Force and explains its organization, duties and prospects as a profession. All the information relating to training, grants, commissions, and opportunities offered in the flying, clerical and engineering departments is given in detail so that readers can be fully acquainted with all essential facts. A study of this book will enhance the prospects of everyone proposing to enter the R.A.F. 120 pp.

5/- NET

A COMPLETE ACCOUNT OF "THE MISSING LINK OF AVIATION"

THE AUTOGIRO AND HOW TO FLY IT

By
REGINALD BRIE

With a Foreword by SENOR DE LA CIERVA

This book tells the fascinating story of the Autogiro, how it originated, how it has grown up, and the part it will play in the future. It describes the new "wingless" type and shows how it is designed and operated, and indicates its immense possibilities. All kinds of vital aviation facts are discussed, together with countless practical details that everyone interested in aviation should know; while for those who want to be able to fly themselves, here is the instruction they need given in a simple and straightforward manner.

CONTENTS

Demy 8vo, cloth, 124 pp.

5/- net

SECOND EDITION

"Gives a great deal of inside information about the technique of flying this type of machine."—MORNING POST.

"An admirably clear little book. . . . Can be understood by every intelligent person."—NEW STATESMAN.

"A most useful and instructive book."—FLIGHT.

"This is a very good book!"

"We recommend all who are interested in the sport of gliding to purchase a copy."

—says THE BRITISH GLIDING ASSOCIATION JOURNAL.

GLIDING AND MOTORLESS FLIGHT

By

L. HOWARD-FLANDERS, M.I.A.E., A.F.R.Ae.S., A.M.I.Mech.E.

Member of the Council of the British Gliding Association

and

C. F. CARR

A fascinating account of gliding, giving a full insight into the principles of motorless flight and the meteorological conditions essential to gliding. It provides, in addition to practical instructions, a wealth of information on gliding achievements, official records, and formation of gliding clubs. Everyone interested in this rapidly developing sport will find this book instructive, practical, and entertaining. There are many delightful illustrations.

Demy 8vo, 158 pp. 7s. 6d. net. Second Edition.

CONTENTS

PRESS OPINIONS

BRITISH GLIDING ASSOCIATION JOURNAL: "We recommend all who are interested in the sport of gliding, and particularly those interested in the formation of gliding clubs to purchase a copy of 'Gliding and Motorless Flight' for use as a text-book."

ROYAL AIR FORCE QUARTERLY: "All those interested in the subject could do no better than read this excellent book."

AEROPLANE: "Many clubs now operating would do well to read what he (the author) has to say, and to re-organize themselves accordingly."

COUNTRY LIFE: "It is thoroughly practical and has some excellent photographs."

MATERIALS OF AIRCRAFT CONSTRUCTION

By F. T. HILL, F.R.Ae.S., M.I.Ae.E.

This practical book embraces the complete range of materials used in the modern practice of aeronautical engineering. It discusses each material from the point of view of its special properties, treatment, and applications for aircraft purposes. Demy 8vo, cloth gilt, 384 pp. 20s. net. Second Edition.

METAL AIRCRAFT CONSTRUCTION

By M. LANGLEY, A.M.I.N.A., A.M.I.Ae.E.

A review of the modern international practice in the metal construction of aircraft, compiled with the assistance of leading international aircraft manufacturers. Demy 8vo, cloth gilt, 338 pp. 15s. net. Second Edition.

MARINE AIRCRAFT DESIGN

By WILLIAM MUNRO, A.M.I.Ae.E.

Describes the individual types of marine aircraft, and describes the practical details of design in aircraft ranging from 3,000 lb. to 20,000 lb. all-up weight for boat seaplanes and from 1,500 lb. to 5,000 lb. for float seaplanes. Demy 8vo, cloth gilt, 240 pp., illustrated. 20s. net.

THE STRESSES IN AEROPLANE STRUCTURES

By H. B. HOWARD, B.A., F.R.Ae.S.

This book discusses those portions of the theory of structures that are of special importance in aeroplane design. The subject is treated in a manner that lends itself readily to purposes of study and reference. Demy 8vo, cloth gilt, 264 pp., illustrated. 20s. net.

MODERN AIRCRAFT

By Major VICTOR W. PAGÉ, *Air Corps Reserve, U.S.A. Member of the Society of Automobile Engineers, Inc.*

A complete treatise, first published in America, for aeronautical students and engineers. It outlines the principles of aeroplane construction, operation and repair, and describes the special features of all types of machines. Med. 8vo, cloth gilt, 870 pp. 21s. net.

AIRCRAFT PERFORMANCE TESTING

By S. Scott Hall, M.Sc., D.I.C., A.F.R.Ae.S., and T. H. England, D.S.C., A.F.C., A.F.R.Ae.S.

This book is written primarily for the constructor who wishes to put his aircraft through an adequate programme of tests on modern lines. It enables the test pilot and engineer to ascertain what tests should be applied, shows how they should be carried out, and what information should be obtained. Demy 8vo, cloth gilt, 216 pp., illustrated. 15s. net.

LIGHT AERO ENGINES

By C. F. Caunter.

A practical manual describing the chief types of light aero engines, with instructions for their maintenance. It will appeal to the owner-pilot, the ground engineer, and the manufacturer. Crown 8vo, cloth gilt, 304 pp., illustrated. 12s. 6d. net.

THE TWO-CYCLE ENGINE

By C. F. Caunter.

Deals with the design of the two-cycle engine, with particular reference to its application in aeronautical design and construction. Crown 8vo, cloth gilt, 294 pp. 15s. net.

AUTOMOBILE AND AIRCRAFT ENGINES

By A. W. Judge, Wh.Sc., A.R.C.S., A.M.I.Ae.E., D.I.C., etc.

This volume records the results of modern scientific research into all branches of the subject. It is a recognized standard work for designers and students concerned with aero engine-work. A particularly outstanding feature is the chapter on high-speed compression ignition engines. Demy 8vo, cloth gilt, 890 pp., illustrated. 42s. net. Third Edition.

DEFINITIONS AND FORMULAE FOR STUDENTS—AERONAUTICS

By J. D. Frier, A.R.C.Sc., D.I.C.

Every student of aeronautical engineering and everyone connected with aeronautical practice will find this a most useful source of essential formulae and data. Pocket size. 36 pp. 6d.

BRITAIN'S AIR PERIL

By MAJOR C. C. TURNER, A.F.R.Ae.S.

A frank statement of Britain's air resources. This is a book of facts in which the author points out the dangers of disarmament in the air, common fallacies, the difficulties of internationalization of aircraft, and the problems of our defensive organization. Demy 8vo, cloth gilt, 144 pp. 5s. net.

CAPTAIN LIDDELL HART in the DAILY TELEGRAPH says: "This analysis should dispel the 'hot air' and produce a clearer atmosphere."

AIR NAVIGATION FOR THE PRIVATE OWNER

By FRANK A. SWOFFER, M.B.E.

Apart from its technical instruction, this course in aerial navigation contains many facts of general interest and practical value, etc. Crown 8vo, cloth gilt, 138 pp., illustrated. 7s. 6d. net. Revised Edition.

JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY: "It can be confidently put upon the list of recommended books on aviation."

AEROBATICS

By OLIVER STEWART, M.C., A.F.C.

Contains simple explanations of aerial evolutions, such as looping the loop, rolling, spinning, and the falling leaf, as well as many that have not hitherto been performed. Every airman should read this book. Crown 8vo, 86 pp., illustrated. 5s. net.

PARACHUTES FOR AIRMEN

By CHARLES DIXON.

Deals with the development of the parachute, its principles and theories, and gives full instructions for its care and use. Every airman should be acquainted with the information given in this book. Crown 8vo, cloth gilt, 132 pp., illustrated. 7s. 6d. net.

DAILY MAIL: "The book is an exceedingly interesting one even for those who are not technically concerned in flying, and is admirably illustrated."

AIR AND AVIATION LAW (Civil Aviation)

By WM. MARSHALL FREEMAN, *Barrister-at-Law.*

A useful reference book on the law relating to aviation; with extensive appendices of practical information. Demy 8vo, cloth gilt, 176 pp. 7s. 6d. net.

FLIGHT: "A valuable handbook on the subject for all who have any connection

AIRMANSHIP

By JOHN MCDONOUGH.

This book describes the construction and use of every part of the machine, and gives instructions for practical flying, training and overhauling. It forms a complete flying course for students, and includes details of the operation of aircraft on wheels, skis, and floats. Demy 8vo, cloth gilt, 128 pp., illustrated. 7s. 6d. net.

FLIGHT: "It is a really good book . . . thoroughly practical . . . there is a sufficiency of technical matter in it describing the theory of flight in a clear and concise, and what is more important, accurate manner."

THE BOOK OF THE AUTOGIRO C.19

By C. J. SANDERS and A. H. RAWSON.

This is a complete manual of information relating to the mechanical details, design, construction, and handling of the Autogiro, C.19. Crown 8vo, cloth gilt, 120 pp., illustrated. 5s. net.

FLIGHT: "Valuable as a guide to anyone interested in the why and wherefore of this type of flying machine."

AEROPLANES AND ENGINES (AIRSENSE)

By W. O. MANNING, F.R.Ae.S.

An excellent introductory manual for pilots, ground engineers, and students of aeronautics. The interesting manner in which it is written commends it to all readers who wish to obtain a good general knowledge of the theory of flight and the technicalities of flying. Demy 8vo, cloth, 94 pp. 3s. 6d. net. Second Edition.

MORNING POST: "An admirable introduction to aeronautics."

RAFTALES

By CHARLES B. BAKER. Illustrated by PING.

This irresistible collection of light-hearted verse will specially appeal to readers interested in the activities of the R.A.F. It describes some of the more exciting incidents in the lives of certain members of the Air Force in the East. Crown 8vo, 68 pp. 2s. net.

R.A.F. QUARTERLY: "All officers, N.C.O's, and airmen will find this little book of verse and illustrations a delightful companion."

co-operated to the fullest extent, although there was considerable opposition from the enemy, many of whose machines were piloted by Germans. Reconnaissances were constantly made of the Turkish dispositions and strength. Enemy batteries were pin-pointed and our artillery registered on them. Photographs were taken of gun-pits and trenches, and the whole basin of the Tigris as far as Baghdad, which enabled accurate maps to be prepared.

In order to make our position in Baghdad safe, it was necessary to establish outposts fanwise to the north. Our objectives were Mushahida on the Tigris, Falluja on the Euphrates and Baquba on the Diyala River, from which a column was pushed out to join hands with the Russians, who were moving down through Persia.

The work carried out by the air at this time was of the utmost importance in view of the tremendous distances the positions were apart. It was essential that the General Staff should be constantly supplied with reports of the enemy's movements at the earliest possible moment, in order that steps might be taken to counter them. It meant long and frequent reconnaissances, but the R.F.C. was not found wanting. On the 2nd of April Lieutenant-Colonel Tennant landed beside the advanced Russian cavalry and delivered despatches to the officer in command. It involved a five-hour flight, but it was another instance of the value of aircraft to an army operating in a vast country.

When the hot weather arrived the operations were brought to a standstill. There was some flying although the temperature sometimes stood as high as 122 degrees in the shade. Most of the work consisted of photography, the prints being needed in the compilation of maps.

Flying was reduced to a minimum in Mesopotamia by the sun, but it was rendered altogether impossible in East Africa by the rain. The rainy season was the wettest known for many years, and it was not until June 1917 that the R.F.C. was able to take any further active part in the campaign. The remaining operations were guerrilla warfare of the most trying kind. General von Lettow-Vorbeck eventually withdrew into Portuguese territory, leaving us in possession. No. 26 Squadron

continued to co-operate until the end, as did the R.N.A.S. unit on the coast.

There was considerably more air work on the Salonika front. On the 27th of February, 1917, the enemy made a bombing raid on Salonika with a formation of twenty machines. They were engaged by machines of both Nos. 17 and 47 Squadrons, and several were sent down.

As on the Western Front, the enemy were temporarily enjoying an aerial superiority. A composite fighting flight was organised to counter this. It consisted of four B.E.12's, two D.H.2's and four R.N.A.S. Sopwiths. An R.N.A.S. squadron was also installed at Amberkoj to conduct a counter-bombing offensive.

This Squadron, known as " F," experienced a most unfortunate accident at the end of May. A bomb exploded whilst being fitted under a machine in a hangar. Four men were killed and ten aircraft were completely destroyed.

Although most of the work in the air during 1917 was bombing and fighting, there was an opportunity for co-operation with ground troops in April. An offensive was launched in conjunction with our Allies, but it was not a success and was eventually abandoned.

In November No. 17 Kite Balloon Section prepared a booby-trap. They were continuously being attacked by enemy aircraft, so one day they filled the basket with a big charge of high explosives. In due course an enemy scout came swooping from the sky. As he drew near the charge was electrically detonated from the ground and sent the raider crashing to the earth. They had baited better than they knew, for he was von Eschwege, a star German pilot with a mounting record of victims. His machine was one of twenty enemy aeroplanes accounted for during the year.

The arrival of S.E.5a's, Bristol monoplanes and Sopwith Camels, in January 1918 assured us aerial supremacy for the remainder of the War. In January also, eight B.E.12's went to Mudros to assist the R.N.A.S. in bombing the German cruiser *Goeben* which was aground near Nagara. Several direct hits were scored on her before she managed to refloat and escape.

At the end of June 1917 General Allenby took over the command of the British Forces in Egypt, and at once

prepared to renew the offensive. The Turkish position now extended from Gaza to Beersheba, and consisted of a series of strong points some 2000 yards apart. The assault began on the 31st of October, and on the 7th of November the enemy's "impregnable" line was broken, and he was in full retreat. Jaffa, Ramleh and Lydda fell into our hands early in December, and we entered Jerusalem on the 9th.

During the summer lull in the operations the R.F.C. detachment had been reinforced by several new types of machines, which enabled them to maintain supremacy in the air. The enemy's positions were reconnoitred daily, and many photographs were taken which proved of the greatest service during the advance. There was also a considerable amount of artillery co-operation, and any bombing on the enemy's part induced immediate and heavy retaliation. The enemy consistently contended our superiority, and there were frequent aerial combats. But there were so many enemy machines damaged or destroyed in the first few days of the advance that our aircraft were practically unmolested during the important month of November. Seaplanes of the R.N.A.S., working from the carrier *City of Oxford*, spotted for H.M.S. *Raglan* in the early days of the operations.

January 1918 was quiet on the ground, but there was considerable activity in the air. Strategical reconnaissances were carried out far over the enemy's lines. Hostile aerodromes at El Afuleh and Jenin were bombed. Many fights took place, in which ten enemy planes were destroyed. After this until the end of March the enemy again avoided combat whenever possible.

The autumn offensive in Mesopotamia commenced on the 29th of September with a successful attack on Ramadi. British cavalry captured Mandali at the same time. Daur on the Tigris front was taken on the 2nd of October and Khaniqin on the Diyala on the 9th of December. By the end of the year we were at Ramadi on the Euphrates, Samarra on the Tigris and Khaniqin on the Diyala.

Strong reinforcements reached the Turks at Hit, which threatened a counter-movement. But as our troops moved forward the enemy withdrew to Khan Baghdadi. Throughout the retirement they were greatly harassed by

aircraft with machine-guns and bombs, which caused many casualties.

Khan Baghdadi was attacked on the 26th of March, and by the following day the Turks were completely defeated. Over two tons of bombs were dropped during the engagement, and many of the enemy were killed by machine-gun fire from the air.

Aircraft made a profound impression on the tribesmen of the North-West Frontier of India. In the first half of 1917 the Mahsuds were very restless, and on the 19th of May the Government sanctioned a punitive campaign against them. No. 31 Squadron supplied the air co-operation.

Several bombing raids were carried out in the neighbourhood of the Khaisara Valley, and the tribesmen were attacked with machine-gun fire. When peace was declared in August the Mahsuds admitted that the air raids were much dreaded.

A second squadron, No. 114, was formed at Lahore in September from a nucleus provided by No. 31 Squadron, but it was not until the spring of 1918 that there was any further active service. The interval was occupied with training.

The Marris unsuccessfully attacked Gumbaz Fort in February 1918, whilst the Khetran tribes followed in March by looting Barkhan. Once again the R.F.C. was extensively employed in bombing, clearly demonstrating the value of aircraft in such extremely difficult country.

We were destined to commence operations on yet another front before the end of the year. When the Allies agreed to send British and French reinforcements to Italy in October 1917, the 7th Brigade R.F.C. accompanied the British Force.

Flying Corps Headquarters was established at Altichiero and flying commenced on the 29th of November. Except that the ground was mountainous, very rugged and densely wooded, conditions were very much the same as in France. The work done was the ordinary routine of trench warfare. The enemy were well equipped with up-to-date aeroplanes and fighting was very intensive, although we quickly established a decided superiority.

Meanwhile the R.N.A.S. had been carrying on its work in the Eastern theatres of war with quiet persistency.

Its units were scattered far and wide engaged on a diversity of tasks. But there is no doubt that the results obtained were out of all proportion to the numerical strength of the force.

Perhaps the most astonishing achievement accomplished during 1917 was the bombing of Constantinople. A Handley Page was flown specially from England for the purpose, a distance of 2000 miles, which in those days was an outstanding feat in itself.

The actual raid took place on the night of the 9th of July. Bombs were dropped on shipping in Stenia Bay, including the *Goeben* and *Breslau* and the S.S. *General*, which was reputed to be German Headquarters. Two direct hits were also scored on the Turkish War Office, after which the machine returned to Mudros.

In January 1918 the *Goeben* and *Breslau* were sighted at sea off Kusu. They were continually harassed by relays of seaplanes from Imbros. The *Breslau* steered a zigzag course to escape them, and ran into a mine off Rabbit Island and sank. The *Goeben* succeeded in entering the Dardanelles Straits although she had a fifteen degrees list to port.

Although the operations on these several fronts have, of necessity, been given in the briefest detail, it can be readily grasped how greatly the Air Service helped in all the operations that were undertaken. When it is remembered how new the air weapon was when war broke out; how little was known about its tactical employment; that the majority of the pilots had to be trained, first to fly, and then to understand the technique of co-operating with the military; that depôts had to be established and maintained for all manner of spares and stores; something of the magnitude of the success will be appreciated. In all weathers, in every variety of climate, often over country where an engine failure meant certain death, the pilots of the Royal Flying Corps and the Royal Naval Air Service carried on with the spirit of determination to succeed which is the heritage of our race, and won for themselves a tradition and a record which will stand for all time.

CHAPTER NINE

THE RAIDERS HELD

SEARCHING for a submarine is rather like fishing. It requires infinite patience and continued vigilance. When at last the prey is located, a strike must be made at the psychological moment or it will be lost.

Finding a successful counter to submarine activities proved one of the most baffling problems of the War. Whilst a direct hit with a bomb or a single shell was sufficient to sink a submarine once it was caught above water and engaged in action, the difficulty was to get within a range at which the *coup de grâce* might be delivered.

Mention has already been made of the lighter-than-air Submarine Scouts, or " Blimps," which were introduced in 1915. The work they accomplished was excellent as far as it went. Whilst they had a performance which enabled them to patrol for long periods, they were readily seen at a distance, and their speed was not great enough for them to come up with their quarry before it had time to submerge. In any case they were not designed for offensive action, and such armament as they carried was intended for use in an emergency. They did, however, have the effect of forcing the U-boat commanders to keep under water, thereby considerably reducing their radius of action.

An improvement on the Blimps was the " C " type or coastal airship. Twenty-seven coastals were built in 1916 and distributed round the coast at various naval stations. In common with the Blimps they suffered from the defect that they were easily seen. Nevertheless the coastals and another type of Submarine Scout, known as the Zero, were very usefully employed in conjunction with the chain of direction-finding stations which had been established at different points. These

wireless stations, working in pairs, kept track of the scouting airships and were at once able to determine their position when a submarine was sighted. The enemy's location was reported immediately to the nearest patrol vessel for necessary action.

Experiments with airships were made during the summer of 1916 with the idea of using them for Fleet reconnaissances and gunnery spotting. It was discovered that the non-rigid airship could not only be readily towed under all conditions, but that it was possible to refuel it at sea. The airship was hauled down to within a 100 feet of the deck and a pipe was passed, through which petrol was forced by compressed air. The crew was also successfully changed by means of a boatswain's chair in which they were hoisted and lowered.

The use of airships for gunnery spotting was found to be impracticable. They provided such an easy target that they would not last very long in face of counter-action by the enemy.

But the success of the trials in towing and refuelling was very promising. The Fleet was still very anxious to have a system of aerial reconnaissance at least equal to the service rendered to the German Fleet by the Zeppelins. It was hoped that the rigid airship—of which No. 9 was nearing completion at Messrs. Vickers' works at Barrow—would supply the much-felt want. In the meantime it looked as though the coastals might be made to serve. At any rate they would prove of value in training personnel to man the rigids when they were ready. A flight by the C.20 on the 30th of September in co-operation with the Battle-Cruiser Fleet proved eminently satisfactory.

An ingenious suggestion had been mooted for attacking the German High Sea Fleet at its anchorage in the Schillig roads. Fast motor-boats carrying torpedoes were to be carried across the North Sea and launched against their objectives on a dawn tide. The necessary preliminary reconnaissance was to be made by an "America" flying boat from Harwich on the 29th of September. It was to alight on the water beside a cruiser of Commodore Tyrwhitt's force which was in position off the German coast. After refuelling it would make the reconnaissance and then refuel again for the

flight home. Unfortunately the weather proved too bad and the Commodore cancelled the operation although the " America " completed its first " hop."

The reconnaissance was attempted again on the 22nd of October with two Short seaplanes from the *Vindex.* Although everything went according to plan as far as the air was concerned, fog blotted out the German Fleet. No further reconnaissance was attempted and the motor-boat scheme was laid on one side.

One of the observers mentioned in his report that seventeen destroyers were on the move in two groups. These were on their way to Zeebrugge in connection with a series of raids which Admiral Scheer had decided to make on the guardships in the Dover Straits. The first sortie was made on the 26th with considerable success. Haze prevented much aerial activity for some days, but it lifted on the 1st of November when the destroyers were clearly visible both at Zeebrugge and Ostend.

As mentioned in the previous chapter it was at this time that Naval Squadron No. 8 was organised at Dunkirk for service on the Somme. The Squadron consisted of one flight of Nieuports, one of Sopwith two-seaters and one of Sopwith single-seater " Pups." They went to Vert Galand Aerodrome towards the end of October. The " Pups " proved so efficient in combating the German Jagdstaffeln that they were eventually provided for the whole Squadron.

This was not the only detachment of the Royal Naval Air Service that operated on the Western Front in 1916. The Admiralty had always been keen on long-distance bombing raids against naval and military stations in Germany. Arrangements were under way for the formation of a special wing to operate from Luxeuil in the Nancy area when the shortage of machines in the Royal Flying Corps was brought to the notice of the authorities by General Trenchard. The Admiralty were approached and at once handed over a number of Sopwith two-seaters which they had earmarked for their new venture. Although the intended operations were consequently curtailed, several raids were carried out in conjunction with the French.

The Mauser factory at Oberndorf was visited by fifteen naval and sixteen French bombers on the 12th of

October. They were escorted by a number of fighters and there were numerous combats. On the 23rd of October the Thyssen Works at Hagendingen were attacked. The steel works at Volklingen were raided on the 10th of November, the blast furnaces at St. Ingbert on the 12th and the iron works at Dillingen on the 24th of November and the 27th of December. There was much fighting on each occasion.

On the 9th of November the bombing offensive was renewed from Dunkirk against Ostend and Zeebrugge. One 500-lb. and nine 65-lb. bombs were dropped on the docks at Ostend and eighteen 65-lb. bombs about the Zeebrugge Mole. On the following day seventy-five le Pecq, thirty-nine 65-lb. and thirty-four 16-lb. bombs were dropped on Ostend. Other raids were carried out on the 12th, 15th and 17th and again on the 29th. Although there was considerable anti-aircraft fire there were few aerial combats. Much material damage was done, but the moral effect was even greater. One of the enemy destroyer flotillas was shortly afterwards returned to Wilhelmshaven.

The 27th of November saw another Zeppelin raid. Ten naval airships, including two super-Zeppelins, set out for the north of England. One had to turn back with engine trouble. The others approached in two groups. The more northern consisted of four airships, but only one dropped any bombs. Sixteen high explosives had fallen from the L.34 on West Hartlepool when she was met by Second Lieutenant I. V. Pyott on patrol from Seaton Carew. He immediately attacked and brought her down in flames at the mouth of the Tees. Her four companions at once turned tail and returned home.

Four Zeppelins of the southern group dropped bombs. Very little damage was done and the total casualties were two people wounded. The L.22 was hit with shrapnel over Howden and only just managed to get home. The L.21 was destroyed over the sea east of Lowestoft. She had been as far west as Macclesfield, but ran into three naval pilots on the return journey. Flight Lieutenant Cadbury fired at her without immediate effect. Flight Sub-Lieutenant Fane was about to attack when his gun jammed. Flight Sub-Lieutenant Pulling had only fired two rounds when his gun jammed also.

But either his bullets or those of Flight Lieutenant Cadbury set her ablaze. She fell into the sea and disappeared with all hands.

The following day saw the first raid on London by a heavier-than-air machine. An L.V.G. arrived over the West End just before midday and dropped six 20-lb. bombs between Brompton Road and Victoria Station. There was a haze at the time and the machine, flying high, had not been recognised as an enemy. On the return journey the pilot was obliged to forced land at Boulogne with engine trouble, and was taken prisoner. This seemingly haphazard flight was the herald of the Germans' attempt to recoup from the defeat of their Zeppelins.

A new division of the naval staff known as the Anti-Submarine Division came into being on the 18th of December, following important changes in the Board of Admiralty. It immediately co-ordinated the various counter-measures which were in operation against the blockade, and organised them to the best advantage. Seaplane bases were provided at Cattewater, Plymouth, and Newlyn, Land's End, and later at Fishguard. A shed was also provided at Mullion for airships. These stations were in addition to those already working on the east coast and were made necessary by the increasing boldness of enemy submarines, which were now operating throughout the English Channel.

Definite areas of search were allotted to all aircraft going on patrol. In this way the work was systematised, so that it became more thorough, and the possibility of duplication by two neighbouring stations was eliminated.

In February 1917 the Germans declared " unrestricted submarine warfare," which meant that vessels would be sunk on sight without warning. It was a challenge which caused us to put forth every effort. The U-boats must not only be held. They must be beaten. If they succeeded in their blockade, the nation would be brought to the verge of starvation and must inevitably surrender.

It was in this period of stress that the flying boat came into its own. Its successful development must be credited to Commander J. C. Porte. He was experimenting with flying boats before the War. Throughout the War he continued to experiment and to improve. The

result was that he supplied his country with an ideal weapon for use against the submarines at a time it was most needed. Like lighter-than-air craft, the flying boat had a large radius of action. But it was infinitely superior on account of its greater speed and manœuvrability. Flying boats also provided a set-off against Zeppelins in that they could be flown over the North Sea to attack them on their own coasts.

An opportunity occurred during this same month for the Dunkirk Base to strike a blow against the enemy's raiding vessels in harbour. Photographs taken of Ostend, Zeebrugge and Bruges revealed that nineteen destroyers and three submarines were frozen in. Bombing attacks were commenced on the 3rd of the month and continued until the 16th. Considerable damage was done.

February also saw the first airship of the year cross the Kentish coast. On the night of the 16th the L.Z.107 passed over Deal and Ramsgate, but dropped no bombs. She had previously raided Calais, and in all probability her flight over the Channel was not intended as an attack.

The first real attack came a month later. Four Zeppelins dropped seventy-nine bombs in Kent and Sussex on the 16th of March, but did very little damage. Thick clouds impeded both attackers and defenders. The wind was also blowing very strongly and the airships were forced to return home over land. The L.39 was caught in an anti-aircraft barrage over the French lines at Compiegne and shot down in flames.

It will be remembered that the German attempt to secure the supremacy of the air was rapidly increasing in intensity on the British Army front. Once again the R.N.A.S. were called on to assist the R.F.C. In February and March, by splitting up the various squadrons, no less than four complete units were provided as reinforcements for General Trenchard. No. 3 Naval Squadron relieved No. 8 Naval Squadron at Vert Galand. No. 8 returned to St. Pol, and was split into two. Later, equipped with Sopwith Triplanes, it went to Auchel (Lozinghem). No. 1 Naval Squadron went to Chipilly and No. 6 Naval Squadron to La Bellevue.

The provision of these units brought about a shortage of flying personnel. The bombing Wing at Luxeuil was consequently disbanded to help make good the deficiency.

A new Naval Squadron, No. 10, was formed with a nucleus of the disbanded pilots and went to join the Second Brigade R.F.C. on the 15th of May. A month later on the 15th of June, No. 9 Naval Squadron relieved No. 3 Naval Squadron at Flez.

About this time the Short bombing planes were replaced by Handley Pages. At first they were employed on day work, but later they were restricted to night bombing. The Sopwiths also gradually gave way to de Havilland 4's which, engined with 250-h.p. Rolls-Royce, could climb over 20,000 feet fully loaded.

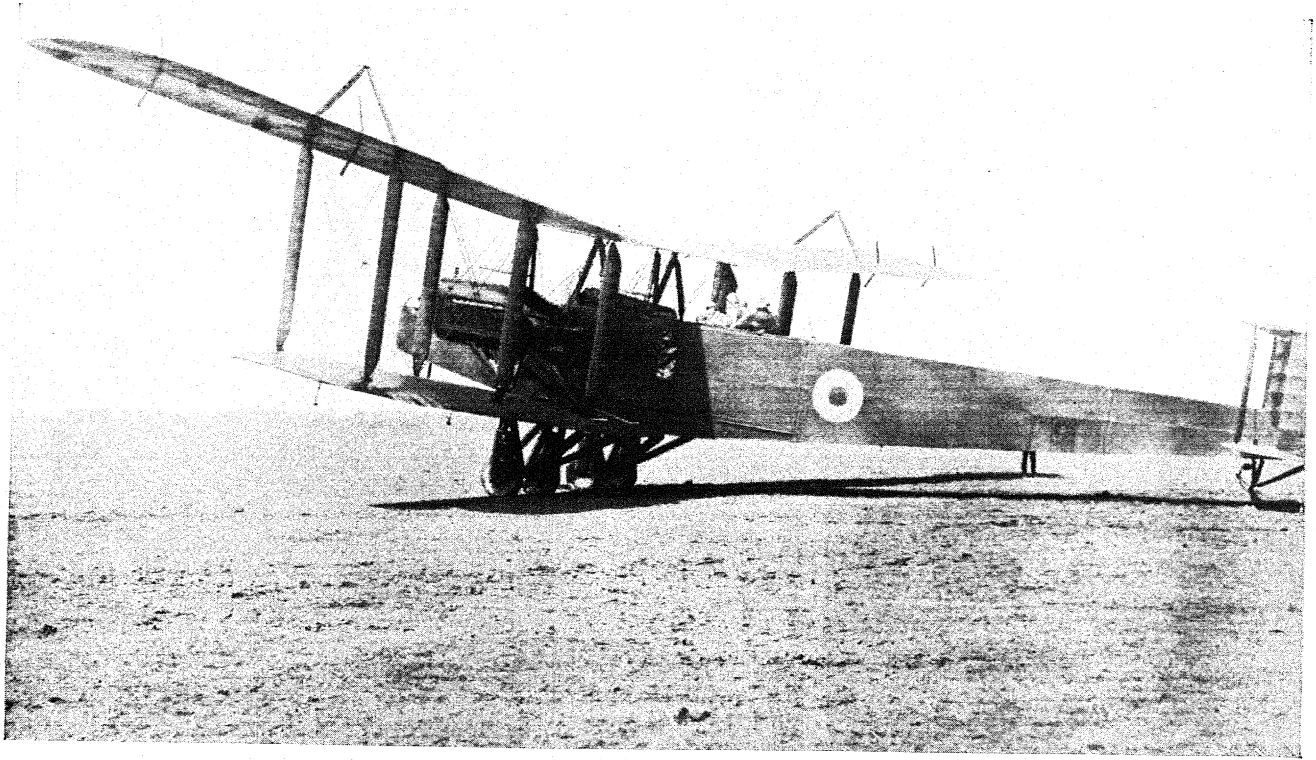
Many bombing expeditions were carried out during the year. As the Handley Page pilots became more experienced in night flying, raids were conducted nightly except in adverse weather. It was discovered that, as a result, destroyers at Zeebrugge were taken outside the Mole at night and anchored in the open sea. On the 7th of April aircraft bombed them from above whilst motor-boats attacked them on sea. One was sunk and another severely damaged.

On the 19th of April German seaplanes replied with a torpedo attack off Ramsgate and the Downs, but without result. The enemy was more successful on the 1st of May when two seaplanes torpedoed the S.S. *Gena* off Lowestoft. Before she sank she succeeded in shooting one of her attackers down.

These attacks and the activities of the German destroyer flotilla from Zeebrugge, which had bombarded Ramsgate, Broadstairs and Dover, called for retaliation. On the 12th of May three monitors with an escort took up positions off Zeebrugge and opened fire at a range of 26,200 yards. The target was the lock-gates of the canal through which destroyers and submarines passed to the inland port of Bruges.

An aeroplane from St. Pol spotted from a height of 14,500. Many attempts were made on it by hostile aircraft, but they were kept off by an escort of fighters. Photographs taken afterwards showed that the lock and gates were slightly damaged. The coastal batteries were prevented from making an effective reply by a smoke-screen.

Whilst the Dunkirk Station continued to keep a close watch on the Flanders submarine bases, the coastal



By the courtesy of "Flight"

HANDLEY PAGE 0/400
The forerunner of a long line of famous night bombers.

stations at home maintained a daily search which extended far and wide across the sea. Every piece of floating wreckage was vigorously scrutinised lest it be a camouflaged periscope. Every shadow cast by a passing cloud was suspect for an oil patch.

The flying boats from Felixstowe scouted over an area some sixty miles in diameter, the centre of which was the North Hinder Light Vessel. An imaginary octagonal figure comprising eight sectors was evolved which enabled many different combinations of patrols to be carried out. Four thousand square miles of sea were regularly searched in the direct path of submarines proceeding to and from Zeebrugge and Ostend. This sphere of action was popularly known as the " Spider's Web." It was put into operation on the 13th of April and many " flies " learned to appreciate the danger of it.

It was between the 17th and 27th of April that the submarine campaign reached its greatest intensity. The Admiralty had reason to believe that over 50 per cent of U-boats were on active service as opposed to a normal of 33 per cent. Our average loss of ships for the month was five per day against a yearly average of three per day. Up to the beginning of this campaign the daily average had been less than one per day. On the 19th of April eleven British merchant ships were sunk by submarines and two by mines.

Within the first fortnight of its inauguration the " Spider's Web " patrol sighted eight enemy submarines, three of which were bombed. On the 20th of May it had its first victory. An " America " flying boat bombed and sank the U.C.36 some miles east of the North Hinder. It was a particularly auspicious omen, as it was the very first occasion that a seaplane destroyed an enemy submarine.

As was to be expected, the enemy did not allow the flying boats to carry out their work unhindered. Fighting seaplanes were sent out to engage them and several aerial combats resulted, but without decisive results.

Just before dawn on the 24th of May an " America " flying boat was despatched to Terschelling to intercept Zeppelins which had been on a raid to England. Six naval airships visited the Eastern Counties on the night of the 23rd. One of them penetrated towards London as

far as Braintree. The others remained near the coast or did not cross it. Several bombs were dropped, but with little result. There was considerable mist and cloud, and no aeroplane succeeded in getting near them. The flying boat sighted one of them on the return journey, but it was lost in the clouds before they could close with it. Petrol was running short and the pilot was reluctantly compelled to turn for home.

The flying boat was piloted by Flight Lieutenant C. J. Galpin and Flight Sub-Lieutenant R. Leckie, and had already achieved fame ten days earlier under the control of the same pilots. They found a Zeppelin, L.22, on a reconnaissance patrol near the Terschelling Lightship shortly after dawn on the 14th of May. The flying boat dived on her from behind and despatched her to the sea in flames.

On the afternoon of the 25th of May the first daylight raid was made against England by twenty-three Gotha bombing planes. Flying in small groups at heights ranging from 12,000 to 17,000 feet, they reached the Thames in the neighbourhood of Gravesend. Instead of continuing on to London they turned south-east and dropped 159 bombs on Kent weighing some three and a half tons. Ninety-five people were killed and 192 injured. Most of the pilots who went up to engage them failed to reach their altitude.

The Gothas came again on the 5th of June. This time they confined their attack to the vicinity of Sheerness and Shoeburyness. Thirteen people were killed and thirty-four injured, but one Gotha was brought down by anti-aircraft fire.

Had their raid taken place in the morning instead of the evening the Gothas would have passed over a detachment of our vessels returning from Ostend. Just after dawn an attempt was made to repeat the success of the 12th of May by shelling the canal gates and submarine repair workshops at Ostend. One hundred and fifteen rounds were fired before a smoke-screen was put up on shore which obscured the targets. On this occasion the air observer was unmolested in his work. Two of the eight principal workshops were destroyed and three were damaged, as were also the lock-gates. The floating docks inside the basin were unfortunately untouched.

London was bombed on the 13th. Twenty machines flew at a height of 12,000 feet. One hundred and twenty-six bombs were dropped, of which more than one-half were released within a mile radius of Liverpool Street Station. The raiders were continuously attacked both by anti-aircraft guns and aeroplanes, but they maintained their solid formation inviolate.

In consequence of this successful attack, in which 162 Londoners were killed and 432 injured, two fighting squadrons were detached from the Expeditionary Force for Home Defence. No. 66 Squadron (Sopwith " Pups ") was moved to Calais to intercept the raiders on their outward and homeward journeys, and No. 56 Squadron (S.E.5's) crossed to Bekesbourne.

But if we had still to find a means of stopping the Gothas, we now had the full measure of the Zeppelins. Four of them started from Germany on the 17th of June. Two turned back before they reached the coast. Of the others the L.42 inflicted considerable damage on Ramsgate and got clean away. The L.48, however, was not so lucky. She evidently intended to attack Harwich, but the anti-aircraft fire turned her north. Second Lieutenant L. P. Watkins engaged her at 13,200 feet and brought her down in flames near Theberton. She had on board Korvettankapitän Schutze, the Commodore of the North Sea Airship Division.

Three days before, on the 14th of June, the L.43 was destroyed by a flying boat from Felixstowe piloted by Flight Sub-Lieutenant B. D. Hobbs and Flight Sub-Lieutenant R. F. L. Dickey. The flying boat had set out to search for hostile airships in consequence of intercepted wireless signals. She sighted the L.43 at a height of about 1500 feet off Vlieland. Flight Sub-Lieutenant Hobbs who was at the controls dived on the quarry at a speed of 100 knots whilst fire was opened on her with tracer bullets. In a few seconds she was in flames.

It was probably because of this success that the next daylight raid of the Gothas was directed at Felixstowe. At seven o'clock in the morning of the 4th of July they crossed the coast at Shingle Street and dropped bombs on the naval air station at Felixstowe. Only one machine in England succeeded in engaging them, but they were

intercepted on the return journey by a formation of five Sopwith " Pups " from Dunkirk, and two of them were shot down.

Three days later twenty-two of them again attacked London. Seventy-two bombs were dropped in the Metropolitan area, killing 57 people and injuring 193. Although about a hundred machines of all types attempted to stop them, they maintained their formation unbroken until their work was done. On the return journey, however, five of them were sent down. From their experiences, the Germans decided that our defences were becoming too efficient for them to venture by day unless at altitudes above 17,000 feet. As a consequence, this was the last daylight raid attempted against London.

On the 22nd of July sixteen Gothas again attacked Harwich. Fifty-five bombs were dropped, killing thirteen and injuring twenty-six. The Home Defence were again powerless to stop them, but one was destroyed by a Bristol fighter off Ostend whilst they were on their way home.

Our Air Service had its revenge on the U-boats. On the 12th of July the U.69 was observed from a balloon being towed by H.M.S. *Patriot*, with the result that the submarine was destroyed. On the 24th a flight of five flying boats sighted the U.C.1 and dropped bombs on it with satisfactory results. Five days later a flying boat from Felixstowe bombed the U.B.20 and damaged her so that she could not submerge. She was sunk shortly afterwards by another flying boat which dropped two 100-lb. bombs.

Kite balloons were now extensively used throughout the Fleet. In addition to gunnery spotting and Fleet reconnaissance, their great range of vision made them eminently suitable for submarine hunting. Bases were formed at suitable points round the coast where the balloons were inflated before proceeding to sea on the towing ships.

Owing to the intensity of the submarine blockade all merchant shipping now sailed in convoys protected by a suitable escort. Balloons were of great service in keeping a look-out for submarines, whilst airships were found to be superior to aeroplanes as general scouts. They had a greater endurance and their slower speed

rendered it easy for them to keep down to the pace at which the convoy moved. It was the practice for each airship to escort its convoy to the limit of its station patrol area and then hand over to another airship from the neighbouring station.

The time any particular airship could remain in flight was naturally limited by the weight of petrol it was able to carry. The Coastals and Blimps had a comparatively low endurance and were never able to venture very far from their bases. To fill the need for more protracted patrols a new type of airship was designed known as the "North Sea." The envelope had a capacity of 360,000 cubic feet and she was driven by two 250-h.p. Rolls-Royce engines and carried petrol for a twenty-hours' flight.

This class of ship was useful both for escort duties and for submarine patrolling. When out of sight of land they obtained their position once every hour by wireless. This had its disadvantages in that it was picked up by the enemy as well as our wireless stations and exposed the airships to attack by enemy seaplanes.

Whilst the submarine blockade was being steadily fought at sea, an effort was made on land to break through the enemy's defences and clear the Flanders coast. If the bases at Zeebrugge, Ostend and Bruges could be captured, the activities of the U-boats would be considerably restricted. The Army operations in 1917 were directed to this end. The Royal Naval Air Force at Dunkirk and its satellite aerodromes assisted by directing an intensive bombing campaign against enemy aerodromes, railway junctions and stations, factories and other targets. At the same time hostile aircraft were sought out and destroyed by the fighters.

A formation of nine Gothas bombed Southend on the 12th of August. Thirty-two people were killed and forty-six injured, whilst one Gotha was brought down. A big raid which was to have taken place on the 18th was defeated by strong head winds. The formation, which consisted of twenty-eight machines, was forced to turn back when half-way across the Channel, and many machines were wrecked.

The final daylight raid on England was made on the 22nd by ten Gothas. Fifty bombs were dropped between Margate and Dover, killing twelve and injuring twenty-

five. Throughout the raid the enemy were energetically attacked, whilst the anti-aircraft fire was continuous. Two enemy machines were struck by shells and one was shot down by Flight Sub-Lieutenant J. Drake.

Because our successes against them in earlier raids had mostly been scored on the return journey, the Germans sent out several formations of fighters to escort the Gothas as they approached the Belgian coast. Two flights of five Sopwith Scouts which had gone up from Dunkirk to intercept the bombers encountered a total of some twenty-five machines. Several were shot down without loss on our side.

On the previous day a Zeppelin was brought down off the Danish coast under somewhat novel conditions. Aeroplanes had been successfully flown from the deck of an aircraft-carrier in the previous year. But the converted vessels used as carriers suffered from the disadvantage that they could not keep up with the Fleet at speed. The increasing confidence in aircraft and the necessity for adequate reconnaissance brought it home to the Higher Command that means must be provided for the Fleet scouts to carry their own machines. By way of experiment the light cruiser H.M.S. *Yarmouth* was fitted with a flying platform on her forward deck.

H.M.S. *Yarmouth* was with the Light Cruiser Squadron off Lyngvig on the 21st of August when the Zeppelin L.23 was sighted. For about an hour she kept parallel to the Squadron and then orders were issued for the aeroplane to be flown from the *Yarmouth*. Flight Sub-Lieutenant B. A. Smart " took off " in a Sopwith " Pup," climbed to 1500 feet above his quarry and dived on her steeply from astern. A few bursts from his Lewis gun set her on fire and she crashed into the sea.

This success was the more satisfactory as the Zeppelin crews had been extremely wary since the destruction of two of their number by flying boats earlier in the year. The Zeppelins could rapidly outclimb the flying boats and unless caught unawares would ascend to altitudes beyond the relatively heavier flying boats' capabilities. To overcome this evasiveness a scheme was evolved whereby a D.H.4 would work in conjunction with a flying boat. When the Zeppelin ascended to avoid attack by the flying boat it would unsuspectingly present itself

as a target for the aeroplane waiting at a much higher altitude.

These tactics were tried on the 5th of September. An "America" flying boat on patrol with a D.H.4 in the Terschelling area sighted the Zeppelin L.44 at a height of about 10,000 feet. The flying boat attacked at its greatest altitude, which was 12,000 feet, with the Zeppelin climbing rapidly out of range. Unfortunately, owing to engine trouble, the D.H.4 could not rise above 14,000 feet and the attack was a failure.

The engine of the D.H.4 failed altogether on the homeward journey. It forced landed on the sea and immediately sank. The flying boat alighted and picked up the pilot and his observer. The flying boat had been slightly damaged by anti-aircraft fire during the attack and could not be got off the sea again with its extra load. The pilot started to taxi for shore, but ran out of petrol. For five days and nights the six men drifted helplessly, continuously bailing, until they were eventually rescued by H.M.S. *Halcyon*.

A few days earlier, on the 2nd of September, the Gothas renewed their attacks. This time they came by night, two machines dropping fourteen bombs on Dover at eleven o'clock. One man was killed and six were injured. The following night ten machines attacked Chatham, Margate and Sheerness. Two days later twenty-six machines attacked London and the Home Counties. Nineteen people were killed and seventy-one injured.

The Germans had developed a new frightfulness and our defence organisation was presented with an extremely knotty problem. It had been difficult enough to pick up Zeppelins with searchlights; it was infinitely more so with the Gothas, since they were no more than specks at the height at which they flew. Even when found they provided so small a target that a direct hit by an anti-aircraft shell must be more luck than judgment. The number of batteries must be increased to make the barrage more intensive and greater reliance must be placed in fighting aircraft.

Up to this time combats between aeroplanes at night had been considered an impossibility. All night flying was done with machines specially designed for stability.

Now, since they were our only hope, single-seater day fighters were tried at night. The experiment was made by three pilots of No. 44 Squadron and proved a success. Thereafter all day-fighting pilots flew at night.

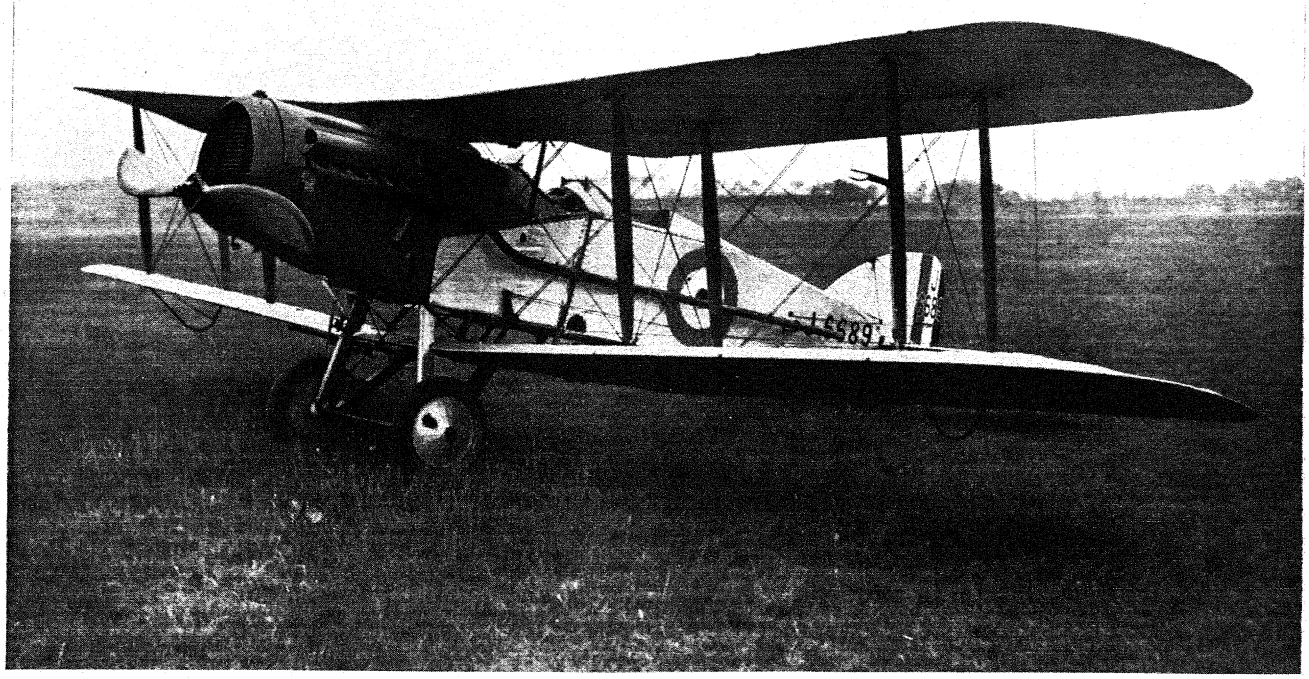
Another innovation was the establishment of a balloon apron round London 8000 feet from the ground. It consisted of a number of steel cables suspended between kite balloons, and it was intended to force raiders to keep above it where night-flying patrols were waiting for them.

On the 22nd of September another expedition set out to shell Ostend. With its fire controlled by an aeroplane, the monitor *Terror* made three direct hits on the dockyard. One of the floating docks in the basin was sunk and the other damaged. Three hostile aircraft which came out to spot for the Tirpitz and other shore batteries were destroyed by an offensive patrol of No. 4 Squadron.

Another success was scored by a flying boat from Felixstowe on the 28th. Wireless interception reported a submarine off the North Hinder Lightship. An "America" flying boat piloted by Flight Lieutenant B. D. Hobbs and Flight Sub-Lieutenant R. F. L. Dickey came across her and dived to the attack. One 250-lb. bomb was dropped which hit the tail of the submarine. The flying boat was attacked by three other enemy submarines and three enemy destroyers, but succeeded in dropping another 250-lb. bomb which effectively dealt with their prey.

The next night air raid against England took place on the 24th of September by twenty-one machines. Only three got to London, the remainder unloading on Kent; Dover being the chief victim. There was a Zeppelin raid by ten airships on the same night, but very little damage was done.

On the following night a raid was made by ten Gothas on Kent and London. Then there was a two days' interval followed by four raids on successive nights. The first was upset by heavy clouds and most of the enemy machines returned home without dropping their bombs. On the second, four machines reached London and another four nearly did. Our anti-aircraft barrage was increasing and most of the others turned back. The raiders were now compelled to keep to a height of 14,000 feet and upwards. The third raid involved London,



By the courtesy of "Flight"

BRISTOL FIGHTER

Assisted considerably in restoring British aerial supremacy in 1917.

Chatham, Margate and Dover. Several of our defending machines caught sight of the enemy, but none was brought down. On the fourth raid only a few machines succeeded in reaching London out of the eighteen which tried to do so.

Simultaneously with this intensive concentration on London, a series of raids was made against Dunkirk. The Royal Naval Air Service Depot was seriously damaged and a number of aeroplanes and other stores were destroyed.

Naval aircraft retaliated in no uncertain manner. Nearly eight tons of bombs were dropped on the aerodrome at St. Denis Westrem between the 27th of September and the 1st of October. As a result the enemy abandoned his aerodrome and moved to another one. Attacks were made on other objectives as well. Patrols were also made to try to intercept the raiders returning from England.

Another Zeppelin raid on the 19th of October was defeated by the elements. Thirteen and a half tons of bombs were dropped, killing thirty-six people and injuring fifty-five. Forced by anti-aircraft fire and aeroplane attacks to operate at a great height, the airships got caught in a fierce northerly gale in the upper regions. Four of the eleven were carried southward, where three were destroyed and one was forced down and captured by the French.

Ten days later the Gothas came again, but made off when they encountered bad weather. They returned on the 31st, twenty-four strong, by way of the mouth of the Thames. Some of them got to London, but our defences were now stiffening, our aircraft were becoming ever more persistent and assured. Although bombs continued to be dropped and people continued to be killed, the force of the raids was lessening. The raiders, flying at high altitudes and exposed to incessant bombardment and attack, were finding their task almost too much for them.

There were three more raids before the end of the year —on the 6th, 18th and 22nd of December. The principal feature which distinguished them from earlier attempts was the introduction of Giant aeroplanes, each with five engines and capable of lifting enormous loads. The Gothas flying light acted as escorts.

The Giants were used considerably at the beginning of 1918. A raid on the 25th of January was rendered abortive by fog. Three days later three Giants reached England accompanied by ten Gothas. One of the Gothas was brought down in flames by two pilots of No. 44 Squadron flying "Camels." This was the first machine to be destroyed in combat by night-flying pilots, and it put a period to the reign of the raiders just as Leefe Robinson's performance had marked the beginning of the defeat of the Zeppelins.

On the following night two Giants reached London, but were forced to turn for home when attacked by aeroplanes of the defence squadrons. After an interval of a month three Giants tried again, but only one got through. The others were driven off. One came back the night after and dropped five 112-lb. bombs on the Midland Grand Hotel at St. Pancras Station. The next attempt was on the 7th of March by five Giants. In relation to the weight of projectiles carried the damage was small. The anti-aircraft barrage proved too hot for the enemy's strength of purpose.

The autumn of 1917 saw considerable strides made in air co-operation with the Fleet. A single-seater Sopwith "Pup" was successfully flown off a specially constructed platform built on a light cruiser. This opened up a new field of experiment. Seaplanes had not been found satisfactory owing to the difficulty of "taking off" during a heavy swell in mid-ocean. It looked as though the change to a land machine with wheels had solved the problem.

At first there was the serious objection that battleships would have to draw out of the line, when they wished to despatch an air scout, so that the aeroplane could be headed into wind. This difficulty was also overcome. On battle-cruisers the platforms were erected on the forward turrets and could be adjusted to the required angle. The first was fitted on H.M.S. *Repulse* towards the end of the year. In the early part of 1918 nine battle-cruisers were equipped with two aeroplanes each—a single-seater on the forward turret and a two-seater on the after turret.

Another triumph was the discovery that aeroplanes could be landed on suitably designed craft at sea.

Squadron Commander Dunning alighted on the deck of H.M.S. *Furious*, a light cruiser converted to a carrier, on the 2nd of August. Unfortunately he was killed when making a second attempt five days later, but he had proved that it could be done. Thereafter, it was merely a question of improved technique and detail. The *Argus*, another big carrier, was launched on the 2nd of August, 1917.

Next time the Fleet went into action, it would not be handicapped by the absence of efficient aerial reconnaissance.

CHAPTER TEN

THE STRUGGLE FOR AIR SUPREMACY

MANY lessons were learned by all arms during the five months' struggle on the Somme. Perhaps the most important was the vital necessity for co-operation. The infantry could not advance unless the artillery smashed the barbed-wire entanglements in front of the enemy position, and prevented the enemy infantry from manning their trenches whilst our troops crossed no-man's-land. The gunners could not be sure that their fire was effective unless it was observed and corrected from the air. Airmen could report battery positions and concentrations of enemy troops, but the ground forces fought the actual battle. It was brought home forcibly on many occasions that success was directly dependent on the degree of joint operation attained.

The artillery had evolved the creeping barrage, which enabled the infantry to attack with the minimum of casualties. It went before the advancing troops like a wall, paralysing the enemy until the last moment before the assault, when it lifted with an uncanny precision to form a protective curtain. At a specified time in the programme of operations it would move forward again to the second objective. If from any unforeseen cause the advance was held up it would leave the infantry unsupported at the very time they needed it most.

That was where the contact patrols came in. By observing what was taking place on the ground, they kept the Staff informed of the exact situation and so enabled fire to be concentrated at those points where resistance was maintained.

Contact patrols had proved invaluable over and over again. It was not only that they enabled the Command to keep a grip on their men such as they had never had in the days before air co-operation was available. But

by bombing machine-gun nests and strong points and using their machine-guns against groups of the enemy massing for counter-attack or coming forward from reserve, pilots contributed directly to the success of the engagement.

Experience pointed to one or two minor changes of policy. Wireless was confined to the reporting of artillery targets directly connected with infantry work—troops on the move, trench-mortar batteries, stubborn strong points, etc. Other communications were made by messages dropped at prepared points. In future the infantry would show their positions, when called upon to do so, solely by lighting flares. Other devices had proved unreliable. Signalling from the ground was by signal-panel or flash-lamp, localities being referred to on a clock code with the sender as the centre of the dial and the twelfth hour pointing to the north.

The system of co-operation between aircraft and artillery was changed very little. Such improvements as were made were the outcome of experience. Training and practice, together with a more concise code of signals, made it possible for one wireless plane to operate on every 1000 yards of front, without clashing and interference of signals, instead of one for every 2000 yards as heretofore. Wireless sections were also better organised, thus obviating break-downs. Proposals were put forward from the Army that R.F.C. squadrons engaged on artillery co-operation should be directly commanded by Corps Artillery commanders. General Trenchard opposed the suggestion on the grounds that the actual work of observation required very little knowledge of gunnery, and the technical details with which a pilot must be conversant, such as aerial fighting, photography, etc., could be controlled more satisfactorily by the Flying Corps than the Army. Many discussions took place on the subject before it was finally decided by the Commander-in-Chief that the artillery machines must remain in the R.F.C.

Fighting tactics were the source of the greatest concern. The enemy had shown in the last few weeks of the Somme battle that he intended seriously to dispute the freedom with which our Corps aeroplanes had gone about their business. Whilst General Trenchard unswervingly upheld

his policy of protecting his working machines by sending fighters to seek out the enemy as far behind his own lines as possible, he had not yet the reinforcements to dominate the situation.

Just as the advent of the Fokker, a year earlier, had forced the adoption of formation flying, so the present temporary superiority of the German fighters compelled that our offensive patrols should now fight in units of two or three aeroplanes instead of singly. Hitherto, although pilots had flown in formation whilst patrolling the area for which they were responsible, the practice on meeting an enemy formation had been for each individual to pick out an opponent and engage him in single combat. From now on units of two or three aeroplanes were to be trained to fight as one, under a formation leader. In this way it would be possible for pilots mutually to support one another and at the same time to execute a combined attack against such foes as the leader selected. Not the least advantage of such united action was the confidence engendered in the members of the unit by working together, and the moral effect on an enemy pilot face to face with three opponents simultaneously. Whilst three aeroplanes were considered the limit in numbers that a formation leader could effectively handle, where greater strength was required, several of such units could be grouped into a larger organisation.

Whilst this new system was in its infancy hard-and-fast rules were not laid down for the tactical employment of units in action. Each squadron commander and formation leader was given the opportunity to use his discretion and initiative. Nor was it forbidden for pilots to continue to patrol singly with the approval of the squadron commander in those cases where individuals, by their skill in manœuvre and fire control, had shown themselves to be superior to the best of the German fighters.

Although the engagement on the Somme took precedence of all other British operations on the Western Front during 1916, the work of the armies in Flanders was not without importance. Their principal task was to pin as many enemy divisions as possible to their positions to prevent reinforcements being moved south to the help of the German First Army. This was accomplished by a series of minor attacks which were made continuously at

different places so that the enemy would be kept constantly alert.

The Royal Flying Corps had a very important rôle to fulfil. In addition to co-operation with the attacking infantry on similar lines to those practised on the Somme, it was important that the Germans should be kept in ignorance of the reserves, or lack of them, which we had available to follow up any successful advance. Squadrons were also continually employed in bombing the enemy's back areas and lines of communication, particularly the railways, to harass movements of troops and munitions to the more important Somme front.

Until the middle of October most of the bombing raids were carried out without serious interference other than anti-aircraft gun fire. But, following on the reorganisation of the German Air Service in the middle of October, several enemy air units were withdrawn from the Somme to reinforce other sectors. Thereafter resistance stiffened and all operations behind the enemy lines were fiercely opposed. Our pilots were, however, more than able to hold their own, since the enemy machines were mostly Rolands and Fokkers, and not the Halberstadts and Albatrosses in use down south.

Towards the end of 1916 a conference was held at Chantilly between the Commanders-in-Chief of the British and French Armies and representatives of our other Allies to discuss plans for the exploiting of our success in the coming spring. It was definitely decided that the Germans must not be allowed to take the initiative as they had done at Verdun in the early part of the year. To prevent this, pressure must be steadily maintained during the winter, until it was possible for the offensive to be renewed on a large scale.

February was the month chosen for the next big effort. The British were to attack on each side of the prominent enemy salient between the Rivers Scarpe and Ancre, whilst the French attacked between the Rivers Somme and Oise. A fortnight later the main French offensive was to commence in the neighbourhood of the River Aisne.

Sir Douglas Haig had another task to undertake which was of vital importance. The intensified submarine campaign, launched by the Germans in October, was causing the utmost uneasiness at home. Shipping was

being sunk at the appalling average rate of three vessels a day. The Admiralty represented that to cope successfully with the menace the enemy must be relieved of his submarine bases at Ostend, Zeebrugge and the inland port of Bruges. The Authorities consequently decided that the main British offensive must be aimed at clearing the coast of Flanders. In pursuance of this policy, Sir Douglas Haig prepared to make his principal attack in the north immediately following the spring campaign at Arras.

Politics were responsible for upsetting all the arrangements. Following on the reorganisation of the French Government in December 1916, General Nivelle was appointed Commander-in-Chief of the French Army in succession to General Joffre. General Nivelle had his own ideas on how the campaign should be conducted. He did not believe in the system of a steady advance from objective to objective such as we had successfully employed on the Somme. Instead, he advocated a single overwhelming blow which would break through the entire German defence and enable him to manœuvre a reserve army in the open country beyond.

He chose the Aisne as the region where his assault was to be made, but he needed an immense concentration of troops for his effort. To obtain these he suggested that the British should extend their line southwards to the Oise. Sir Douglas Haig could not see his way to agree to so great an increase, but promised to stretch as far as the Amiens–Villers–Bretonneux cross-roads. General Nivelle appealed to his Government, who made representations to the British War Cabinet. A conference was held in London and Sir Douglas Haig was instructed to take over the French line as far as the Roye–Amiens road. Later he was informed that he must place himself under General Nivelle's command for the forthcoming operations until such time as the French offensive terminated.

By the 26th of February, 1917, the British were holding 110 miles of line. In order to confine as many of the enemy as possible to their positions when the French offensive opened, plans were prepared for the Fifth Army to attack on the Ancre, the Third Army at Arras and the First Army at Vimy Ridge. But, as in 1916, before the Allies could put their ideas into execution, the Germans forestalled them.

By the courtesy of "Flight"

R.E.8
Followed the B.E.2c. as standard for Corps reconnaissance.

This time it was a retreat instead of an advance. Towards the end of February there was a steady and methodical withdrawal from between Arras and Noyon to a new and formidable defensive system of trenches henceforth to be known as the Hindenburg Line.

Successive air reconnaissances had reported on the preparation of this line ever since November, and from time to time it was photographed. But it had been regarded as a reserve defensive position rather than the enemy's future main system.

At the commencement of the retirement the Flying Corps was prevented from keeping watch on the movements of the enemy by mist and fog. But on the afternoon of the 25th of February a patrol of No. 54 Squadron saw numerous fires in villages and dumps throughout the area. The following day No. 18 Squadron reported on the strength of the Hindenburg Trench System, and that a number of strong points had been prepared behind the existing line to assist the retirement. On the 14th of March the complete plans of the German evacuation were found in a dug-out in Loupart Wood. Three days later orders were issued for a general British advance opposite the retreating enemy.

There was not any question, however, of a spectacular pursuit of a routed and demoralised army. The Germans controlled their retirement from start to finish. They fell back according to a carefully prepared programme on positions arranged in advance for the maximum resistance. In following them we were severely handicapped by the necessity to establish our lines of communication. Roads and railways had to be repaired; guns, ammunition and stores brought forward; defences organised in case of a counter-movement.

Cavalry and infantry outposts kept touch with the enemy whilst the main body advanced by definite successive stages. Although aircraft constantly reported the positions of the troops on both sides and harassed the enemy with machine-guns and bombs whenever possible, there was not a great deal they could do otherwise. In view of the forthcoming spring offensive, General Trenchard was in no position to spare extra squadrons for the sole purpose of annoying an unbeaten enemy.

The general situation, from the point of view of the

Royal Flying Corps, was one of extreme anxiety. Air co-operation was essential to the success of the infantry attack at Arras to be made early in April. For that co-operation to be effective the Corps Squadrons engaged in spotting for the artillery, photography and close reconnaissance must be protected from attacks by enemy fighters. But the German Halberstadt and Albatros single-seaters were daily proving themselves superior to almost every type of machine we could send against them.

On the 9th of March an offensive patrol of nine F.E.8's met an enemy formation led by Richthofen. Four of the F.E.'s were shot down, four others were severely damaged and in the last one the pilot was wounded and his machine burst into flames before he reached the ground. Of the enemy, one pilot was wounded and Richthofen was obliged to forced land with a bullet through his petrol tank.

Distance reconnaissances attempted by the Ninth Wing were punished severely. Six Sopwith two-seaters which tried to reach Valenciennes on the 24th of March lost two of their number, whilst the remainder were badly damaged. On the following day, when the reconnaissance was again attempted, there was only one survivor, who happened to have turned back with engine trouble.

History was repeating itself. A year earlier the brief reign of the Fokker had taxed our resources to the utmost. We had weathered the storm then. Would we be able to weather the blizzard which was raging now ?

The attack in front of Arras was to be made on the 9th of April, between Givenchy-en-Gohelle and Croisilles. On the left, the Canadian Corps and the Fifth Division of the First Army were to tackle the important Vimy Ridge. The rest of the attack was to be made by the Third Army.

For three weeks before the assault was made artillery co-operation machines had been engaged in registering the artillery on enemy battery positions and on the systematic destruction of the barbed-wire entanglements. The general preliminary bombardment began on the 2nd of April against Vimy Ridge and on the 4th of April for the Third Army front. Frequent reconnaissances were made of the enemy's defences and many photographs were taken during the progress of the bombardment.

On the 4th also, five days before the infantry advanced,

an intensive air offensive was begun. It was undertaken with the object of driving the enemy airmen away from the vicinity of the lines so that the Corps' machines could work unhampered. Those in command knew it would be a costly business. The pilots knew it would be a costly business. But everyone also knew that it was vital to the success of the operation as a whole. Somehow, by sheer determination we must regain the upper hand.

It was a costly business. During the five days seventy-five British aircraft were destroyed and one hundred and five pilots and observers became casualties. Nineteen were killed, thirteen wounded and seventy-three missing. Another fifty-six machines were wrecked through flying accidents.

The enemy were fighting with the boldness inspired by success. They knew they had the better machines and practice was constantly making them more proficient. Greater speed, a higher rate of climb and easy manœuvrability gave them complete control of any fight in which they engaged. Very often the British pilot, who was the opponent, was unable to get into position for a single shot at his adversary. He could merely turn and twist in every direction until he was shot down or rescued by a numerically superior formation of his own side. The German, on the other hand, had the advantage that if he believed himself to be losing, he could accelerate his engine and escape.

There were some British machines, however, that were able to give a good account of themselves. The Sopwith "Pup" and the Sopwith Triplane were the equal of the best of the German fighters. The new Bristol Fighter of which so much was expected, made a bad beginning. On its first offensive patrol six Bristols of No. 48 Squadron were attacked by five Albatros Scouts, led by Richthofen. Four of the Bristols were shot down and one of the remaining two was severely damaged. This engagement led Richthofen into the mistaken belief that the Bristol was only mediocre. The Germans were soon to learn how far out his estimate was.

A bombing programme was carried out as part of the air offensive. Raids were made against the railway junctions at St. Quentin and Marcoing, the sidings at Valenciennes and many other places. Enemy aero-

dromes were specially singled out, mostly for attack by night. Owing to the vigilance and intrepidity of the enemy fighters all bombing formations had to be strongly escorted.

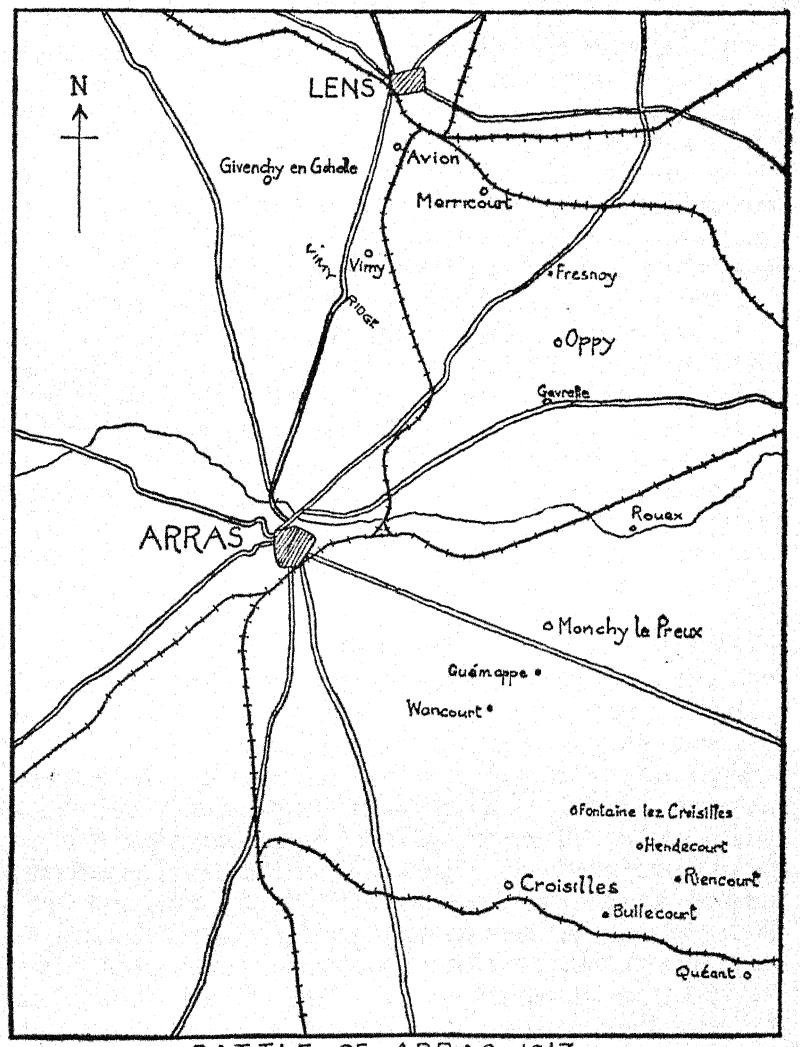
The infantry assault began at 5.30 a.m. on the morning of Easter Sunday, the 9th of April. By the evening the enemy's third line had been taken along the whole front. The advance was resumed on the following day and on the 11th, Monchy-le-Preux was captured. By the 14th we had advanced four miles and the enemy had withdrawn to a line which ran from Avion–Mericourt–Oppy, to in front of Monchy-le-Preux in the south.

Throughout these operations the weather was decidedly inclement and seriously interfered with the work of the air observers. Although pilots carried on and did as well as they could, it was not until the 13th that a full day's work was possible. Contact patrol and artillery observation machines were up all the time, but the bombing programme was cancelled on nearly every day, and the number of offensive patrols was reduced.

There was some fighting in the air on the 11th. Enemy fighters attacked our Corps' aeroplanes, destroying seven. Four Bristol Fighters of No. 48 Squadron fought four Albatros Scouts and shot two of them down. One of the Bristols was obliged to return to the aerodrome. The remaining three Bristols met four other Albatros Scouts and were all shot down in their turn.

Very often, during this period, offensive formations completed their patrols without encountering any of the enemy, although several of the Corps' machines were attacked and destroyed. It was discovered that the German fighters were slipping under our Scouts, operating at a high altitude, in order to prey on the artillery and reconnaissance machines which were less able to resist them. Actually the enemy had provided special observation officers at forward points who watched our movements and so guided their offensive machines to the most likely targets. This system forced us to supply two sets of patrols, one high up as before and the other on the same level as the Corps' machines.

Aerial activity was very prominent on the 13th. Bombing raids were carried out on several enemy targets, although not always without loss. There was a lot of



BATTLE OF ARRAS 1917

fighting and, on the whole, the Germans had the best of it. On this day Richthofen's formation claimed no less than thirteen British machines.

German air reinforcements were now arriving and it looked as though the struggle in the air would become even more intense. But, since all the aeroplanes were not Halberstadt and Albatros, and since all the pilots were not Richthofens, we were able to hold our own.

The fact was emerging most clearly that it was not merely the superior performance of any particular machine that assured success in an aerial combat. Nor was it entirely the skill with which individual pilots handled the controls. It was rather a combination of the two. A resolute, determined pilot on an inferior machine often outfought an adversary flying an aeroplane of the latest type. An over-cautious, hesitant pilot, with all the advantage of speed and manœuvre, might fail to send down an opponent round whom he could fly in circles. It was the fast superior-performance aeroplane handled confidently by a clever pilot with a quick brain that was dangerous. If, in addition, he was a first-class shot with his machine-gun, his predominance was overwhelming.

On the 16th of April, General Nivelle's big offensive opened on the Aisne against the Chemin-des-Dames. It was a colossal failure for several reasons which it is outside the scope of this work to enumerate. Some progress was made, but it fell lamentably short of the much-advertised shattering blow. The repercussion of its non-success was that the British bore the brunt of the fighting on the Western Front for the remainder of the year. Since the French had spent their effort, the enemy were able to move large reserves to Flanders to frustrate Sir Douglas Haig's intention to clear the coast.

The Battle of Arras and the attack on the Vimy Ridge had been made primarily with the object of diverting German strength from the French front. It must now be vigorously continued to prevent the enemy catching our Ally on the rebound with a counter-attack. In itself it had no strategical importance. It was not being developed on a sufficiently wide front for a break-through to be seriously exploited.

The offensive was renewed on the 23rd of April and continued until the 4th of May, after which it resolved

itself into minor operations to tidy up the front line. On the whole the engagement was a success. Had Sir Douglas Haig been able to break off the action as originally planned it would have been a brilliant success. But the latter half was impromptu for the benefit of the French, whilst the eyes of the Staff were directed towards the Wytschaete–Messines Ridge, the capture of which was the first step towards our main Flanders objective.

Co-operation by the Air was as efficient as ever, but it was only carried out at a heavy price. The enemy fighters were following the line of least resistance and concentrating more and more on our Corps' machines. During the month of April 1917, whilst the German Air Service enjoyed its second spell of air equality,—it could not be accurately regarded as supremacy—aerial fighting was fiercer than at any other period during the War, and British casualties were relatively heavier.

Neither side had yet perfected the tactics of fighting in formation which enables each individual pilot to support and be supported by his companions. Pilots flew in formation, but when two opposing patrols met they still often became split up. This was greatly to the advantage of pilots of outstanding ability who were able to shoot down a succession of less-skilful opponents.

There was a sprinkling of these Paladins on both sides. Richthofen was the principal German "Ace," as a man was called when his official record of machines destroyed reached double figures. In the Royal Flying Corps, Captain Ball of No. 56 Squadron and Lieutenant Bishop of No. 60 Squadron had established reputations which were the pride of the Service. J. T. B. McCudden was already becoming well known and E. Mannock, who was to hold the record on the British side, had commenced his career at the front.

Ball lost his life on the 7th of May. Whether he was killed by Richthofen's brother Lothar, who was his last opponent, brought down by anti-aircraft fire, or crashed through his aeroplane breaking, will never be known. His S.E.5 disappeared into a cloud during his last combat and the wreckage was discovered on the ground near Annoeullin. He was posthumously awarded the Victoria Cross.

There were two noteworthy innovations in the employ-

ment of aircraft in the last few days of the Arras offensive. On the 2nd of May pilots of No. 40 Squadron, taking advantage of the cover of trees and houses, made a low flying attack on hostile kite balloons. They kept at an altitude of fifty feet, and reached their objectives before the enemy grasped their purpose. Four balloons were destroyed. They were subjected to rifle and machine-gun fire from the ground, but the relatively greater speed at which an aeroplane appears to be travelling at a low altitude made aiming difficult, and the artillery put down a heavy barrage at the same time, which was well calculated to keep the infantry under cover.

The same squadron repeated the success on the following day. This time the line was crossed at no more than twenty feet, whilst other machines flew higher up to attract the attention of anti-aircraft gunners. No less than seven balloons were destroyed.

Aircraft were also used for the first time on the same day for a direct attack against infantry. Contact patrol observers reported that enemy were massing for a counter attack, whereupon five Sopwith two-seaters of No. 43 Squadron were sent out to attack them. Although pilots had repeatedly used their machine-guns against ground targets during the Battle of the Somme, they had never before been sent up for this sole purpose. A second flight went over in the afternoon. The enemy were scattered and there were many casualties.

On the 30th of April the Germans made another change in their offensive tactics. Four Jagdstaffel were combined in one group to form a Jagdgeschwader. When this huge formation first appeared it was promptly named "Richthofen's Circus," although Richthofen himself was not with it. He went on leave on the 1st of May, and his absence took the sting out of the German attack. Without the force of his personality to drive them the German fighters lost a great deal of their aggression. The number of British casualties lessened. Gradually but definitely the Royal Flying Corps began to regain its ascendency. Determination and an undiminished offensive spirit pushed the fighting away from the lines to German territory.

Whilst local attacks by the infantry continued on the Arras front throughout May, preparations on a gigantic

THE S.E.5

Will always be associated with such outstanding fighters as Ball and Mannock.

scale were in full swing in Flanders. The concentration of artillery of all calibres was the greatest since the outbreak of war. The batteries had to be registered and all possible targets recorded, which meant a mountain of work for the artillery planes. There were so many guns and so much to do that machines were working at the rate of one to every four hundred yards of front. It was a triumph of organisation, since jamming and interference between the wireless signals of one machine and another had to be eliminated.

Just after three o'clock on the morning of the 7th of June, nineteen mines, containing nearly one million pounds of high explosive, were detonated beneath the Messines Ridge. Simultaneously the artillery barrage opened and the infantry advanced to the assault. Practically the whole of the desired objectives were reached on the first day. The battle continued until the 14th of June, by which time the complete ridge was in our hands from Klein Zillebeke to Ploegsteert.

A description of the work of the Royal Flying Corps during these operations would be largely a repetition of that done on other occasions. Artillery machines co-operated with the gunners, many photographs were taken both before and during the action; contact patrols kept Divisional and Corps Headquarters speedily informed of the situation in the front line and the constant fluctuations through attack and counter-attack; offensive patrols penetrated far behind the German lines in search of enemy aircraft, line patrols tackled the enemy fighters which came to prey on our Corps' planes; formations of bombers with their escorts systematically bombed the enemy's aerodromes and dumps. Every detail of the vast machine which had been gradually evolved to meet the exigencies of war worked with the smooth precision which the Higher Command had come to expect of it.

There was one important innovation. Low flying attacks against infantry, first carried out on the 3rd of May by No. 43 Squadron, were employed as a regular thing. Pilots of four squadrons flew literally within a few feet of the ground throughout the enemy's back areas and engaged every target they encountered with their machine-guns. Batteries in action, troops on the march, troops in trenches and shell-holes, billets, railway

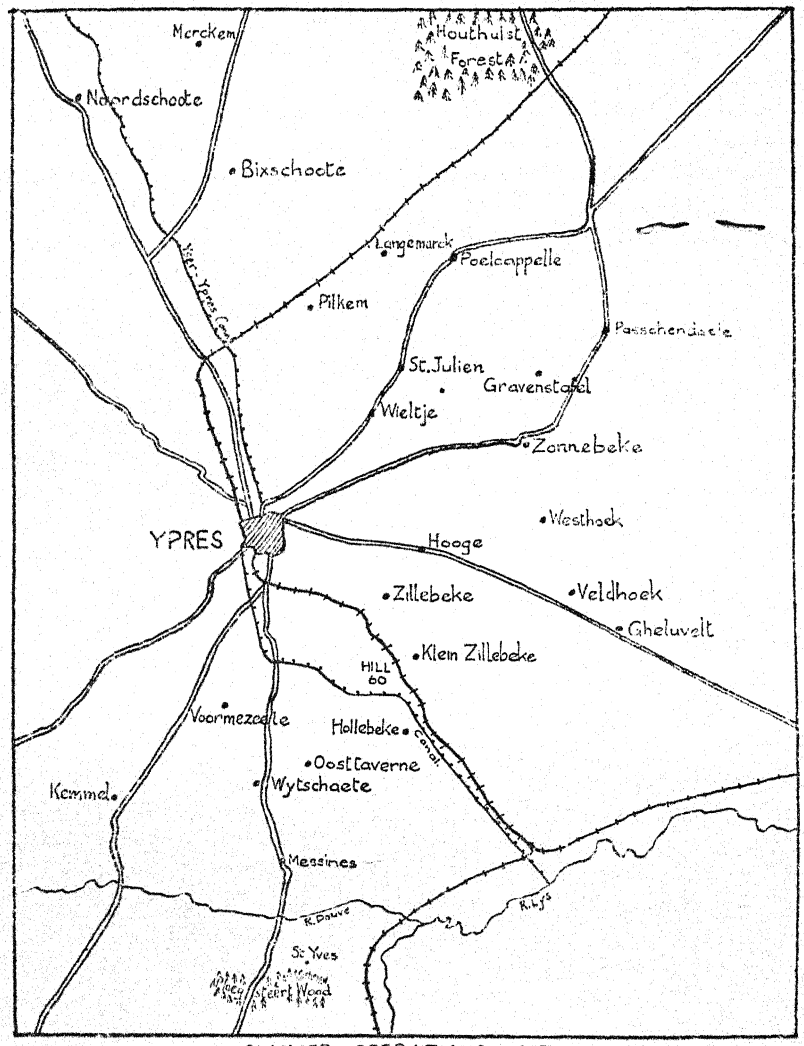
trains, lines of transport, enemy aerodromes; nothing escaped the rain of bullets. The experiment was so complete a success that it was evident that it would be extensively repeated.

The offensive was not continued until the 31st of July, when nine Divisions of the Fifth Army assaulted a front of seven and a half miles in front of Ypres. It was fairly successful in the north, but in the south the enemy succeeded in holding on to the crest of the ridge astride the Menin Road. It began to rain during the afternoon, and it continued raining with very few bright intervals for four days. It was the worst possible thing that could have happened. Water is never very far from the surface of the ground in Flanders and the whole area soon became a quagmire, made worse every instant by the incessant bursting of shells.

Low clouds and poor visibility interfered with work in the air, although it also curtailed interference from the enemy. In view of the enormous numbers of batteries engaged, the artillery co-operation machines were kept extremely busy, each squadron maintaining two machines in the air from dawn until dusk. Our low-flying tactics were copied by the enemy, and there were many combats at an altitude of two hundred feet.

Before the action commenced all Corps Squadrons began to be increased to three flights of eight machines each. This required a total of fifty-four pilots and observers apart from squadron headquarters. In theory this number was ample for the work to be undertaken. In practice it was frequently impossible to send up a pilot and observer together who were both acquainted with the ground over which they flew. One or the other was only too often a new recruit. Casualties were still extraordinarily heavy. Taken in conjunction with the leave roster, the sick roll and promotions, the flying personnel of each squadron was constantly changing.

August 1917 was the wettest known for several years. It looked like clearing up towards the middle of the month, and a second attack was organised for the 16th. It was again only partially successful. The Germans had evolved a new system of defence in this area which was more difficult to pierce than any they had ever prepared before. The water-logged ground rendered the sinking



SUMMER OPERATIONS 1917

of deep dug-outs an impossibility. As an alternative they had erected a series of block-houses of reinforced concrete several feet thick. Each of these was garrisoned by picked troops armed with several machine-guns. The pill-boxes, as they were promptly nicknamed by Tommy Atkins, were sited in such a way that every one supplied covering fire for its neighbours. They were also situated in great depth, with the idea that the most forceful attack must spend itself before the belt of them was broken.

They gave the defence another important advantage. Since they did not require nearly so many men to man them as a trench system, a large number of troops were released and could be held in readiness for an immediate counter-attack. The Germans were rightly convinced that these were the tactics that produced the best results.

The Royal Flying Corps could not do a great deal directly against the pill-boxes. They were invulnerable to machine-gun fire and they presented very small targets for accurate bombing from the air. But the artillery machines could and did bring gun and howitzer fire to bear on them. Low flying machines also continued to play havoc amongst the enemy infantry concentrating for counter-attacks.

Some idea of the activity of the Flying Corps can be gathered from the fact that despite the bad weather 238 enemy machines were sent down during the month of August; 11,000 photographs were taken; 1806 hostile batteries were reported by the artillery observers; 304 gun-pits were destroyed and 803 were damaged; and approximately seventy-nine tons of bombs were dropped on various objectives.

September looked more promising when it opened, but it soon degenerated into a depressing succession of dull days. Flanders mud, heavily churned into a morass by the incessant artillery bombardment on both sides, made all ground movement extremely difficult. Special roads and rail tracks had to be prepared, and constantly repaired, for the transport of stores and munitions. The infantry wallowed in mud and water.

Yet, in spite of all obstacles and in the teeth of the most ingenious scheme of defence that the German mind could evolve, an attack was successfully carried out on the 20th of September. The high ground traversed by

the Menin Road was captured and several other important strong points were taken. The enemy counter-attacked according to plan, but failed to dislodge us. They tried no less than eleven times on the first day and again on several days following, but without result.

On the 26th the advance was renewed. Our assault forestalled, by a short time, a powerful enemy counter-attack which was being prepared. This was completely shattered and some five thousand prisoners fell into our hands. Our advance was continued on the 4th of October, and again on the 9th. Two advances on the 30th of October and the 6th of November gave us the Passchendaele Ridge.

In the original programme prepared by the Staff, Passchendaele Ridge should have been overrun quite early in the operations. Immediately afterwards a strong force from the Fourth Army was to have been landed in the neighbourhood of Ostend under cover of a naval action, whilst the Fifth Army continued their push across Belgium. The enemy, caught between the points of the pincers, would have been forced to yield us the Belgian Coast.

As on the Somme, we were defeated by the weather. Given dry ground on which troops, tanks and guns could manœuvre and nothing could have withheld us from victory. The British Army had been welded by Sir Douglas Haig into a perfect weapon of offence. Each arm of the Service co-operated in unison. The guns, supplied with unlimited quantities of ammunition, accurately directed by the observers flying above the targets, blasted a way for the infantry to advance. When the weather turned, the very excellence of our attack militated against us. Our barrage crushed the enemy but made the ground on which it fell into a swamp through which the infantry were unable to advance at the requisite speed, giving the enemy time to reorganise his scattered defence.

The tragedy was that we received no help from any of our Allies at this time. The Russian Revolution on the 12th of March, which was to result in the defection of Russia from the Allied cause, invalidated the pressure which was to be increased on the Eastern Front during the year. In the south, the Italians were finding difficulty

in holding a combined force of Austrians and Germans. The French failure in Champagne had disheartened the whole French Nation, and although an Army operated on our left flank during the Third Battle of Ypres it acted in a definitely subsidiary capacity.

Opposite to us the Germans were continually being relieved and reinforced by fresh Divisions brought across from the stagnant Russian Front. We occupied the almost undivided attention of the German Supreme Command. We were confronted by the picked troops of the German Army. The weather was against us. Still we advanced. Very much slower than we had intended, perhaps; at the cost of enormous casualties; but—we advanced. We could not help ourselves. There could be no question of postponement of our effort. Had we been content with remaining where we were in trench warfare the enemy would have had time to concentrate his overwhelming force for one mighty drive. By continually pecking we undermined his morale and restored that of our Allies.

Throughout the whole of these operations, the Royal Flying Corps played its full part. It is as impossible to compare the value of work done in the air and on the ground as it is of the forwards and the backs at football. Each is complementary to the other. The weather affected both Services alike. Rain, wind, low clouds, restricted visibility were obstacles which pilots had to contend against continually throughout the whole battle. At times observation was literally impossible. But, whenever opportunity offered; often when conditions were definitely dangerous for aircraft; pilots went up to take photographs, to direct the gunners; to drop bombs, to attack the enemy from low altitudes, to prevent him from using his aircraft against us.

On the 26th of October the Italians were severely defeated by an Austro-German Army at Caporetto. The effect on the morale of the Italian populace was serious. To restore confidence, five French and five British Divisions were transferred to Italy as reinforcements. The Seventh Brigade R.F.C. accompanied them.

Under cover of the necessary readjustments in our line, six divisions were concentrated on the Third Army front before Cambrai. Led by a fleet of 340 tanks, they attacked

on the 20th of November without the usual preliminary bombardment. The enemy were completely taken by surprise, and by the second day we had advanced an average depth of four and a half miles on a ten-mile front. We were held at Bourlon Wood, which proved to be the key to the whole operation. The Germans counter-attacked with fresh troops on the 30th and we were thrust back on the southern half of the line beyond our original starting point. In the northern sector the enemy was held, but we withdrew to a strong position on the Flesquières Ridge on the 7th of December.

This completed the operations for the year 1917.

On the 18th of January, 1918, Major-General J. M. Salmond, C.M.G., D.S.O., succeeded General Trenchard in command of the Royal Flying Corps in France. The change coincided with another burst of enemy activity in the air which increased crescendo during January, February and March. Nor were we idle in our retaliation. More enemy aeroplanes were destroyed in the first three weeks in March than were in existence at the commencement of the War. In addition to which continuous bombing attacks were carried out against the enemy's back areas.

We were fully aware of the reason for the enemy's alertness. It had been advertised throughout Germany that the War was about to be brought to a victorious conclusion. The blow fell on the 21st of March. After five hours' intensive bombardment the Germans attacked on a fifty-four-mile front between the Rivers Oise and Sensee with a force in excess of the whole of the British Army in France.

CHAPTER ELEVEN

THE ROYAL AIR FORCE IN 1918

THE Royal Air Force was born on the 1st of April, 1918. It had experienced many changes during its growth from an embryo to an entity. Its right arm, the Royal Flying Corps, and its left arm, the Royal Naval Air Service, had developed without seeming reference to one another. They needed the functioning of a heart to co-ordinate them properly. This vital organ was provided by the formation of an Air Council.

At the start of our national air service in 1912 it was intended that the naval and military wings should operate as one. Both naval and military pilots were trained at the Central Flying School and were taught something of the conditions in which war is waged both on land and sea. But differences of administration and employment caused the two wings to drift apart, and before the outbreak of hostilities in August 1914 they were entirely separate units, even to nomenclature.

The disunion was of no importance as regards employment. The duties of pilots flying naval or military aircraft were very different. Administration was another matter. Each service had to draw on the common pool of the country's resources for its personnel and its supplies. Had our available means been unlimited there would have been no friction. But men and munitions had to be very carefully husbanded. The requirements of all three branches—army, navy and air—had to be considered in relation to one another.

An attempt was made to bring the two wings into line in February 1916. The Government formed a joint Naval and Military Committee to collaborate on questions of design and supply. It found that the two flying services were unable to agree on questions of policy, which naturally dictated what types and numbers of

aircraft were required, and since it had no executive powers it failed.

The Joint War Air Committee, as it was termed, was succeeded by an Air Board on the 11th of May, 1916, under the Presidency of Lord Curzon. The Air Board had somewhat wider powers, but, like its predecessor, was handicapped by the deprivation of executive authority. Nevertheless, it did much useful work during the seven months it was in existence, especially in providing a means by which the representatives of the R.F.C. and R.N.A.S. could ventilate their divergencies.

On the 7th of December, 1916, Mr. Lloyd George succeeded Mr. Asquith as Prime Minister and at once instituted his famous War Cabinet. Lord Curzon immediately reported on the question of aircraft supplies, with the result that a widening of the Air Board's powers was decided on.

A new Board was formed under the Presidency of Lord Cowdray, and since it was provided in the Section of the New Ministries and Secretaries Act 1916, which constituted the Board's authority, that the "President of the Air Board shall be deemed to be a minister appointed under this Act," an Air Ministry had come into existence.

In practice it was a Ministry of Supply rather than of administration and direction, and in this limited capacity it was highly successful. But if any weight was needed to keep the question of air organisation fresh in the public mind, the German air raids adequately supplied it. The daylight invasions by the Gothas in June and July 1917 brought the whole question right to the fore. General Smuts was appointed by the Prime Minister to make an examination of all matters pertaining to the air. His report advocated the amalgamation of the air services and the formation of an Air Ministry adequately empowered to control them.

This view was supported by Lord Cowdray, General Henderson and many others, with the result that the Air Force (Constitution) Act 1917 was submitted to Parliament early in November. The Bill passed both Houses, and received Royal Assent on the 29th of November, 1917.

Although a fully fledged Air Ministry was now lawfully

established under the control of an Air Council analogous to the Army Council at the War Office, the date at which it officially commenced operations was put forward to the 1st of April, 1918, so that there should be no confusion during the amalgamation. The Air Council was formed on the 3rd of January under the Presidency of Lord Rothermere, Secretary of State for Air, and with Major-General Sir Hugh Trenchard, brought home from France, as Chief of the Air Staff.

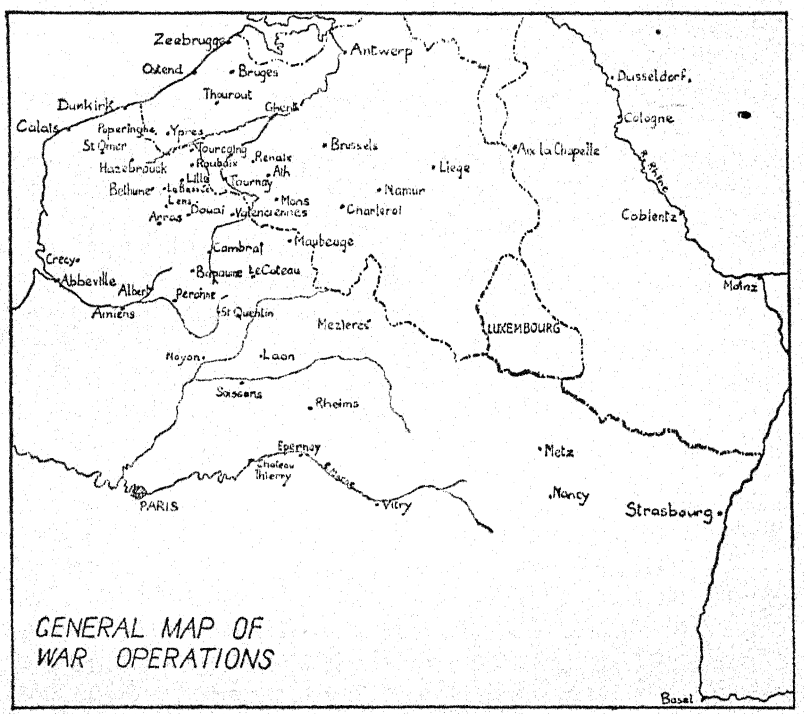
When the Royal Air Force came into being the Germans were in the middle of their gigantic offensive which was intended to finish the War. From the 21st of March until the 28th huge masses of infantry pushed relentlessly against the front held by the Third and Fifth Armies. Although each foot of the way was stubbornly contested, mere force of numbers carried the assaulting troops forward. The wave was eventually checked on the forward slopes of Villers-Bretonneux. The enemy held Montdidier to the south and Albert to the north. On the 28th the enemy extended the attacking front by an assault on the position before Arras. They advanced a little way in the first shock, but were afterwards resolutely held. Although their efforts were continued until the 5th of April our resistance gradually stiffened.

The peril of this mighty thrust had a momentous effect of far-reaching consequence. A meeting of allied chiefs was held at the Hôtel de Ville at Doullens on the 26th of March, at which it was decided to unite the command on the Western Front under Marshal Foch. This had the immediate effect of strengthening the liaison between the French and British Armies, and ensured a proper concentration of reserves wherever needed.

The immediate object of the first German push was to drive a wedge between the French and British Armies. When this failed they transferred their attention farther north. On the 9th of April, following a thirty-six hours' gas bombardment, an assault was made in immense strength along the line of the River Lys. The important railway junction at Hazebrouck was the premier objective with the Channel ports as a subsequent prize. Fighting continued up to the 29th, by which time the enemy were definitely stopped. They had, however, advanced to within six miles of Hazebrouck and had run

right through our defences between Ypres and La Bassée.

On the 24th another assault was made on the Somme Front. Four Divisions, supported by tanks, attacked the high ground at Villers-Bretonneux. Tank met tank for the first time. The Germans took Villers-Bretonneux,



but they did not hold it very long. At ten o'clock the same night they were driven from the ridge by a brilliant counter-attack.

Whilst the German offensive forced us backwards on the ground we retained a marked superiority over enemy aircraft in the air. Machines were up during every moment of daylight, flying low over the enemy's back areas, bombing and machine-gunning concentrations of troops and hostile batteries. No one could complain of lack of targets. Troops marched along the roads in columns of fours, and batteries and ammunition wagons stretched in long lines across the country. Pilots were able to see clearly the effect of their fire. With the urgency

of the situation fresh in their minds, they did not spare themselves in doing everything within their power to help the ground troops check the enemy's advance.

None of this support would have been forthcoming had we been dominated by the German Air Service. Every one of our fighters would have been required to act defensively in an endeavour to prevent enemy aircraft from treating our infantry and gunners as we were treating theirs. Whenever formations of enemy machines attempted to avail themselves of our pilots' preoccupation with ground targets and attacked our Corps machines they found that the fighters were quite alert and ready to climb up to meet them.

But although they were adequately protected the Corps machines were not able to get such good results as when we were advancing. The enforced retirement seriously upset co-operation with the artillery. In many instances batteries had been obliged to abandon their wireless receiving stations when hurriedly changing their positions. Until fresh issues could be made, communication with air observers was necessarily curtailed.

The German Air Service suffered a grievous loss on the 21st of April when Richthofen was shot down by Captain A. R. Brown of No. 209 Squadron. Fifteen Camels of this Squadron met Richthofen's "Circus" in the neighbourhood of Cerisy. During the ensuing dog fight, Captain Brown dived on Richthofen's machine, which was on the tail of one of the British machines. The German was killed instantly, his aircraft crashing behind the British lines.

This mention of No. 209 Squadron does not mean that there were that number of squadrons on active service in France. Actually there were less than half that figure. But the incorporation of the R.N.A.S. in the Royal Air Force necessitated a certain amount of renumbering to avoid confusion. So that the naval air units might continue to preserve something of the identities which they had created, it was arranged that the numbering of naval squadrons should commence from 201 onwards and naval wings from 61 onwards. Thus No. 209 Squadron R.A.F. was originally No. 9 Squadron R.N.A.S. It was amongst a group of five squadrons withdrawn from

Dunkirk to meet the critical military situation caused by the German push.

Dunkirk was a hive of industry throughout April in connection with the operations which the Navy was planning against Zeebrugge and Ostend. It was intended to block the entrances to the canals which led to the inland port of Bruges. The first essential was an accurate and detailed knowledge of every inch of the defences at each port. To supply this, D.H.4's of No. 202 Squadron took a series of photographs from which scale models were constructed showing every unit of the attacking force exactly what obstacles would be encountered.

The attack was originally timed for the night of the 11th of April, but owing to unfavourable weather it was postponed until the 22nd–23rd. The various vessels of the Fleet taking part assembled at a point sixty-three miles from the Belgian coast, from which it would take about seven hours to reach the two objectives. Had the enemy got wind of the project during that critical period, four hours of which was daylight, the expedition must have failed. Every nerve of the Air Force at Dunkirk and Dover was strained to keep a single enemy machine from obtaining a glimpse of the Fleet. The vigilance of the patrols was rewarded by a surprise of faultless perfection.

Aircraft had another duty to perform. Commencing two and a half hours before the zero of the attack, Handley Pages were to commence an intensive bombing of the shore batteries and the ports to engage the defenders' attention and keep them and their searchlights occupied. Unfortunately, the weather was too bad to allow this part of the programme to be carried out.

The Navy successfully blocked the entrance to the ship canal at Zeebrugge, but failed to close the harbour at Ostend. Reconnaissances made on the morning of the 23rd discovered some twelve submarines and twenty-three torpedo boats imprisoned at Bruges. Throughout the day Nos. 213 and 217 Squadrons kept up a series of attacks with bombs and machine-guns to prevent the working parties from clearing the wreckage. Many photographs were also taken.

The failure at Ostend was largely due to the fact that the Stroombank buoy, which marks the channel to the

entrance of Ostend harbour, had been moved a mile and a half to the east, causing the blocking ships to mistake their position. A similar mischance nearly spoiled a second attempt which was made on the 9th of May. The Fleet was already steaming towards Belgium when an air reconnaissance discovered that all the buoys off Ostend had been removed. This timely warning enabled us to anchor a special buoy of our own to act as a pivot for the operation.

When the signal to open fire was given at 1.43 a.m., seven Handley Pages of No. 214 Squadron assisted by bombing the defence batteries. Each aeroplane also dropped a series of parachute flares which lit up the harbour and piers, considerably assisting the attackers in their work. The following morning a reconnaissance by Camels of No. 213 Squadron reported the *Vindictive* blocking about a third of the fairway between the Ostend piers.

These attacks were part of a carefully considered programme of naval measures which had been drawn up to deal with the still serious menace of the German submarine blockade. The scheme contained a definite policy for the employment of aircraft, allotting various types to the work for which they were best suited. Airships would continue to be used as escorts for convoys in conjunction with balloons carried on the guard-ships. Aeroplanes and seaplanes were to patrol allotted areas near the coast according to their radii of action. Further out to sea kite-balloons, flying-boats and aircraft operating from auxiliary cruisers and towed lighters would share the work between them. Attacks would also be organised against enemy aircraft in their own home waters and the various bases on the German coast.

A reconnaissance in connection with this latter heading took place on Tuesday, the 19th of March. In order to increase the effective striking distance of the "America" flying-boats, some special lighters had been designed, capable of being towed at speed. Each carried a flying-boat which could be rapidly got into the water by flooding tanks built into the craft for the purpose. The flying-boats could be as easily lifted from the surface by emptying the tanks with compressed air.

Three lighters were towed into position off the German

coast and the flying-boats " took off " at seven o'clock in the morning. They were attacked by two enemy sea-planes from Borkum, but one was shot down in flames, and the reconaissance was completed without further opposition. It was successfully repeated two days later, on the 21st.

These reconnaissances were directly connected with our anti-submarine campaign. Throughout the War the Navy were continually laying minefields round the Heligoland Bight to obstruct the passage of submarines. As fast as they were put down, the German mine-sweepers got to work to clear a way for the underwater craft to the North Sea. Our scouting expeditions were carried out to discover these tracks, so that we could lay fresh mines in place of those that had been removed.

The Harwich Force often raided the area with the idea of catching the mine-sweepers at work and destroying their escort. Two F.2a flying-boats which were co-operating in one such operation on the 20th of April, sighted four German destroyers and four mine-sweepers about twenty miles north of Terschelling. Supporting them, were two battle-cruisers, with four light-cruisers and destroyers. The receipt of the information resulted in a short action between the striking Force and four enemy destroyers.

Admiral Scheer made his last sortie into the North Sea on the 24th of April. It was again unsuccessful. He intended to catch a large convoy proceeding towards Great Britain under escort from Norway. Secrecy was well maintained, and the High Sea Fleet was at sea before the Admiralty received any intimations of its intentions. The Grand Fleet was at once ordered to the Long Forties, but a heavy fog intervened, and Admiral Scheer returned unmolested to his base, without having sighted his quarry.

On the 10th of May, another flying-boat scored a success against a Zeppelin. Wireless direction-finding stations discovered that the L.62 was working over the Heligoland Bight, and an F.2a flying-boat, piloted by Captain T. C. Pattison and Captain A. H. Munday, set out from Killingholme to engage her. They attacked with explosive bullets whilst the Zeppelin climbed rapidly to evade them. Once she succeeded in getting directly above them, and dropped five or six bombs. In the end,

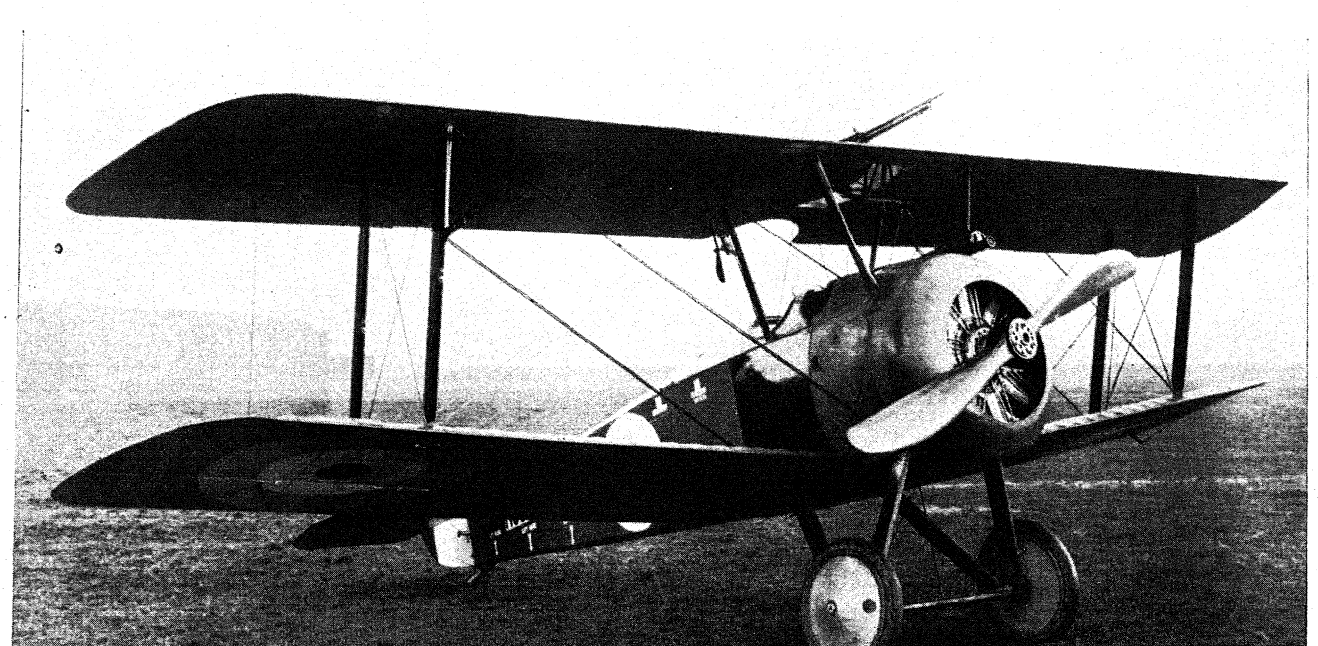
their fire took effect and she went down in flames. Seven enemy destroyers put up a barrage of anti-aircraft fire, but although the flying boat was obliged to forced land with a broken oil-pipe, it returned home in safety.

The last and greatest enemy aeroplane raid against London, took place on the night of the 19th of May. Forty-one machines set out, but only thirteen reached their objective. Three Gothas were brought down by the anti-aircraft barrage, three more were shot down by fighting aeroplanes, one forced landed near Clacton with engine trouble, and three more crashed on the home aerodrome in Belgium. It was a costly effort considering the relatively small amount of damage that was done. Over eleven tons of bombs were dropped, which wrecked a number of houses and buildings, but the number of casualties was surprisingly small—forty-nine people killed and one hundred and seventy-seven injured. England was only visited by enemy aeroplanes on three further occasions during the War. Single machines visited Kent on the 17th of June and the 18th and 20th of July.

Though the enemy now decided that the London defences were too strong for them, their activity did not abate against the Dunkirk aerodromes. Strong bombing attacks were made on the 4th, 5th and 6th of June at Bergues, Coudekerque, Petite Synthe and Capelle. The Royal Air Force replied with concentrated attacks against docks, railway centres and aerodromes.

The intensity of the air war was not confined to the coast. Along the whole front, both sides were engaged in a day and night struggle for the upper hand. Its fierceness found expression in the increased size of fighting formations. The German Jagdgeschwader, composed of four Jagdstaffeln, flew in a group of between thirty and fifty machines. To combat such a formidable, if somewhat unwieldy, air fleet, the Royal Air Force was obliged at times to send out complete squadrons, although the Flight continued to be trained as the ideal tactical fighting unit.

If our patrols were too large, the enemy often evaded combat, but there were some notable battles between large detachments. On the 3rd of April, twenty-seven aircraft of No. 65 (Camel) and 84 (S.E.5) Squadrons, met a formation of thirty Pfalz and Albatros Scouts over



By the courtesy of "Flight"

SOPWITH "CAMEL"

In addition to valuable work overseas it had a great reputation in Home Defence.

Rosieres. The fight took place at only 1500 feet. Seven enemy machines were destroyed and two more sent down out of control. On our side, two Camels failed to return.

There was an amazing encounter on the 7th of May. Two Bristol Fighters of No. 22 Squadron, on an offensive patrol near Arras, attacked seven Fokker biplanes at a height of 15,000 feet. Four Fokkers went down in the first onslaught; both pilots and observers accounting for one each. In the meantime, enemy reinforcements had arrived, bringing the total of the opposition to twenty. The Bristols continued the fight until their ammunition was expended, when they returned home. They had destroyed another four machines between them, making a total of eight.

When the Germans failed to break through the British line at Hazebrouck, they had not, by any means, exhausted their offensive capabilities. Finding they could not gain their ends either at the Somme or the Lys, they tried the Aisne. On the 27th of May, twenty-eight German divisions, supported by tanks, attacked the French Sixth Army on a thirty-five-mile front, north-west of Rheims. By the 6th of June they had reached the Marne, where they were held.

Three days later, a fresh assault was launched between Noyon and Montdidier. Repeated attacks during the following month carried the passage of the Marne, and took the Germans slowly south-westwards, but at a great price. Marshal Foch watched, made his preparations, and bided his time. Gradually he collected together an overwhelming force. In the main, it was French. There were also Italian troops, British troops and newly arrived American troops, who had been pouring into the country at the rate of 50,000 men a week. On the 18th of July, Marshal Foch struck a mighty blow at the German salient between Château Thierry and Soissons. The Germans were thrown back eight miles on the first day, with the loss of 16,000 prisoners and 500 guns.

The tide had turned for the last time. It was appropriate that it was in the neighbourhood of the River Marne, where the German advance was successfully stemmed in 1914, that the first step should be taken to drive the enemy finally from France. The offensive was renewed

on the 8th of August, and, although it was not realised at the time, it was to continue without interruption for three months, until the final victory.

The Royal Air Force squadrons which were detailed to assist the British advance took little part in the opening attack. Thick fog over the whole battlefield nullified all attempts at observation. Fortunately, the lack of aerial co-operation did not interfere with the success of the operation. The enemy was taken completely by surprise. The first objectives were overrun by the tanks and infantry with the minimum of resistance. By the end of the day the enemy had been pushed back seven miles from in front of Amiens.

When the fog cleared towards midday, the aeroplanes were able to commence low-flying attacks behind the enemy lines. Each machine carried four 25-lb. bombs and a plentiful supply of machine-gun ammunition. Although considerable damage was done to enemy infantry, batteries and transport, many aircraft were lost through attacks by enemy fighters. Consequently, when the operations were continued on subsequent days, special fighting patrols were detailed to protect the low-flying bombers.

Meanwhile, the last airship attack on England was attempted on the 5th of August. A force of five Zeppelins set out, but none reached our coast. They were intercepted by a D.H.4, piloted by Major E. Cadbury, with Captain R. Leckie as his observer. They attacked the L.70 at a height of 17,000 feet and in a few minutes she was a blazing wreck. They then turned on the L.65, but after a few moments, Leckie's gun jammed, and they were obliged to break off the engagement. Seeing the destruction of their consort, which carried Fregatten-kapitän Strasser, the Chief of the Service, the remainder of the Zeppelins retired homewards.

Although we had not succeeded in checking the submarine campaign quite so effectively, our counter-measures were causing a definite diminution of losses to merchant shipping. Patrols by aircraft, both lighter and heavier than air, now formed an extensive network round the coast. Their greatest value lay in keeping submarines either submerged or well out to sea, but some U-boats were sent to the bottom through their agency.

The U.C.49 was sighted and bombed by a D.H.6 aeroplane, on the 30th of May, shortly after she had torpedoed S.S. *Dungeness* off Sunderland. She was seen again, later, off Seaham, by a Sopwith Baby seaplane, which dropped a 65-lb. bomb close to her conning-tower. All trace of her was then lost until the following night, when she was picked up by an F.E.2b. Two 100-lb. bombs were dropped by the aeroplane as well as some depth-charges by the *Locust*, a destroyer that was searching for her. She broke the surface, turned over, and sank.

On the 28th of August, the U.C.70 was destroyed off Seaton Carew, by a Blackburn " Kangaroo " in conjunction with H.M.S. *Ouse*. The same destroyer also co-operated successfully with the airship R.29 against the U.B.115, on the 18th of September. Another submarine, the U.B.83, was sighted by a kite balloon earlier in the month, and reported to H.M.S. *Ophelia*. Depth-charges were at once dropped on the spot where she submerged, with fatal results.

It was not only in home waters that a ceaseless vigilance was maintained against the submarines. The threat to Allied shipping was equally virulent in the Mediterranean. Counter-measures organised air units into five main groups, with Headquarters at Malta. The seaplane-carriers *Engadine*, *Riviera* and *Vindex* were sent out to join the *Manxman* to provide mobile seaplane bases for concentrated action.

Many long and arduous patrols were carried out by aircraft in the daily painstaking hunt. Airships and aeroplanes escorted convoys of troops and supplies for our armies in Mesopotamia, Salonika, Palestine and Egypt. Kite-balloons, with their lengthy radius of vision, proved their value over and over again. Many convoys were entirely immune from attack, whereas before their employment at least 50 per cent lost one or more ships in the dangerous zone between Egypt and Gibraltar. Several bombing raids were carried out against the enemy submarine bases at Durazzo and Gjenovic.

In the North Sea, in addition to the use of flying-boats operating from towed lighters for long-distance reconnaissances, much work was done by the aeroplanes carried in the *Furious*. In company with a Light-Cruiser

Squadron, supported by a Battle-Cruiser Squadron, she made several sweeps in enemy waters. She was off Lyngvig on the 18th of June when she was attacked with bombs by two enemy seaplanes. Camels went up to drive off the enemy, but the action was indecisive. In a later attack an enemy seaplane was forced down on the water and destroyed.

A month later the *Furious* was again off Lyngvig. Her objective on this occasion was the airship sheds at Tondern, the destruction of which had been attempted many times without success. At 3 a.m. on the morning of the 19th of July, a flight of three Camels "took off" from the deck, followed a few minutes later by a second flight of four. Each machine carried two 50-lb. bombs.

The first flight scored direct hits on the northernmost of the two large double sheds. Only one pilot of the second flight reached Tondern—Captain B. A. Smart, the leader of the party. He attacked the second shed and scored a direct hit with his second bomb. Not only were the two sheds completely destroyed, but also the Zeppelins L.54 and L.60 which were inside them.

It can be readily understood that we were not allowed to carry out our offensive operations in the Heligoland Bight without interference from the enemy. Seaplanes operating from List, on the island of Sylt, Borkum, Heligoland and Nordeney regularly patrolled the coast and the sea within their range of action. They were largely instrumental in reducing the effect of our mines by piloting submarines past them. They also gave timely warning when the Harwich Force was approaching, which enabled their mine-sweepers to retire in safety.

Nor did they remain solely upon the defensive. Fighting patrols frequently attacked our flying-boats on reconnaissance. On the 4th of June, five flying-boats encountered a formation of hostile seaplanes. Six Brandenburg seaplanes were shot down and two large Americas.

Seaplanes operating from Zeebrugge were especially active. Flying-boats from Felixstowe were continually attacked, and several were destroyed during the year. These hostile formations sometimes ventured right into the Thames Estuary. Two Shorts from Westgate, escorted by two Camels, were attacked by seven enemy

seaplanes near the Sunk Light Vessel on the 18th of July. Though the scouts got back home one Short was definitely destroyed whilst the other was never seen again.

Since enemy aircraft and airships were preventing our destroyers and cruisers from getting within striking distance of their mine-sweepers and escort by sounding the alarm, it was proposed to make a surprise attack with shallow-draft motor-boats which could cross the mine-fields in safety. The motor-boats were carried in cruisers to a point within fuel range of their objectives. Flying-boats were to assist in locating the enemy and in helping to recover the motor-boats on their return.

The first attempt was made on the 29th of June. The motor-boats got within reach of two large mine-sweepers, but were unsuccessful with their torpedoes. The operations were repeated without success on the 7th and 17th of July, and again on the 1st of August. In this last operation the light cruisers were attacked by a Zeppelin which approached under cover of a bank of cloud. A long swell prevented our aircraft being launched to make an effective reply.

The next and last try was both a victory and a defeat. In view of the Zeppelin attack it was decided to include with the force a fighting aeroplane with a ceiling equal to that of the airship. Rear-Admiral Sir Reginald Tyrwhitt had suggested much earlier in the year that Camels could be flown off lighters fitted with special " taking-off " platforms. With his usual energy, Colonel C. R. Samson had reduced the idea to practice, although he nearly drowned himself at the initial trial. After various modifications and improvements a Camel was successfully flown from a lighter towed at speed behind a destroyer by Lieutenant S. D. Culley.

On the 10th of August, when the Harwich Force again crossed the North Sea with the motor-boats, a Camel was included with the large Americas on the towed lighters. Shortly after the motor-boats were sent away a Zeppelin was sighted ahead. Lieutenant Culley " took off " in the Camel without the airship being aware of his presence. He attacked at a height of 19,000 feet and in a few moments the L.53 was in flames.

Meanwhile eight enemy two-seater seaplanes were attacking the motor-boats. The Americas which were

towed with the fleet should have been there to protect them, but the sea was dead calm and they were unable to leave the water. A second flight of three large Americas from Yarmouth, which arrived afterwards, failed to find either the motor-boats or the enemy seaplanes.

The motor-boats were able to hold their own against the two-seaters. But before they could disengage, four fighting seaplanes arrived on the scene. The crews of the boats succeeded in bringing one machine down, but they could not stand up to the continuous attacks of the low-flying aircraft. They were forced ashore at Terschelling and interned by the Dutch.

The German Army on the Western Front was now definitely on the defensive. A force of thirty divisions, which had been concentrated in Flanders for a renewal of the Lys offensive, had to be distributed along the line in a vain endeavour to check the victorious advance of the Allies.

August the 8th, 1918, will be remembered by the Germans as the "black day" of the War. It was the beginning of the end. By the 13th the Allied advance had reached the threshold of the old Somme battle-field. But the German defence was still very obstinate. When the Battle of Bapaume opened on the 21st of August, north of the Ancre, the British Third Army had to fight hard to reach their objectives. On the following day the Fourth Army took Albert. Thereafter the troops pushed steadily forwards. Combles fell on the 29th. Bapaume was evacuated on the same day. On the right the French reached Noyon. On the night of the 30th the 2nd Australian Division took Mont St. Quentin, forcing the enemy to retire from Peronne.

The immediate result of this offensive was that the Germans abandoned the Lys Salient opposite Hazebrouck. They needed every man they could muster to oppose the British and the French in the south. They were allowed no respite. Whilst we were still pressing between Bapaume and Peronne the First Army assaulted the German positions on the River Scarpe to extend the northern flank of our operations. By the end of the month we held the height of Monchy le Preux, and were back in Roeux and Gavrelle. The pressure was not relaxed. On the 2nd the Hindenburg Line was carried

at Quéant. During the night the enemy retired to the line of the Canal du Nord.

On the 12th of September four divisions of the Third Army drove the enemy from Trescault and Havrincourt. The success was repeated on the 18th when the Germans were attacked on a front of seventeen miles between Holnon and Gouzeaucourt. The position now ran from Holnon in the south, through Epehy and Havrincourt along the Canal du Nord to the River Sensee and then in front of Monchy and Gavrelle to between Oppy and Lens. A truly notable victory with many thousands of prisoners and hundreds of guns.

The Royal Air Force co-operated as brilliantly in advance as in retreat. Though the enemy were being forced back on the ground they were by no means beaten in the air. Following the example of our own men, the German pilots strained every nerve to protect their retiring infantry. Low-flying attacks with machine-guns and bombs were supplemented by bombing raids against our back areas.

Their bombing campaign, especially at night, reached unprecedented intensity. Our bases, rail-heads, dumps and aerodromes were subjected to almost continuous attacks. To combat them we were forced to develop a system of defence similar to that evolved in England for protection from the air raids. Searchlights and anti-aircraft guns were arranged round the principal objectives, the chief of which were Abbeville, Arras and Doullens; whilst aircraft were held in readiness to attack.

On the night of the 31st of May, Lieutenant C. C. Banks of No. 43 Squadron brought down an enemy Friedrichshafen in flames. This was the first machine destroyed by night in France.

No. 151 Squadron (Camel) was specially formed in England from units of the Home Defence Squadrons for night-fighting duty. It arrived on the 21st of June, under the command of Major G. W. Murlis-Green. Its success was remarkable. During its five months' active service it accounted for twenty-six enemy bombers—two five-engined Giants, two ordinary two-seaters and twenty-two twin-engined Gothas, Friedrichshafen or A.E.G.—without having a single casualty.

As in other classes of air work, we succeeded in holding the enemy and gradually passed from the defensive to the offensive. Whenever the enemy carried out a raid we retaliated by attacking the aerodromes from which their bombers emanated. Camels would hover in the neighbourhood and attack returning enemy machines as they were about to land.

A big daylight attack was conducted by four squadrons of the 80th Wing against Haubourdin aerodrome on the 16th of August. There were sixty-five machines in all, led by the Wing Commander—Lieutenant-Colonel L. A. Strange—in person. The squadrons flew in layers at different heights. Bristol Fighters of No. 88 Squadron were at 13,000 feet; S.E.5's of No. 92 Squadron at 11,000 feet; S.E.5's of No. 2 Squadron, Australian Flying Corps, at 9000 feet; and Camels of No. 4 Squadron, Australian Flying Corps, at 7000 feet. The two Australian squadrons made the attack whilst the other two afforded them protection. One hundred and thirty-six 25-lb. and six 40-lb. bombs were dropped and considerable quantities of machine-gun ammunition were expended from below four hundred feet from the ground. The four squadrons returned without a casualty, and repeated the performance against Lomme aerodrome on the following day.

Everybody in the infantry realised and appreciated the tremendous amount of work done by our low-flying contact-patrol aircraft in helping the advance. The reporting of positions reached by the troops, which prevented them being fired on by their own artillery; the subjugation of stubborn machine-gun nests by bombs and machine-gun fire from the air; the prevention of attacks by hostile aircraft; all helped to reduce the casualties of ground units and thereby increased their enthusiasm and strengthened their morale—if that were needed. Similarly, the knowledge that they were never out of range of an insidious form of attack, which they were powerless to combat, had a decided depressing effect on the enemy.

No. 8 Squadron (Armstrong Whitworth) had the interesting task of co-operating with the Tanks. Much useful information was taken back to Tank Headquarters, but it was found very difficult to determine when a tank

was out of action. Pilots were able to render a great deal of assistance in nullifying the anti-tank guns which the enemy brought into action. In August, No. 73 Squadron (Camels) was also allotted to the Tank Corps especially for this work.

The Cavalry were served by No. 6 Squadron (R.E.8). A special Popham Panel code was worked out for orders to be transmitted from the ground, air observers replying by means of messages dropped in message bags.

A great offensive was carried out against enemy kite balloons. It was found that incendiary ammunition would not normally set a balloon on fire unless fired within a range of fifty yards. The problem was to get so near before the balloon team had time to haul it down to safety and to escape the enemy fighting patrols. The attacks were based on a squadron flying in layers of flights; the two upper ones acting as a protective force to the lower one which dived on the objective. This was found to be most satisfactory.

One of the most important steps of the War was taken —rather late in the day—when the Government ordered the formation of the Independent Air Force in April, 1918, for the purpose of conducting bombing raids in the heart of Germany. It had always been a prominent item in the policy of the R.N.A.S. that the enemy should be continually attacked in their own country. But something always materialised to prevent it being put into operation.

They started in 1914 by bombing raids on Düsseldorf, Cuxhaven and Friedrichshafen. They intended to carry on with a special Wing to be established at Luxeuil in 1916. The project had to be abandoned when the Admiralty were called upon to supply the R.F.C. with a number of aircraft for use in the Battle of the Somme although several raids were carried out in conjunction with the French.

The day and night aeroplane raids on England created an outcry for retaliation. General Trenchard was requested in October 1917 to take immediate action against such German industrial and munition centres as could be reached. Accordingly he formed the 41st Wing, under the command of Lieutenant-Colonel C. L. N. Newall, with headquarters at Bainville-sur-Madon and an aerodrome at Ochey. Up to the 5th June, 1918, when

it became the Independent Air Force, this force carried out no less than 142 raids.

Major-General Sir Hugh Trenchard arrived from England to take over the command on the 6th of June. The machines he used consisted of Handley Pages, D.H.9a's, D.H.4's, F.E.2b's with a squadron of Camels for protection against enemy fighters. Between them, during the last five months of the War, they dropped 160 tons of bombs by day and 390 tons by night.

The moral effect of this intensive campaign, quite apart from the material damage done, seems to point to the correctness of the R.N.A.S. policy. The Reichstag was inundated with petitions from the Rhine towns requesting that an arrangement be made with the Allies for the cessation of reprisals. Leaving the military issue on one side, it is possible that if we had been able to reply effectively to the Zeppelin raids by raining bombs on enemy non-combatants immediately they started in 1915, the German people would have insisted on the air war being confined to targets which pertained unmistakably to war.

Towards the end of the War a special group was formed to bomb Berlin from England. They were to be equipped with super Handley Pages, but the machines were not ready until three days before the signing of the Armistice.

The successful advance of the Allies was not confined to the Western Front. In every other theatre of operations, the Central Powers were weakening under the steady pressure exerted against them. On the 15th of September a united assault was launched along the whole front in Salonika. The British objective was the heavily fortified Bulgarian position from the Vardar River to Lake Dovran. The Royal Air Force co-operated both before and during the battle. There was practically no opposition from enemy aircraft and the work of the artillery, bombing and contact-patrol machines was carried out with the precision of a manœuvre exercise.

On the 22nd the Bulgars evacuated their whole line. As they retired they were pursued by aircraft sometimes flying as low as twenty feet. The incessant shower of bombs and machine-gun bullets from the air turned many of the roads into a shambles. The complete disorganisation of the traffic created a block which the panic-stricken

rout was unable to pass. The Kresna defile was a hell. The whole country from the Cestovo Valley to Kosturino was strewn with dead horses and oxen, piled up corpses of men, broken transport and ammunition wagons, derelict guns and abandoned munitions of all kinds.

The British entered Bulgaria on the 25th of September through the Kosturino Gap, and an armistice was signed on the 29th. Hostilities ceased at noon on the 30th.

In Palestine, the final offensive began on the 19th of September. Its success was due in a large measure to the supremacy which the Royal Air Force had established over the German-piloted aircraft of the Turkish Army. Before the attack started, offensive patrols were continually maintained to prevent the enemy gaining any knowledge of our dispositions. This was particularly important, since the strategy of General Allenby's attack included the employment of a large force of cavalry, which was to advance through a gap made by the infantry, and take the enemy in the rear. Three cavalry Divisions were massed in close order on the beach. Had they been spotted by an enemy air observer and the artillery turned on to them, the result might have been disastrous.

The infantry began the assault at 4.45 a.m., after a fifteen minutes' bombardment. By 7.30 the 60th Division had captured their objectives on the left flank, and the cavalry were through. By the 20th they had occupied Beisan and Nazareth. The Turkish Eighth Army was rolled right back from the coast, and the Seventh Army began to retire. The cavalry had closed the road to the north and the now disorganised force tried to break out East, across the Jordan. The British forces closed in on them like a pincers whilst, overhead, aircraft harassed them with incessant attacks. By the 24th, both the Seventh and Eighth Armies had ceased to exist.

Meanwhile, the Turkish Fourth Army had been defeated by Chaytor's Force. The crossing of the Jordan at Jisr Ed Damiye had been seized by a British detachment, which isolated them on the East of the river. Their retreat to Damascus was cut off by the Sheriffian Arabs, who had cut the Hejaz railway at Deraa.

By the 26th we had captured Haifa and Acre, and Damascus was entered on the 1st of October. The subsequent advance was so rapid that there was little for

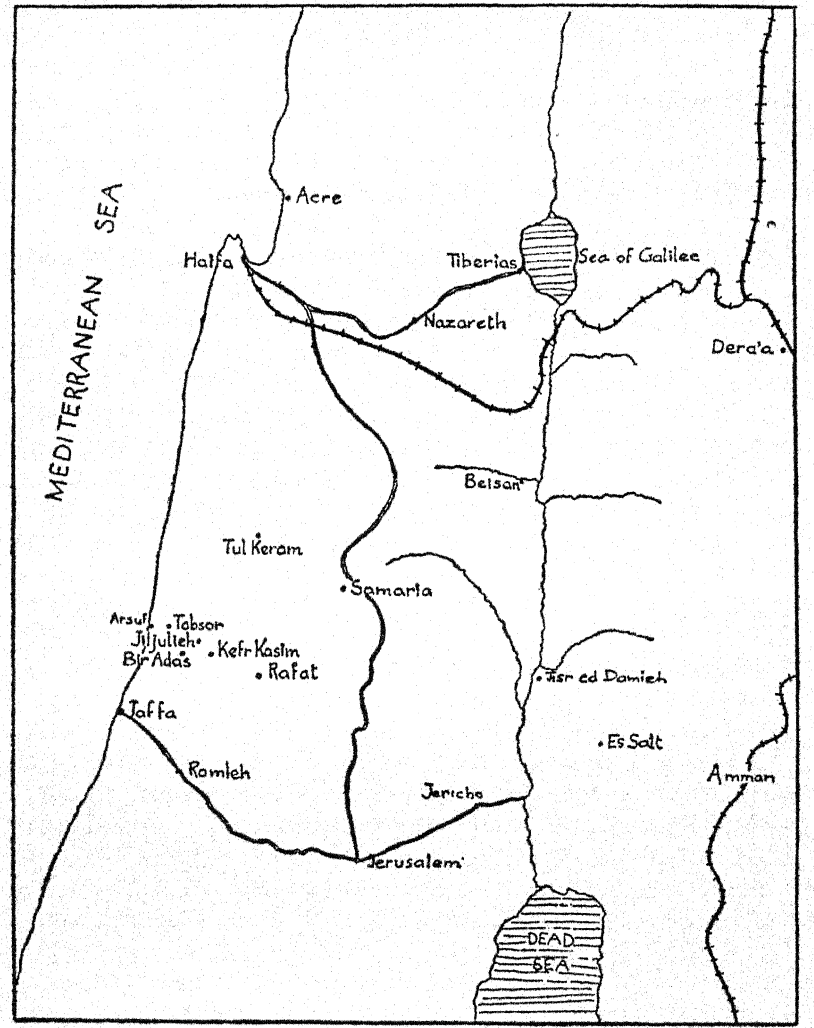
the Air Force to do, beyond harassing the retreating enemy. In five and a half weeks the Allies advanced 300 miles, taking 75,000 prisoners, 360 guns and a vast quantity of stores. The armistice with Turkey came into force at noon on the 31st of October.

General Allenby's overwhelming success in Palestine had a definite repercussion in Mesopotamia. The operations on the Euphrates ceased early in April, and except for a series of minor engagements there was no action of great strategic importance until October.

In no country where we were engaged in warfare was the work of the Air Force more valuable than in Mesopotamia. Long flights carried out daily over wild and desolate country saved the ground-troops many difficult marches, yet enabled us to keep a close watch on the enemy and continually annoy them with bombing attacks. Patrols were regularly maintained over all lines of communications, right into Persia and Kurdistan. Two Martinsydes of No. 72 Squadron operated from an aerodrome at Baku on the Caspian Sea during the first fortnight in September, considerably assisting the tiny British force which was besieged there.

On the 23rd of October an advance was begun on Mosul. Low-flying aeroplanes drove the Turks from their strong position at the Fat-ha Gorge on the Tigris. A British column marched up by the side of the river, whilst another took the road through Kifri and Kirkuk. The Turks were discovered by the Royal Air Force, in a maze of hills near Huwaish, and heavily bombed, and 7000 surrendered to the enveloping infantry. Mosul was occupied on the 3rd of November.

With the exception of an unsuccessful attack by the Austrians in June, the British front in Italy was comparatively quiet until the end of October. On the night of the 23rd, British infantry of the Seventh Division crossed the swift-running Piave and captured the island, Grave di Papadopoli. This established a jumping-off point for the main offensive, which began on the 27th. Although the Italians on either flank were unable to cross the river, the Seventh and Twenty-third Divisions went forward to their final objectives. Their success enabled the Italians to advance. After four days of open warfare, the whole of the Austrian Army was in retreat.


MEDITERRANEAN SEA
Acre
Haifa
Tiberias
Sea of Galilee
Nazareth
Dera'a
Beisan
Tul Keram
Samaria
Arsuf
Tabsor
Jiljulieh
Kefr Kasim
Bir Adas
Rafat
Jisr ed Damieh
Jaffa
Es Salt
Ramleh
Amman
Jericho
Jerusalem
DEAD SEA

PALESTINE

As in Salonika, Palestine and Mesopotamia, pilots of the Royal Air Force inflicted terrible casualties on the retiring enemy, turning what might have been an orderly rearguard action into a disorderly rout. There had been considerably more opposition on this front from enemy aircraft, but the R.A.F. always held the upper hand. During the year they accounted for three hundred and seventy-three enemy aircraft, drove thirty-two down out of control and destroyed twenty-five kite balloons. The losses on our side were only forty-five aeroplanes missing and three kite balloons destroyed.

In addition to their work of hunting submarines and escorting convoys, the units of the Royal Air Force in the Mediterranean carried out a continuous series of bombing-raids against enemy ports and lines of communication wherever they could be reached. On the Gallipoli Peninsula, the Dedeagatch–Bodoma–Ferejik–Adrianople Railway, the Turkish–Bulgarian frontier, Durazzo, Constantinople and many other places, the enemy were never sure that they would not presently hear the unmistakable hum of aeroplane engines, followed shortly afterwards by the peculiar whistle of falling bombs. Machines of the 66th and 67th Wings of the Adriatic Group also co-operated with the Italians during their offensive on the Albanian front in July.

The Germans in France were now facing an inevitable defeat. Their only hope, and it was a slender one, was to hold out on their strong defensive position until the winter weather made further operations against them impossible, so that they would have a breathing-space for reorganisation. The Allies, under Marshal Foch, were resolutely determined to allow the enemy no respite.

There was to be a combined offensive. The Americans in the south were to advance through the Argonne Forest on Mexieres. The British were to attack Cambrai. The French filled the space between, whilst in the north, the Belgians and the British Second Army were to attempt to clear the Belgian coast.

The assault was everywhere successful. The attack in the Argonne began on the 26th of September. The British advance commenced the following day. The enemy resisted doggedly and repeatedly counter-attacked, but it was of no avail. The Flesquières Ridge and the

heights of Bourlon were overrun. The following day the Third Army crossed the Scheldt Canal at Marcoing, whilst the Fourth Army stormed Bellenglise. The French took St. Quentin on the 1st of October, and by the 5th, the whole of the famous Hindenburg line was in our hands.

Meanwhile, the Second Army and the Belgian Army had stormed the Passchendaele Ridge. The whole line, from Voormezele to the Yser, moved forward on the 28th of September without a preliminary bombardment. The Germans were taken completely by surprise. They had depleted their defence to a screen to reinforce the south and they were simply swept away.

This success forced them to withdraw in front of Lens. On the 14th a fresh advance pushed them still further back, and by the 20th the Allies' left flank rested on the Dutch frontier. The Belgium coast was clear.

The air units at Dunkirk took a well-deserved part in this advance. For over four years they had opposed the enemy attacks from the Belgian seaplane bases, and it was only meet that they should supply the aircraft co-operation for the final victory.

Their work was mostly of an offensive nature, independent of ground operations. Enemy reserves were engaged with machine-gun fire and the old targets of Thourout, Cortemarck and Lichtervelde were heavily bombed. On the 17th several reconnaissances were made to see if the coastal towns were still occupied. As the Germans retired, all efforts were concentrated on disorganising his communications, which enabled the naval pilots to indulge in low-flying attacks.

Cambrai was taken on the 8th of October and the advance still continued. Everywhere, as they retired, the Germans wrought havoc and destruction in a vain effort to avert their end. Scarcely a bridge was left standing, and the whole countryside was a blaze of fires.

The French entered Laon on the 13th. On the 20th the Third Army and part of the First attacked the line of the Selle, north of Le Cateau. In the north, the Fifth Army reached the River Scheldt, north of Valenciennes. Valenciennes was entered on the 2nd of November. By the 8th the whole German line was in retreat. Maubeuge and Renaix were taken on the 9th, and on the 11th the

Canadians entered Mons. We were back where we started from in 1914.

Much rain and mist interfered with the operations of the Air Force on the last few days of the War. The enemy air service was still fighting with good heart and there were many combats. But aircraft continued to bomb the enemy's railways and lines of communication; artillery co-operation machines carried on with their work of directing the artillery on to the German batteries; contact patrol pilots reported the positions reached by the infantry and harassed the enemy strong-points. The almost perfect organisation went about its work with an ever-increasing efficiency.

Sir Douglas Haig's despatch, "The Advance to Victory," officially records the opinion of the Commander-in-Chief.

"During the past year the work of our airmen in close co-operation with all fighting branches of the Army, has continued to show the same brilliant qualities which have come to be commonly associated with that Service; while the ever-increasing size of the Royal Air Force and the constant improvement in the power and performance of machines, combined with the unfailing keenness of pilots and observers, have enabled intense activity to be maintained at all times.

"Some idea of the magnitude of the operations carried out can be gathered from the fact that, from the beginning of January 1918, to the end of November, nearly 5500 tons of bombs were dropped by us, 2953 hostile aeroplanes were destroyed, in addition to 1178 others driven down out of control, 241 German observation balloons were shot down in flames, and an area of over 4000 square miles of country has been photographed, not once, but many times.

"The assistance given to the infantry by our low-flying aeroplanes during the battles of March and April, was repeated during the German offensives on the Aisne and Marne, on both of which occasions, British squadrons were despatched to the French battle front and did very gallant service. During our own attacks, hostile troops and transport have been constantly and heavily attacked, with most excellent results.

"Both by day and night, our bombing squadrons have continually attacked the enemy's railway junctions and

centres of activity, reconnaissance machines have supplied valuable information from both far and near, while artillery machines have been indefatigable in their watch over German batteries and in accurate observation for our own guns. In these latter tasks our balloons have done most valuable work, and have kept pace with admirable energy and promptness with the ever-changing battle line."

The Armistice came into force at eleven o'clock on the 11th of November, 1918. The War was over.

CHAPTER TWELVE

AFTERWARDS

THE predominant thought in everyone's mind on the 12th of November, 1918, was "What next?" Although the period for which the Armistice was signed was no longer than thirty-six days, no one could contemplate that the option to extend it would not be exercised. The possibility that the guns would once more thunder out their message of death was unthinkable. To most, Armistice was synonymous with Peace. And since the pre-War conditions of peace time were no more than a half-forgotten memory, the prospect which the future held was something of a mystery.

Those who controlled the Royal Air Force were in a unique position. They directed an organisation which grim necessity had welded into an instrument of the finest temper. Now that its work was done, they could put it in the melting-pot, and, whilst preserving those components that were essential to its future efficiency, re-mould it in miniature.

At the outbreak of war the R.F.C. consisted approximately of 150 officers and 1100 other ranks, the R.N.A.S. of 50 officers and 550 other ranks. At the cessation of hostilities, the Royal Air Force had a strength of 28,000 officers and 264,000 airmen. As most of this huge force was enrolled in the service solely for the duration of the War, the Air Council were at liberty to choose whom they would retain. Applications were invited for permanent commissions, but before they could be granted a decision had to be reached regarding the peace-time organisation, which would determine the number of vacancies to be filled.

Whilst this was being prepared, demobilisation went on apace. Squadrons were brought home from active service and their personnel was absorbed in peace-time

duties. By the end of 1919, 26,000 officers, 21,000 cadets and 227,000 airmen had received their discharge papers.

The first post-War permanent commissions were gazetted on the 1st of August, 1919. There were 6 Major-Generals, 17 Colonels, 79 Lieutenant-Colonels, 176 Majors, 294 Captains and 493 Lieutenants. A total of 1065 officers of all ranks. It was announced at the same time that officers of the Royal Air Force would be distinguished from the other services by distinctive titles which would emphasise that the new arm was definitely an independent unit.

The titles chosen and their equivalent rank in the Navy and Army are set out below:

AIR FORCE	NAVY	ARMY
Marshal of the Royal Air Force	Admiral of the Fleet	Field-Marshal
Air Chief Marshal	Admiral	General
Air Marshal	Vice-Admiral	Lieutenant-General
Air Vice-Marshal	Rear-Admiral	Major-General
Air Commodore	Commodore	Brigadier
Group Captain	Captain	Colonel
Wing Commander	Commander	Lieutenant-Colonel
Squadron Leader	Lieutenant-Commander	Major
Flight Lieutenant	Lieutenant	Captain
Flying Officer	Sub-Lieutenant	Lieutenant
Pilot Officer	Midshipman	Second Lieutenant

The first Air Chief Marshal was Sir Hugh Trenchard. He had made the Air Force what it was in war-time, and contributed as much as any single individual to the ultimate Allied success. As Chief of the Air Staff it was his job to design the foundation on which the service should be re-built in peace. The world was exhausted and there was no prospect of a renewal of hostilities in the near future. There was plenty of time to make the

footings sound. He decided on a highly trained nucleus capable of an infinite expansion.

His suggestions were contained in a White Paper which was submitted to Parliament by Mr. Winston Churchill, the Secretary of State for Air, in December 1919. Whilst special squadrons would be trained for co-operation with the Navy and the Army, the main force would be entirely independent of the older services, trained to operate separately in its own element, which the War had shown to contain so many possibilities.

Squadrons were reduced to an absolute minimum. Most service units were allotted to foreign stations. India took eight, Egypt seven, Mesopotamia three, Malta and Alexandria one flight of seaplanes each, whilst a seaplane carrier was allotted to the Mediterranean.

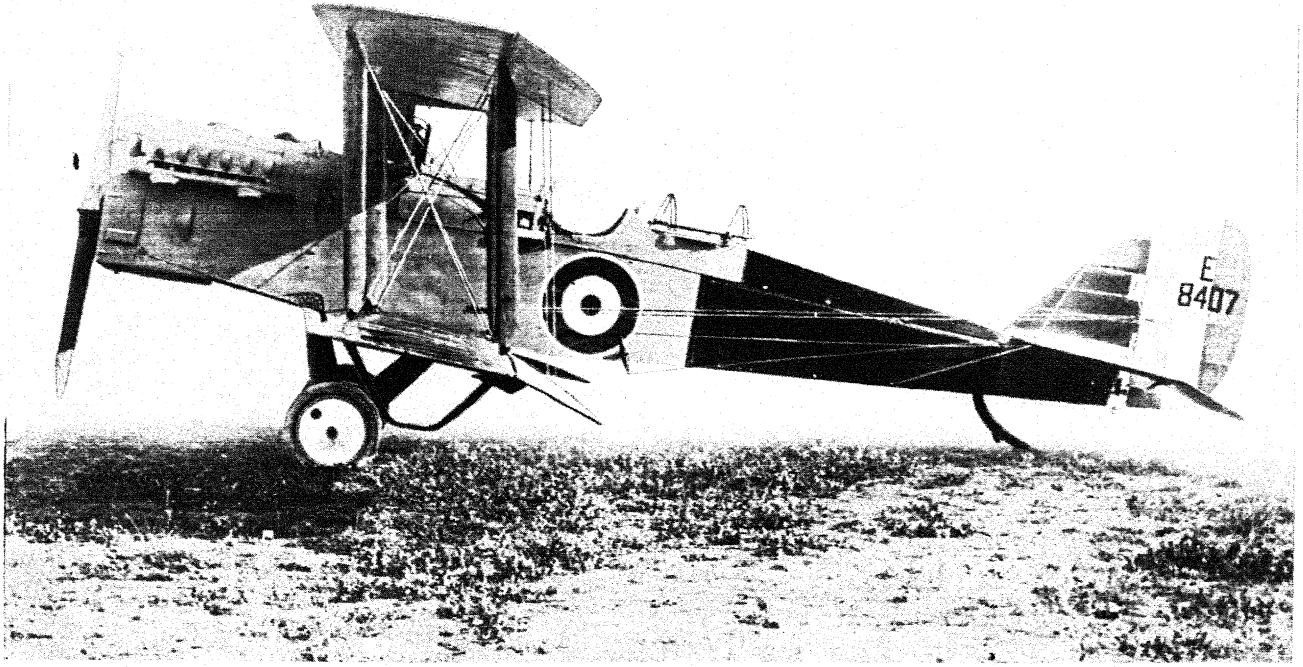
The Home Force was organised in two separate Commands—the Coastal Area and the Inland Area. The Coastal Area controlled all units working with the Navy, including airships. Provision was made for three aeroplane and two seaplane squadrons, although these were not fully established at the beginning.

The Inland Area controlled a small striking force which was laid down as four squadrons. Army co-operation would be on the basis of one flight for each division with additional squadrons for the artillery.

Sir Hugh was emphatic on the preservation of the Air Force spirit which he had been at such pains to foster during the War. He fully realised the value of tradition. In order that the records of those squadrons which had done especially well in war should give character to the growing service, he recommended that their numbers should be perpetuated.

Since the future of the Service depended entirely on the training of its personnel he advocated the creation of an Air Force Cadet College; an Air Staff College; and a depot for training mechanics and riggers.

The Royal Air Force Cadet College was opened at Cranwell in February 1920 with Air Commodore C. A. H. Longcroft as its first Commandant. The Royal Air Force Staff College was opened on the 4th of April, 1922, with Air Commodore H. R. M. Brooke-Popham as the first Commandant. Aircraft apprentices began to be trained straight away at Halton Park, near Wendover. With his



By the courtesy of "Flight"

D.H.9A
A long-distance day bomber used extensively in Iraq.

usual long-sightedness Sir Hugh decided to enlist boys and give them a thorough three-years' training in a particular trade before they were absorbed in the ranks. In this way they would have a trade to practise when they eventually passed out of the Service into civil life.

The Short Service Commission Scheme was put into operation right at the beginning. Only 50 per cent of officers were granted permanent commissions. The remainder were obtained from trained pilots who had served in the War. In 1920 the scheme was extended to civilian candidates and is still in existence although the age limit for entry has been gradually reduced to twenty-one.

Immediately after the Armistice, Major-General W. G. H. Salmond decided to make a tour of inspection of the units under his command in the Middle East. He set out from Cairo in a Handley Page on the 29th of November, 1918, accompanied by Brigadier-General A. E. Borton and Captain Ross Smith. After reaching Baghdad on the 1st of December they carried on to India, arriving on the 12th. The object of this extension was to survey the possibilities of an Imperial Air Route.

The year 1919 saw a number of remarkably fine flights. In addition to the migration of squadrons homewards for demobilisation or to their new stations overseas, there were some outstanding performances on service-type machines by pilots who had served in the Air Force during the War. On the night of the 14–15th of June, Captain John Alcock with Lieutenant Arthur Whitten Brown as navigator, flew a Vickers "Vimy" across the Atlantic from St. John's, Newfoundland, to Clifden on the coast of Ireland. Their time was only sixteen hours twelve minutes. This was the very first time the Atlantic had ever been flown.

A fortnight later the Naval Rigid Airship R.34, set out for America under the command of Major G. H. Scott, A.F.C. It started on the 2nd of July and reached home at the end of the return journey on the 13th. During the whole of its 6000-miles' flight, it maintained wireless communication with the Air Ministry in London.

The first flight to Australia took place towards the end of the year. A Vickers "Vimy" piloted by Captain Ross Smith, M.C., D.F.C., A.F.C., and Lieutenant K. M.

Smith, left Hounslow on the 12th of November and arrived at Port Darwin on the 10th of December.

No one was successful in reaching Cape Town until March 1920. Wing Commander H. A. Van Ryneveld and Flight Lieutenant C. J. Q. Brand left Brooklands in a "Vimy" on the 4th of February. After many adventures, during which they crashed two machines, they eventually landed at Cape Town in a D.H.9 on the 20th of March.

Although the war with Germany was over, martial operations still continued in different parts of the world. When Germany and Russia made peace in March 1918 various considerations forced us to take action. There was a possibility of the Germans establishing submarine bases at Archangel and Murmansk. We also had to lend assistance to the pro-Allied Czechs. Consequently an expeditionary force was despatched in June 1918 followed by a French contingent. A flight of D.H.4's accompanied the detachment and were followed in July by the seaplane-carrier *Nairana*. The R.A.F. co-operated in all the operations undertaken by the Allied forces until North Russia was evacuated at the end of 1919.

We still maintained a force in South Russia in support of the Russian Army under General Denikin which was opposing the Bolsheviks. The R.A.F. had a Wing with headquarters at Petrovsk on the Caspian Sea. In the spring of 1919 they carried out a number of reconnaissances to see if the ice was breaking so that the Bolshevik flotilla would be let out of the Volga. When the flotilla succeeded in reaching Port Alexandrovsk, they flew across and bombed it.

A training mission was established at Novorossisk on the Black Sea in May. Reinforced by No. 47 Squadron the R.A.F. units co-operated with General Denikin in several small actions. There were also numerous bombing raids on Astrakhan and on the Bolshevik ships. Astrakhan was defended by aircraft and there was some fighting.

Notable work was performed by a flight of Camels of No. 47 Squadron under Captain S. M. Kinkhead. They carried out a number of low-flying attacks in co-operation with cavalry of General Wrangel's force. By the beginning of 1920 it was realised that the Russian Nationalist campaign had failed and our troops were evacuated.

The year 1919 also saw the third Afghan War. Aircraft accompanied the expedition which pushed through the Khyber Pass under the command of Sir Charles Monro. A number of reconnaissances were carried out, and bombing attacks were made on enemy back areas. There was a magnificent flight by a four-engined Handley Page, piloted by Flying Officer R. Halley. He dropped several bombs on Kabul, a gesture which took the enemy completely by surprise.

Later in the year there was another rising by the Mahsuds in Waziristan which the Royal Air Force assisted in suppressing.

By the end of October every service Squadron had returned from France and there was only one on the Rhine. This—No. 12 Squadron (Bristol Fighter)—remained until July 1922, when it was disbanded at Bickendorf.

In order that members of H.M. Government attending the Peace Conference should travel between London and Paris with the least possible delay the 86th (Communication) Wing was formed at Hendon. At first there was only a small detachment at Paris, but later a second squadron was established at Buc whilst No. 1 moved from Hendon to Kenley.

Another cross-Channel service was established between Folkestone and Cologne for Army mail for the Army of Occupation. This continued between March and August 1919. A postal service was also maintained in Egypt between Alexandria, Cairo, Ismailia, Port Said and Suez during the rising in March 1919.

Somaliland was the next theatre of war in which the Royal Air Force operated. Mohammed bin Abdullah Hassan, known as the "Mad Mullah," had caused the British Administration a lot of trouble ever since 1895. Ground operations prior to the War had failed to round him up, but it was expected that the Air Force would be more successful.

The "Z" Force Expedition left Egypt in December 1919 under the command of Group Captain Robert Gordon in the carrier *Ark Royal*. A base was established at Berbera with advanced landing-grounds up-country. Bombing raids caused heavy casualties amongst the tribesmen and drove them into the desert. Several

reconnaissances were carried out in co-operation with the Camel Corps. The enemy was consistently driven out of his forts until Tale Fort was bombed and occupied early in February. The Mullah managed to escape, but his prestige was broken and his following dispersed.

A small detachment of D.H.9a's, known as " H " unit, also accompanied a punitive expedition against the Garjak Nuer tribe in the south-east of the Sudan. The expedition went up the Nile River to Nasser Port in a steamer with five barges lashed to its bows. The air work consisted of reconnaissance, the maintenance of contact between the two infantry columns, and attacks on the tribesmen with machine-guns and bombs. The operation was highly successful, forcing the native chiefs to cry for peace.

Great Britain accepted the mandate for Mesopotamia in April 1920. Almost immediately afterwards the Administration was faced with an insurrection in the lower Euphrates. The house of the Political Officer at Shatrah was surrounded, but he was rescued by two D.H.9a's of No. 30 Squadron which flew over and picked him up. Another party of the rebels was attacked by machine-gun fire whilst attempting to destroy the railway line.

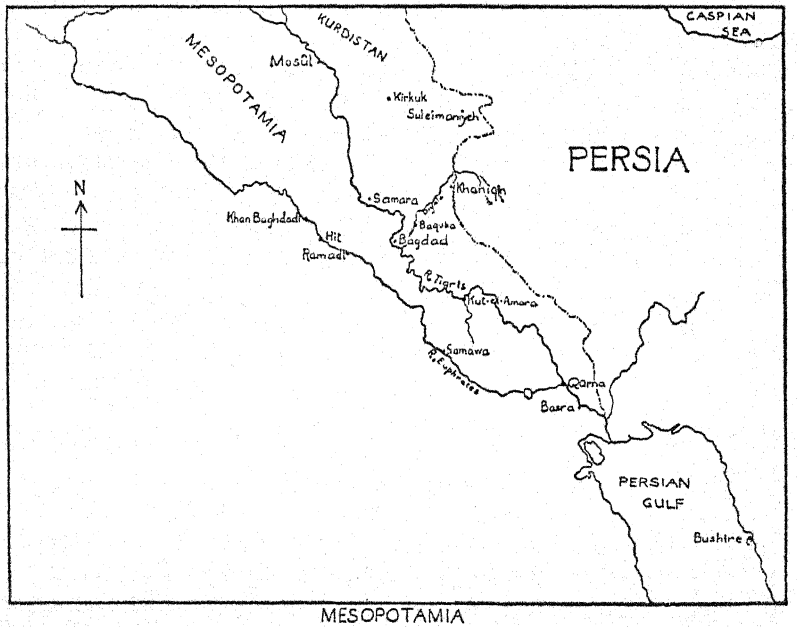
Turkish Nationalist forces were causing trouble at the same time in Anatolia. The carrier *Pegasus* was in the Black Sea and a force known as " Q " was mobilised in Egypt and shipped on the *Ark Royal* to Constantinople. It consisted of No. 55 Squadron (D.H.9 and D.H.9a) and an aircraft park, and was transferred to Mesopotamia in September.

The utility of employing aircraft for operations over vast tracks of difficult and sparsely populated country was taken into consideration at an important conference which met at Cairo in March 1921, to examine the question of mandated territories, with particular reference to Mesopotamia.

At that time there was a considerable body of troops scattered over the country. In addition to five squadrons of the Royal Air Force, with the necessary aircraft parks and stores depots, there were sixteen batteries of artillery, thirty-three battalions of infantry and six regiments of cavalry. The numbers were not at all extravagant to maintain proper order if viewed from the pre-War stand-

point. The country is over 50,000 square miles in extent. There are deserts, hills and rocky defiles to negotiate. The inhabitants were decidedly unsettled. An anti-Mandate agitation was fostered and supported by the Turks. If we were unable to suppress local outbreaks quickly and efficiently, our prestige would rapidly deteriorate.

But already, in a hundred ways, the Royal Air Force had shown what it could do. The work of No 31 Squadron



MESOPOTAMIA

on the North-West Frontier of India; Group Captain Gordon's "Z" expedition into Somaliland; the employment of aircraft during the War in East and South-West Africa and in Mesopotamia itself. There was plenty of concrete evidence of accomplishment. There was also the all-important question of cost of administration. The scheme submitted to the Conference by the Chief of the Air Staff, showing that Iraq—as Mesopotamia was to be officially called—could be controlled entirely by the Royal Air Force, disclosed an enormous reduction in expense. It was supported by Sir Percy Cox, the High Commissioner. The Conference considered it and expressed their approval.

The change-over was of necessity gradual. Eight Squadrons were regarded as the minimum requirement. No. 6 (Bristol Fighter) and Nos. 8, 30, 55 and 84 (D.H.9a) Squadrons were already in the country. No. 1 (Snipe) was transferred from India and, later, Nos. 45 and 70 Squadrons equipped with Vickers "Vernon's" from Egypt. The Army was reduced by degrees. By October 1922, when the Royal Air Force formally took over control under the command of Air Vice-Marshal Sir John Salmond, there were only nine battalions of infantry and two batteries in the country. The Air Force was strengthened by four companies of armoured cars.

Sir John Salmond's task was no sinecure. Eighteen Turkish Divisions were massed on the frontier, some ninety miles from Mosul, and it was exceedingly probable that they would make an attempt to occupy the town. Already, during the previous winter, there had been several "frontier" incidents which are usually regarded as a prelude to hostilities. The Turks had encroached into Kurdistan and been driven out again by air action.

Since the armistice the Turks had become infused with fresh blood. Under Mustafa Kemal's vigorous leadership the army had been reorganised and the national spirit inflamed. They were in the process of inflicting a crushing defeat on Greece. They had defied Italy and France. Now it was our turn. Troops crossed the neutral line in the Dardanelles at Chanak, in addition to the concentration on the frontier opposite Mosul.

The small British force in the Dardanelles was immediately reinforced. The Air Force detachment consisted of Nos. 4, 25 and 207 Squadrons from England, No. 208 Squadron from Egypt and one flight of No. 267 Squadron from Malta. This force, which was stationed at Kilia, was known as the Constantinople Wing, and remained until August 1923, when the crisis was over.

The situation in Iraq was a delicate one. If we withdrew from Mosul the Turks would be encouraged to advance. The natives would also regard it as a sign of weakness and would seize the opportunity for a rising. Sir John decided he must maintain his forward position as long as possible, although he was clearly informed that he could not be reinforced.

Five squadrons of the R.A.F. and one of the armoured

car companies, together with a mobile force of Regular Army and Iraqi Levies, was concentrated at Mosul with a flank protection of an additional squadron and armoured car company. In case the enemy should attack in overwhelming force, plans were prepared for a withdrawal to Baghdad.

Towards the end of February 1923 it was discovered that Sheikh Mahmud, the Governor of Sulaimania, was planning a general rising in conjunction with the commander of the Turkish forces. Sir Percy Cox summoned the Sheikh to Baghdad, but he refused to obey.

Air action followed swiftly. Two companies of Indian infantry were flown from Kingraban to Kirkuk, and an ultimatum was dropped to Mahmud, together with a reminder in the form of delay action bombs which exploded at six-hour intervals. He still held out, so bombing began in earnest, which drove him into the hills.

In the operations which followed, the troops at Mosul were formed into two columns, one of Imperial troops and the other of Levies. The Air Force co-operated by the bombing and machine-gunning of ground targets, the carrying of rations to forward positions, the evacuation of wounded, and in many other ways. By the beginning of June the Turkish troops were driven across the border and the tribal leaders had surrendered.

During 1922 the R.A.F. was also called upon to co-operate in Transjordania. A flight of No. 14 Squadron was sent in July to help " Peake's " Force bring the Kura District to submission. The affair did not last very long. Two days' intensive bombing enabled the ground force to occupy the district and apprehend the Sheikh who had made the trouble.

The two Vickers Vernon Squadrons in Iraq had a secondary rôle of a more peaceful nature than the protection of the country. The Cairo Conference had agreed to a proposal to establish an air route between Cairo and Baghdad. This was an important step in the linking of Empire communications. It meant a saving in time for mails of nearly three weeks between London and Baghdad. It also provided an easy way of sending aircraft ready rigged from Egypt instead of in cases via the Persian Gulf.

The route was opened on the 23rd of June, 1921, by

three D.H.9a's of No. 47 Squadron. The pilots were guided by the car tracks made by the survey party. In the following year a plough track was completed over the whole route, emergency landing grounds being marked out and numbered at average intervals of twenty miles. Later on refuelling points were established with sunk tanks and locked petrol pumps. The first mails were carried in October 1921 by D.H.9a's. As soon as the Vernon Squadrons arrived from Egypt they took over the service and continued to operate it until it was handed over to the Imperial Airways at the beginning of 1927.

Disaffection again broke out on the Lower Euphrates towards the end of 1923. This time it took only two and a half days to put down. The Sheikhs of the area were summoned to Samawa, but only one appeared. Air action followed a warning which was ignored. Vickers Vernons dropped a number of high-explosive and incendiary bombs, and the rebels gave in in under twenty-four hours.

Air Vice-Marshal Sir John Higgins relieved Sir John Salmond in April 1924. A month later a party of 150 police were attacked by tribesmen in the Diwaniyah area. The commandant was killed with three of his men. Retribution came in the form of bombs dropped by aircraft.

Sheikh Mahmud stirred up more trouble in Sulaimania a month later. He refused to surrender, with the result that forty-two aircraft dropped twenty-eight tons on the town. There were no casualties as the inhabitants had fled on receipt of the usual preliminary warning.

Towards the end of the year, when the Mosul conference held at Constantinople failed to reach an agreement, the situation at Mosul again became acute. A squadron of Vernons was held in readiness for bombing pending a decision by the League of Nations to whom the case had been referred. The League established a provisional boundary in November and conditions settled down once more to normal.

The next action was not one of discipline against Iraq, but in protection of it. Akhwan tribesmen from the Najd territory had continually raided the natives of Southern Iraq since 1920. Raids in December 1924 and

January 1925 suffered reprisals by air action with the result that the Sultan gave orders that there were to be no more in the future.

Whilst the overseas units had been rendering such an excellent account of themselves, the Royal Air Force at home had been mainly occupied with consolidation. In accordance with Air Chief Marshal Trenchard's policy, every possible effort was concentrated on the perfection of training officers and men. The result was exhibited at the Royal Air Force pageant. This display was first held on the 3rd of July, 1920, at Hendon and has continued annually ever since. Whilst it assists R.A.F. charities with financial support, it also helps to familiarise the general public with aviation and shows the tax-payer what he is getting for his money. It is now known as the Royal Air Force Display.

An extremely important announcement was made in the House of Commons in March 1922. The leader of the House, Mr. Austen Chamberlain, speaking during the debate on the Naval Estimates, stated that in the case of defence against air raids the Navy and the Army were to play a secondary rôle to the Air Force. Also, that whilst the Air Force commander was to be in strict subordination to the admiral or general in supreme command during operations on sea or land, in other cases, such as home defence, the relations between the services were to be in a spirit of co-operation rather than subordination.

The all-important question of Home Defence has bulked prominently on the national horizon ever since. In March 1923 the Government appointed a committee under the chairmanship of the Marquess of Salisbury. Its purpose was to enquire generally into the question of National and Imperial Defence, with particular reference to the air.

An interim report was issued in June 1923 which was the basis of a statement in the House on the 20th of June by the Prime Minister, Mr. Stanley Baldwin, as follows:

"In addition to meeting the essential Air Power requirements of the Navy, Army, Indian and Overseas commitments, British Air Power must include a Home Defence Air Force of sufficient strength adequately to protect us against air attack by the strongest air force

within striking distance of this country. . . . In the first instance, the Home Defence Force should consist of fifty-two squadrons, to be created with as little delay as possible, and the Secretary of State for Air has been instructed forthwith to take the preliminary steps for carrying this decision into effect. The result of this proposal will be to add thirty-four squadrons to the authorised strength of the Royal Air Force. The details of the organisation will be arranged with a view to the possibility of subsequent expansion, but before any further development is put in hand the question should be re-examined in the light of the then air strength of foreign powers."

The strength of the Royal Air Force at that time was a total of thirty-four squadrons in all. The fifty-two home defence squadrons, when created, would consist of thirty-five bombing squadrons and seventeen fighter squadrons. Six were to be Auxiliary Air Force squadrons, raised and maintained by county associations, and seven others were to be Special Reserve squadrons.

This force did not begin to be formed until 1925. When Air Marshal Sir John Salmond returned from Iraq he was appointed Air Officer Commander-in-Chief Air Defence of Great Britain. The total of fifty-two squadrons was to be reached in the course of the following five years. The command was to include all auxiliary forces, such as anti-aircraft batteries, searchlights and observation stations.

Co-operation with the Navy and Army was working smoothly, helped largely by the system of seconding officers of the older services to the R.A.F.

In April 1924 the Admiralty formed the Fleet Air Arm. Naval co-operation units were organised in flights of six aircraft and either work from a base or an aircraft-carrier. A large percentage of the pilots in the Fleet Air Arm are provided by naval officers trained by the Royal Air Force. It was also decided that all air spotting and reconnaissance duties should be carried out by naval personnel.

Airships came to the fore once again in 1924. Following the disaster to the R.38 in August 1921, when structural weakness caused it to break up in the air, causing the loss of forty-three lives, the Air Ministry had allowed

the airship service to lapse. It was revived at the instigation of Commander C. D. Burney. The R.33 seemed to justify his confidence in lighter-than-air craft. On the 16th of April, 1925, she was torn from the mooring mast at Pulham in a gale. Although badly damaged at the nose, skilful handling enabled her to ride out the storm and return safely to her mooring after being adrift for thirty hours.

The year 1925 was memorable for the equipment of the Royal Air Force with parachutes. After many experiments the make chosen for standard was the one designed by Mr. Leslie Irvin, an American. It is now compulsory for every pilot and passenger to wear a parachute whenever he leaves the ground in a service aircraft.

Towards the end of the year several long-distance service flights were undertaken with the object of demonstrating the reliability of British aircraft. In September four flying-boats from Calshot flew 2500 miles round the South of England to the North of Ireland and Scotland. A month later three D.H.9a's flew from Cairo to Kano and back. At the beginning of 1926 a special unit of four Fairey III.d's was organised for a flight from Cairo to the Cape. There was also a flight from Cairo to Aden in 1926 by two Vickers Victorias, and a cruise round the Mediterranean in flying-boats.

There was more trouble in the Middle East in October of this year. A party of Syrian raiders looted a number of camels from territory south of Basra. A Vernon Squadron was detailed for the counter-action as there were no proper communications and the base which was formed at Rutbah had to be supplied by air. During nine days, five Vernons delivered two tons of stores and over 3500 gallons of petrol.

In 1927, the Air Council gave permission for Service aircraft and personnel to compete in the contest for the Schneider Maritime Trophy. A high-speed Flight was trained at Felixstowe and sent to Venice where the contest was won by Flight Lieutenant S. N. Webster, in a Supermarine S.5. His average speed for the course of 217·35 miles was 281·49 miles per hour, which was the fastest that an aircraft had ever attained.

This speed was beaten immediately afterwards by an

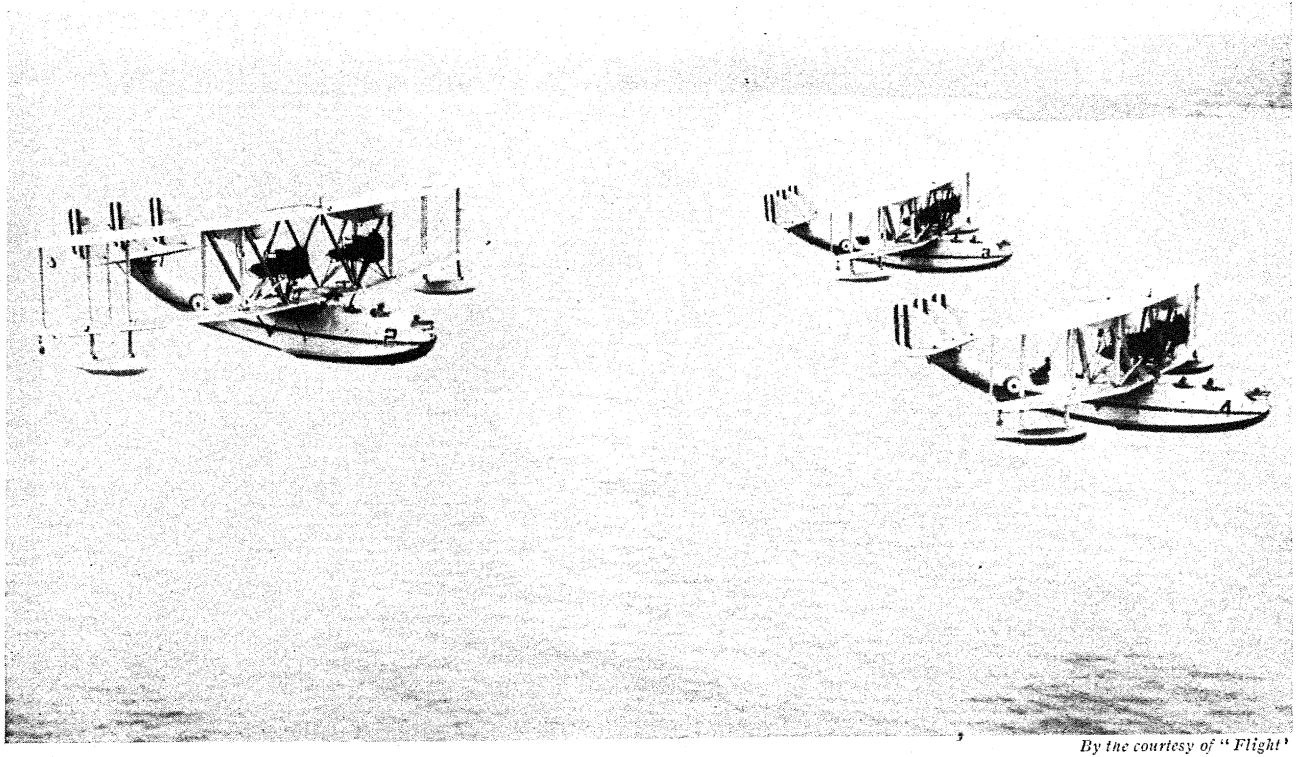
Italian, and the high-speed Flight made several unsuccessful attempts to win it back. There was an unfortunate accident during a practice flight when Flight Lieutenant S. M. Kinkhead, D.S.O., D.S.C., D.F.C., crashed in the Solent and was killed.

The next Schneider Trophy contest was held over the Solent in 1929. Squadron Leader A. H. Orlebar was appointed to the command of the High Speed Flight, and several machines were specially designed. The Supermarine Company built two S.6 type machines, engined by Rolls-Royce, and the Gloster Company built two others with Napier engines. This contest was won by Flying Officer H. R. D. Waghorn, in one of the S.6's, at an average speed of 328·63 miles per hour. A few days later Squadron Leader Orlebar captured the World's Speed Record for Great Britain at 357·7 miles per hour.

Two years later the Trophy was won outright by the High Speed Flight with Squadron Leader Orlebar still in command. Flight Lieutenant J. N. Boothman flew the winning machine, an S.6b, at an average speed of 340·08 miles per hour. A few days later, Flight Lieutenant G. H. Stainforth raised the World Speed Record to 407·5 miles per hour. This record remained with the Royal Air Force until the 10th of April, 1933, when Warrant Officer Agello of the Italian Air Force took it from us with an average speed of 423·76 miles per hour. Government policy and not inclination is all that prevents the Royal Air Force from regaining it.

Another record attempted by the Royal Air Force in 1927 was the World's Distance Record. Flight Lieutenant C. R. Carr, D.F.C., A.F.C., and Flight Lieutenant L. E. M. Gillman flew from Cranwell to the Persian Gulf, a distance of 3400 miles in 34¾ hours. Their machine was a Hawker Horsley, with a Rolls-Royce engine. This record did not last very long, being beaten almost at once by Colonel Charles Lindberg in his flight from America to Paris.

Squadron Leader Jones-Williams, M.C., and Flight Lieutenant N. H. Jenkins, O.B.E., D.F.C., D.S.M., made the next attempt in April 1929. They succeeded in reaching Karachi, which is 4130 miles, but it was not enough to beat the record which was then standing. Their aircraft was a specially built Fairey monoplane with a Napier engine. In December of the same year they



By the courtesy of "Flight"

VICKERS-SUPERMARINE "SOUTHAMPTON"
Four of these giant flying-boats covered 30,000 miles on a cruise to the Far East.

started to fly to the Cape of Good Hope, but by some mischance they hit a mountain in the Atlas Range, near Tunis, and both were killed.

In October 1931, Squadron Leader O. R. Gayford and Flight Lieutenant D. L. G. Bett flew from Cranwell to Abu Sueir, in Egypt, to test a new monoplane which the Fairey Company had built. They returned by easy stages and prepared to make the long-distance flight to the Cape as soon as the weather was suitable. Unfortunately, Flight Lieutenant Bett died in the meantime.

Flight Lieutenant G. E. Nicholetts took his place and the flight was made in 1933. A distance of 5309 miles was covered in 57 hours 25 minutes, the machine alighting in Walvis Bay with scarcely half an hour's supply of petrol.

This was a new record, but again it was not held very long by the Royal Air Force. On the 7th of August, 1933, M. M. Codos and Rossi beat it with a flight of 5657·6 miles from New York to Rayak in Syria.

The year 1927 also saw further long cruises by flying-boats. Four aircraft of the Flying Boat Development Flight—a Saunders Valkyrie, a supermarine Southampton, a Blackburn Iris II and a Short Singapore—flew 9400 miles round the Baltic on an experimental cruise.

In October of the same year, four Supermarine Southamptons with Napier engines set out from Cattewater for the Far East, for the new flying-boat base which had been opened at Singapore. After an overhaul in India, they flew right round Australia and up to Japan before reaching their destination. The total distance was 30,000 miles, but the flight was accomplished without a single engine failure. Group Captain Cave-Browne-Cave was in command.

There have been many long flights by flying-boats since then, but none of the same length. Three Southamptons flew to a new base at Basra in the Persian Gulf in 1929, under the command of Wing Commander Welsh. Shortly afterwards, two of them made a survey flight to Muscat in connection with the present route of the Imperial Airways. The three Southamptons were replaced in 1931 by three Short Rangoon-flying boats, each of which had three Bristol Jupiter engines.

One Blackburn Iris III flew to Iceland in 1931 for the Millenary celebrations of the Icelandic Parliament. A Short Singapore II and a Saunders A.7 flew from Felixstowe to Port Sudan and back. In 1932, three Southamptons made a cruise to the Baltic and back. During the flight they took part in the opening ceremony of the Copenhagen Exhibition, which was performed by H.R.H. the Prince of Wales.

The area round Aden was placed under air control in 1928. Group Captain W. G. S. Mitchell was given the command of all British forces of which No. 8 Squadron (Bombing) represented the R.A.F. Shortly afterwards the Imam Wawa of Sana, in the Yemen, invaded the Protectorate with a powerful army and captured two Sheikhs who were under British protection. The Imam was bombed into submission, after due warning.

In addition to its garrison duties, the air detachment at Aden has also performed some valuable civil duties. It assisted materially in the survey of the Somaliland–Abyssinian border. It also maintains a fortnightly mail service to Perim and Kamaran. A flight under Squadron Leader Vachell took part in the ceremonies at Addis Ababa for the coronation of the Emperor of Ethiopia.

When the Shinwari tribe in Eastern Afghanistan rebelled against King Amanullah at the end of 1928, the British Legation at Kabul was isolated. Between the 23rd of December and the 25th of February, 586 persons of various nationalities were evacuated by the Royal Air Force. The machines used were mostly Vickers Victorias, specially sent from Iraq for the purpose.

The history of the North-West Frontier of India is made up of incidents between the tribesmen of the trans-frontier districts and the frontier outposts. Since the advent of the Royal Air Force, the periodical disturbances have been dealt with more and more by aircraft, which are now recognised as more efficient and less costly than punitive expeditions by ground troops. Time and again, serious trouble has been averted by a demonstration of a Squadron in formation flying over the disaffected areas. On those occasions when the natives have got out of hand air action has speedily brought them back to their senses.

In April 1930, six squadrons were engaged in extensive operations, lasting several weeks, in the defence of

Kurram. It was the height of the hot season, but despite the trying conditions, the Air Force dealt efficiently with the situation in co-operation with the Army. There was another outbreak in 1932, when air action was taken against the Haji of Turangzai. A year later, aircraft assisted in operations during a rising on the Afghan border.

Conditions in Iraq and the Middle East were very similar. From time to time isolated tribes would cause trouble. A warning would be dropped from the air and, if ignored, a bombing campaign of varying intensity would follow, until the situation became once more normal. No. 14 (Bombing) Squadron took action against the Beni Sukhr tribe in March 1929, in conjunction with ground troops and armoured cars. Infantry reinforcements were flown from Egypt to Palestine in August of the same year, to help quell the serious disorders that had broken out. The Air Force was not used in this operation except for reconnaissance, although five Flights were concentrated in readiness at Amman. But, even when there were no disturbances, aircraft regularly patrolled the borders as a matter of routine. The sight of the machines overhead was calculated to act as a deterrent to potential raiders, just as the policeman on his beat reminds the criminal of the power of law and order.

Iraq was recommended for admission to membership of the League of Nations in 1929. The Iraq Government was encouraged to take control and fend for itself. Sheikh Mahmud was still causing trouble in Sulaimania, but in 1930 he was finally driven into Persia. In 1931 the newly formed Iraq Air Force and the Iraq Army operated against Sheikh Ahmed in Barzan with R.A.F. support. The rebels retired into caves, but were harried night and day by aircraft, until resistance was broken down.

The year 1930 witnessed the final end of airships in this country as the result of the shocking disaster to the R.101. At that time the R.101 was the biggest airship in the world, and great things were expected of her. She was 777 feet long, had a girth of 132 feet, and an overall height of 140 feet. Her cubic capacity was 5,500,000 cubic feet, which gave her a gross lift of nearly 166 tons in normal conditions. Nevertheless, on an experimental flight to India by way of Ismalia, she struck the ground near Beauvais about two o'clock in the morning of the

3rd of October, and was completely destroyed by fire. Forty-eight persons lost their lives of the complement of fifty-four passengers and crew she was carrying.

The present Chief of the Air Staff is Air Chief Marshal Sir Edward L. Ellington, K.C.B., C.M.G., C.B.E., A.D.C. Sir Hugh Trenchard resigned the appointment at the end of 1928. A year earlier he had been promoted to Marshal of the Royal Air Force. On his retirement he was created Baron Trenchard of Wolfeton in the County of Dorset. He was succeeded by Sir John Salmond. Air Chief Marshal Sir Edward Ellington was appointed on the 22nd of May, 1933.

Many thousands of hours are flown annually by pilots of the Royal Air Force in the course of their duties No flight is undertaken without some definite purpose in view. It may be only a few circuits of the aerodrome to practise landing ; it may be an endurance flight of many hours ; it may be with a load of death-dealing bombs to preserve order in some outpost of Empire. Whichever it is, it is carried out as a matter of course, cheerfully and efficiently.

There has been no room in this chapter to give any account of the daily work which is going on at every station of the Royal Air Force throughout the Empire. Regular routine aiming all the time at greater effectiveness. Behind the scenes, a ceaseless research for improvement in machines and engines. Experts concentrating their trained minds on the problems which still remain to be solved.

Perhaps I might mention one routine job that is carried through daily in all weathers. The Meteorological Office is under the control of the Air Ministry. The weather forecasts, which are made two or three times a day, are based on information obtained from as many sources as possible. Data is required of conditions in the upper atmospheres as well as on the ground.

There is a special Meteorological Flight at Duxford which sends a pilot twice a day to an average height of 25,000 feet. He has to take accurate readings of special instruments all the way up and check them over again on the way down. When specially designed aircraft, specially equipped, flew over Mount Everest and took photographs, it was heralded as a remarkable achievement. I am not belittling it. It was a very fine perform-

ance. The members of the expedition had to face unknown air currents which might easily have spelt disaster. But next time you hear those nicely modulated accents announce, "Weather forecast for to-night and to-morrow..." think of the pilot who has been aloft in the ordinary course of his duty to find out whether you should carry an umbrella to-morrow, or not. His work, performed unostentatiously, without fuss, typifies the spirit of the Royal Air Force.

CHAPTER THIRTEEN

THE THEORY OF FLIGHT

THERE are very few people alive to-day who have never seen an aeroplane. There are very many, however, who have not the slightest conception, how a weight, without any natural buoyancy, can be raised from the ground and flown.

This chapter is not in any sense a technical treatise on flight. The study of the theory of aerodynamics requires a very high standard of mathematical knowledge. A comprehensive exposition of the scientific facts in relation to the subject would be tedious to the uninitiated. It must be clearly understood that much of the description is incomplete. All that is attempted is a simple explanation of the principles on which an aircraft works, and why it flies.

Everyone knows that the air which is all around us has a certain density. This is made apparent when the wind is blowing. The air in motion exerts a definite force, which varies according to the speed at which it moves.

It is equally noticeable when an object is moved quickly in still air. If one waves one's hand, for instance, one can distinctly feel the resistance which the air offers. The air displaced swirls round the hand to fill the space which the hand has vacated.

This pressure is exerted by the air in every direction.

When an object is dropped, its fall is partially retarded by the air through which it moves. It would fall with greater rapidity in a vacuum. This checking impulse acts more or less forcibly according to the shape of the object. A square of paper falls quicker when upright than when parallel with the ground. It is offering a smaller surface of resistance to its line of motion.

Our parallel square of paper, which can be termed a perfectly horizontal plane, will be even more hindered in

its fall if it is moved at the same time in rapid horizontal motion. The air opposing its movement is swirled around it. Some of it is deflected upwards in the direction from which the paper has fallen; some of it rubs against the surface of the paper and tries to stick to it. With aircraft, this is called "skin friction."

Now imagine our piece of paper or plane being moved in a horizontal direction with its front edge tilted up higher than the back. The reaction of the air will be in two definite directions. That underneath and some which flows over the leading edge is called "lift." That which tends to obstruct the forward motion of the plane is known as "drag." If the tilt is only very slight, the lift is very much the greater. Many of us have experienced this fact in actual practice when flying kites or playing with paper darts. It is the basis of flight.

The lift does not act equally on all parts of the plane. When the angle of tilt or incidence is slight, as in an aeroplane, its greatest force is immediately behind the leading edge. It piles up in a heap, as it were, as the plane is moved above it. The portion that swirls over the top forms eddies which create a vacuum and consequently increase the force of the lift by removing a natural obstruction to it.

These facts have emerged from long and careful experiment. Men have groped for them for centuries. Almost to the beginning of recorded history men have yearned to fly. They could run like the beasts on the earth. They could swim like the fish in the sea. When the beasts outdistanced them and the fish showed greater endurance, they used their superior intelligence to invent chariots and boats to make up their deficiences. But the birds were always above, wheeling and turning. Try as he would, man was unable to contrive a mechanical device which would be a substitute for his physical disabilities.

The irritating part was that, on the face of it, it seemed so simple. It was not like experimenting in the dark on something which had no precedent. There were no lack of examples to show the great range of possibilities. The dainty butterfly, the common fly, the stately eagle, the graceful swallow, even the clumsy goose could all fly at will. They could be caught and their apparatus examined. It could be, and was, copied, yet all to no

purpose. The secret which enabled them to leave the ground remained unsolved.

Now that it is no longer a secret, but an accomplished fact, we can look back and understand. The birds can fly because their strength is sufficient to work wings designed by nature of a size adequately to support their weight. The range of each bird is limited proportionately by this ratio. Birds with heavy bodies and more or less squat wings, like geese and swans, cannot fly so high, so far, or so fast as other birds with small, light bodies in proportion to their wing span, such as sea-gulls, swallows, and pigeons.

Man will never be able to fly with his own motive power unless in the evolution of time he develops shoulder muscles very many times stronger than those with which he is at present equipped. To lift the weight of an average man and to support him in the air, wings would be required of a span of at least twenty-five feet. Even the strongest man the world has ever known, would not be able to work wings of such a size, constructed in the lightest material compatible with sufficient strength, to maintain himself in flight, even if he succeeded in lifting himself above the earth. It would be the air resistance that would defeat him; not the weight, although once at a height he could glide without difficulty.

He has found an efficient substitute for his lack of strength in the petrol motor. But he need not have waited for the invention of the internal combustion engine before conquering the air. There is no reason why a steam-engine should not have been successfully applied for the purpose, provided it was built into a machine correctly designed to support its weight. A one-horse power steam-engine was actually used by Professor Langley in the flying machine which he invented and flew in 1896. Its best flight was three-quarters of a mile, but it only had its own weight to support and did not carry a passenger.

But if he has not been able exactly to copy the birds in his method of navigating their particular element, man has found that the nearer he can get his artificial structures to conform with their instinctive actions the more efficient is his machine. It is not within the scope of this work to trace all the ideas and attempts that have been devised in the past. The ground has been very

efficiently covered elsewhere. The story of man's struggles to overcome his natural disabilities is a romance of patient experiment and research. Many people subscribed to the final triumph. No one can claim that he did it alone with an aeroplane entirely revolutionary in its principles. It was rather a gradual improvement and development of existing ideas. For, right from the beginning, the birds supplied the desired model.

Anyone who takes the trouble to compare a modern flying machine with a bird will notice the marked analogy between the two. The camber of the main planes and the curvature of the wing. The great length of the wing in each case in proportion to the breadth. The ailerons and the action of the delicate feathers at the trailing edge.

All these similarities were not noticed and incorporated at the same time. Otto Lilienthal introduced cambered wings in the gliders on which he successfully flew in the '90's. But although he also added a movable horizontal elevator to control the fore and aft balance of his machine, he never succeeded in mastering the lateral balance.

Even the Wright Brothers, who were the first people in the world to fly a power-driven aeroplane, did not conquer the all-important problem of equilibrium. They succeeded in flying by the quickness with which they countered any tendency on the part of their machine to tilt. The factor of safety was extremely low.

The method by which they controlled their machine was ingenious but cumbersome. They warped the wings to offset the effect of the wind on either side ; the amount of warp being altered by wires operated by the pilot, which also controlled a vertical tail plane. There was also a forward horizontal rudder or elevator at the front of the machine to make it ascend or descend.

That was in 1902. The air was conquered. It would seem that the obvious thing was for man to take full advantage of the fact. If we believe stories of ancient mythology it was what he had been attempting ever since the world began. But nothing happened. Absolutely nothing.

The Wright Brothers continued with their experiments. Two years later, on an improved machine, they succeeded in making several lengthy flights. The best was a distance

of twenty-four miles at an average speed of thirty-eight miles an hour. But when they attempted to commercialise their valuable invention they met with the fate so often accorded to pioneers. The American, British and French Governments all refused to buy. By 1908, when they were at last recognised, several other pioneers were busy with experiments, many of which were based on the Wright Brothers' successes.

France was the country that paid most attention to the development of heavier-than-air machines in Europe. Since they were aware, to an extent, of the construction of the Wrights' machine, it is a little difficult to assign accurately to French inventors which of their developments were original and which influenced by the known success of the Americans. But they introduced certain notable improvements which have lasted without change to the present day.

The Wrights' machine was definitely unstable. The French introduced a horizontal tail plane which considerably improved longitudinal stability. The Wrights' machine was controlled by two levers, one of which was grasped in each hand. The French centralised control in a single lever operating a universal joint, the rudder being worked by a rudder bar. The Wrights' machine "took off" from rails and alighted on skids. In the event of a forced landing it could not rise again until rails were provided. The French slung elastically sprung wheels under the fuselage which made their machine independent of any particular aerodrome. It was also the French who introduced ailerons in place of wing warping.

Yet, such was the extraordinary skill and mastery that the Wrights exercised over their unsteady craft that when Wilbur Wright visited France in 1908 he eclipsed every record that the French Aviators had so painstakingly set up.

Amidst all these striking advances England was singularly behind. As has already been mentioned in Chapter One, the very first flight in this country was made by Mr. A. Verdon Roe on the 8th of June, 1908. Yet this same Mr. Verdon Roe designed in 1913 his famous Avro machine, which, with very few alterations, has been used as the ideal training machine in the service ever since.

At the time it was produced it led the whole world in tractor biplanes. It has been improved on by designs for certain specific purposes, such as speed, manœuvrability or weight lifting, but it still remains the basis of all present day types.

Although I have, so far, made very little mention of the engines which supplied the motive power, it is not because they did not take a very definite part in making the conquest of the air an accomplished fact. Looking back on the progress of events, it is realised that flying became a possibility the moment the petrol engine was invented. That it did not become a reality until many years later was because no one fully appreciated the relation between lift, weight and power. Had that been understood it would have been quite practical to have built a plane which an early type steam-engine would have been capable of propelling.

The engine which Langley used in 1896 weighed only seven pounds and developed one horse-power. The Wright Brothers used an eight horse-power motor. During subsequent progress every effort was made to reduce weight per horse-power. As long as it was as high as five pounds to one horse-power the size of engines was restricted. The development of the motor cycle engine helped considerably. For racing, engines had to be powerful yet light. Those applicable to motor cycles were equally applicable to aircraft.

In 1909 Mr. Verdon Roe flew a triplane with a nine horse-power J.A.P. motor cycle engine. The twenty-four horse-power Antoinette engine he used on his first flight weighed less than five pounds per horse-power. His famous Avro was originally engined by a fifty horse-power Gnome rotary engine. As the weight ratio was reduced, power was able to be increased. To-day most engines weigh no more than one pound per horse-power.

But whilst an engine was a necessity to keep a machine in the air, several people had succeeded in gliding short distances before a power-driven aeroplane lifted a man from the earth. Lilienthal covered a hundred yards many times in the course of his experiments. The Wrights practised the control of their invention before they fitted their engine to it. After their efforts were crowned with success Wilbur Wright continued to experi-

ment in gliding. From his observations of birds he knew that they were able to remain in the air with very little effort, and he wanted to discover the secret of their ability.

The secret still remains undiscovered. No one has yet succeeded in remaining in the air as long as he pleased. But thanks to the patience and perseverance of many intrepid pilots, considerable progress has been made.

The air, though invisible, is continually moving. There are warm currents which rise and cold currents which descend to take their place. When this change of position is very rapid a wind is caused. Actually the atmosphere is always in motion, even when it appears quite calm. This paradoxical statement is explained by the fact that temperature and barometric pressure are never constant. They vary constantly at different places and different altitudes.

The birds take advantage of these upward air currents when soaring. They know instinctively where they are to be found, under clouds of a certain type, in the neighbourhood of cliffs, etc. When they spread their wings and glide, although they gradually lose height in relation to the air, they may be actually rising in relation to the earth.

It is not surprising that men studying the birds in an endeavour to emulate their example should have noticed this ability to conserve their strength. The natural sequel was an attempt to do the same thing artificially. From the first many of the best brains trying to solve the problem of flight maintained that it would only be achieved by designing an efficient glider. After all, that is the way the Wright Brothers did it.

In the early days of flying men considered they had accomplished something miraculous if they hopped a few hundred yards in an aeroplane with an engine to drive them. To-day men cover miles in gliders without engines or any form of power. In July 1929 Robert Krönfeld reached an altitude of 8494 feet. He has also crossed the Channel. Günther Groenhoff covered 166 miles in 1931. Kurt Schmidt has remained in the air for thirty-six and a half consecutive hours.

These are tremendous strides but they will undoubtedly be beaten. As more and more is discovered about meteor-

ological conditions, so these records will fade into insignificance. But the world of aviation will always owe an incalculable debt to those who have taken their lives in their hands to prove the vast possibilities which have been opened up by soaring flight.

But whether in soaring flight or flight with a power unit, design has a great bearing on success. Aerofoils vary in flying machines, in the same way that wings of birds vary in shape, according to the work they are intended to accomplish. The planning of the specific shape, curve, length and breadth to be used is an exact science in which every detail is carefully considered.

In the earlier part of this chapter I used an illustration of a flat, horizontal plane, such as a piece of paper, which, moved rapidly through the air with its front edge slightly tilted, creates a reaction in the atmosphere which tends to lift it, or to retard it from falling. It is obvious that the lift should be as vertical as possible to be most effective. In practice it is found that this is best obtained from a slightly curved surface. I am not going to attempt to explain the way by which this was discovered. But a reference to a wind tunnel will make it clear how the fact is proved.

A wind tunnel is a tube in which a wind is artificially created. Its diameter may be sufficiently great for a full-sized aeroplane to be suspended in the centre of it. If air is pumped into it with a force equivalent to the wind, observation can be kept on the aeroplane's behaviour. The wind can be varied at will from a gentle breeze to a gale. The data obtained give a very clear idea of any faults or weaknesses, which can be corrected without endangering human life.

The introduction of wind tunnels was a great improvement on the old method of trial and error. Their use has enabled designers to ascertain with great exactitude the best shapes of wings for various purposes. By using a stream of water containing drops of oil, which is very similar to a flow of air, it can be seen which parts of the aerofoil are useful as supporting surfaces and which are better eliminated.

In this way it was found that the greatest lift is a little way only behind the leading edge and there is practically none at the trailing edge. Thus we have planes which

are long and narrow. The relation between the length and breadth of a plane is called the aspect ratio. In practice, it is, of course, limited by the need for strength, otherwise, theoretically, planes could be of any length and of scarcely any breadth. It is interesting to note that this fact, which has been scientifically proved in wind-tunnel research, is in exact conformity with nature. The albatross, which is considered the greatest soarer amongst birds, has remarkably long and narrow wings.

Similarly, the amount of lift depends on the curvature or camber of the plane. The greater the camber the more the lift. At the same time, the greater the camber the greater the surface of resistance offered to forward movement, which reduces speed.

It cannot be had both ways. If an aircraft is intended for speed it has low cambered planes which present the minimum of resistance. The lift is supplied by the rapid movement of the plane through the air. If the aircraft is needed to carry heavy loads, such as bombs or passengers, it has thick, heavily curved wings to give the maximum of lift. Speed becomes a secondary consideration.

It is, of course, possible to design aerofoils with a combination of both features. Some planes have a variable camber which gives a high flying speed and a low landing speed. In others, such as are employed in training machines, stability is the main feature. And so on.

All these factors are limited by circumstance, just as the aspect ratio is limited by the need for rigidity and strength. The total lift is determined by the maximum weight the aircraft will eventually carry. But there is another influence to be taken into consideration. The lift varies with the angle at which the plane is tilted in flight. The lift is not so great when the plane is climbing as when it is flying level. If the pilot attempts to climb his machine above a certain angle it will " stall."

Whilst the lift is decreasing, the drag or resistance is increasing. Both lift and drag depend to an extent on the speed at which the aerofoil is moved through the air. At its minimum this is termed flying speed. If the aeroplane falls below this speed, lift ceases and the result will again be a stall.

If the aeroplane was flown in absolutely still air, the centre of the lift force would always be in the same place, provided the controls were kept quite steady. But since it actually encounters gusts, and the pilot occasionally alters course or altitude, the centre of the lift force varies, either forwards or backwards as the case may be. To balance this and to preserve stability and equilibrium, a small auxiliary aerofoil is placed some distance behind the main planes. This is the tail plane. In normal flight, it is arranged to have no lift. If the aircraft rises or dives, however, its tilt in relation to the air stream through which it is passing, or angle of incidence, as it is called, varies. It then exerts a force, either upwards or downwards, contrary to the force acting on the main planes, which tends to bring the machine back to stability.

Its size and the distance it is placed behind the main plane, which determines the length of the fuselage, are carefully calculated. Hinged behind the tail plane and forming a prolongation to it is the elevator. When it is raised or lowered it exerts a force which reacts at the other end of the fuselage on the main planes, causing them to tilt either upwards or downwards.

In many aeroplanes, the whole of the tail plane unit can be altered through a slight range by the pilot. By this means he can "trim" his craft, according to the weight he is carrying and other factors so that it will fly level without a constant employment of the elevator.

Banking an aeroplane for a turn is accomplished by means of the small hinged ailerons on the outer trailing edges of the wings. They are so arranged that when one is raised, the other is lowered. Their action is temporarily to increase the lift on one wing and lessen it on the other.

Aeroplanes are kept from rolling from one side to the other partly by the fin to which the rudder is attached and partly by setting the two main planes slightly upwards or downwards in relation to each other. This has the effect if one wing drops of temporarily increasing the lift in the lower wing over that in the upper and thus restoring it to its original position.

Some aeroplanes are fitted with two main planes on either side, one above the other, and some with only one. The chief advantage of more than one is an increase of structural strength. But, because of the eddies of air,

caused by the camber of the planes in their function of supplying lift, the planes must be set a sufficient distance apart to avoid interference between the one and the other. For the same reason they are usually staggered so that one is a trifle in advance of the other.

The question of the advantage of the biplane over the monoplane or vice versa is very controversial. Some experts prefer one type and some another. There is little doubt that monoplanes would have been considerably more in vogue than they are if the Authorities had not banned their employment in the Royal Flying Corps in 1912 owing to a number of unfortunate accidents.

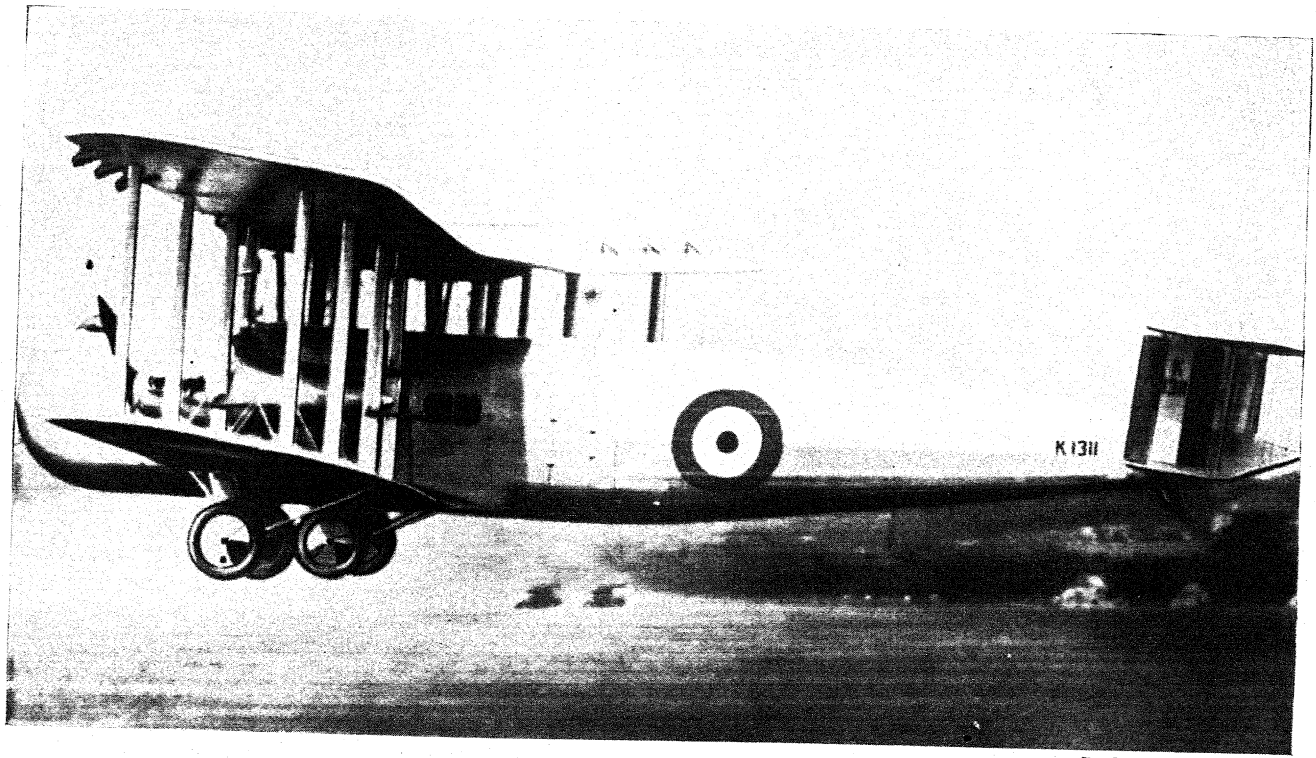
Whilst the above is not, in any way, a comprehensive explanation of all the forces acting on an aeroplane and the manner in which they are employed, it is my sincere hope that the uninitiated will be able to form some slight idea of what is taking place when they see an aeroplane passing overhead. But, before passing on, I must mention one more force which has to be counteracted.

The propellor turning under the propulsion of the engine, draws the aeroplane forward through the air. In doing so, it throws back an agitated slip-stream behind it. Because the propellor is turning at great speed always in one direction, this stream is in the form of a corkscrew and tends to turn the aircraft with it. In straight flight it is resisted by setting the fin slightly to one side.

The propellor also has an effect on the aeroplane during a turn. When turning in the same direction that the propellor is turning, the nose of the aeroplane tends to drop and has to be held up by the pilot with his controls. For the same reason, slight rudder has to be applied when executing a loop or a steep turn or the aeroplane will fall off to one side.

Most people know from observation that an aeroplane is banked during a turn. Without going into the mathematical and technical reason for this, it will be sufficient to say that it is a question of compensation. If the machine were turned by means of the rudder only, it would tend to skid outwards. If it were over-banked, it would tend to slip inwards. The correct amount of rudder and bank to use depends on the radius of the turn.

Should the engine fail for any reason, or when the pilot is descending to land, he depresses the nose of his machine



By the courtesy of "Flight"

VICKERS VICTORIA

Troop carriers which ensure the mobility of a ground force over a large area.

into a glide. Without the engine to draw it forward the wings have not sufficient lift to support the weight of the machine. By tilting them downwards, the force of gravity is employed to do the work of the engine in maintaining flying speed. At a normal gliding angle an aeroplane advances between seven to ten feet every foot it drops. Thus an aeroplane at 5000 feet altitude will glide nearly ten miles before it reaches the earth.

Nowadays, by the employment of gyroscopes, it is possible to set the controls of the machine so that it will maintain a set course and an even keel in flight. If gusts take the plane off its setting it is automatically brought back again so that the pilot has nothing to do except to work out the course he wishes to follow.

But even before the War the Royal Aircraft Factory at Farnborough evolved a machine which would do almost as much on its own. The type, the R.E.1, or Reconnaissance Experimental, was so inherently stable that it would right itself and regain an even keel if the pilot abandoned his controls in a nose dive. If the engine was throttled down it assumed a normal gliding angle. It would also automatically bank if the rudder was moved for a turn.

Splendid though that machine was, we have advanced a long way since. Slotted wings which make a stall impossible. The autogyro which reduces the size of flying-grounds. Engines which will run for hundreds of hours without a breakdown. Aeroplanes that will travel at six miles a minute. These and countless other improvements make a formidable tally.

He would be a very bold man who would deny the prediction that aerial travel will one day be as common, and as safe, as crossing the ocean. The development of flight waits on the evolution of motive power as much to-day as it always has. Given a suitable engine, there is no weight that could not be borne through the air. It may be wireless electricity that will solve the problem, or splitting the atom. But it will come.

CHAPTER FOURTEEN

THE SELECTION AND TRAINING OF PILOTS

THE pilot is the most important unit in the Service. The ultimate effectiveness of any Air Force is in direct ratio to the skill, knowledge, initiative and personality of the men who actually fly the machines.

Whilst the standard of efficiency of the ground staff goes a long way to help, even if it were 100 per cent perfect, it would be of no avail were the man actually handling the controls in the air to break down. Consequently, the selection of the right type of pilot, and his training, are of the most vital moment.

Fortunately, in this country, we have a large natural field from which to pick. The policy pursued by our Public Schools forms an ideal foundation for airmen in embryo. From early youth they are taught self-confidence and initiative, qualities essential to success. Even more important is the principle of playing for a team which does not submerge individuality, but encourages it along altruistic lines.

I do not wish to infer that the Public Schools form the only recruiting ground, nor that they necessarily supply the best pilots. There are many good sergeant pilots promoted because of their ability. But they are naturally endowed with those attributes which others, more fortunately situated in life, acquire by education.

As in the two older Services, it is quite possible for an airman to work his way up to attain the highest command. Right from the day boys are enlisted from the age of fifteen, Commanding Officers under whom they serve are on the look-out for potential pilots. Everyone considered suitable has the fact recorded on his Certificates of Service. Thereafter he is closely watched.

Twice a year a list of names is forwarded to the Air Ministry in order of recommendation. If an airman is

not subsequently selected for training, it is his own fault, due to some lapse which reverses the previous high opinion formed of him.

There are, of course, other reasons. It occasionally happens amongst both officers and men pupils under instruction that mental or physical disabilities become apparent in the air, which have not been detected by the most rigorous medical examination. These drawbacks often show themselves only after a long period. Very often the best pilots are very slow beginners. But even where temperament puts a period to further instruction, no one is turned down until failure in a series of tests renders such a course inevitable.

The medical examination is so strict and searching that it is difficult to conceive how anyone's weaknesses can possibly remain undiscovered. Each candidate passes through the hands of a number of doctors, each in charge of a different test: sight, hearing, blood pressure, nerves, lungs and heart, etc. Each point is a fence which may prevent a final pass.

Some of the tests are extremely interesting. One of them consists in blowing down a tube and raising a column of mercury to a certain height. This is equivalent to the atmospheric pressure on the lungs at an altitude of several thousand feet above the earth. If the potential pilot is unable to sustain this apparently simple trial with ease, he is obviously not capable of flying at an equivalent altitude.

Other ordeals concern ingenious instruments which reproduce flying conditions. Standing on one leg for a minute with the eyes closed shows the examiner whether the candidate has a natural sense of balance without the eye being fixed on some object to assist. The moment the minute is up, he is required to change to the other leg and repeat. I recommend everyone to try it. It is not so simple as it appears. If you do not succeed you will know, at any rate, that you are not fit to be trusted in charge of an aeroplane.

It is essential that everyone who flies has to pass the medical. Moreover, each pilot is put through a further examination annually. If he is found unfit, he is immediately suspended from flying duties until such time as his health is restored. Even when he is in perfect condition,

if, from any cause, he experiences an accident, other than slight damage to the undercarriage when landing, he has to report immediately to the Medical Officer at the aerodrome, although he, himself, may be apparently uninjured. The provisions against possible danger from a pilot flying whilst in ill-health are very complete.

The initial training of pilots before they are qualified, is carried out under three main categories: Royal Air Force Cadets are trained at the Royal Air Force College, Cranwell, in Lincolnshire. This is equivalent to Sandhurst and Woolwich in the Army, and Dartmouth in the Navy. They are under instruction for two years, when they pass into the Service with permanent commissions.

Seconded Army Officers, short service Commissioned Officers and Airmen Pilots are trained at one of several Flying Training Schools. Their instruction lasts for a period of eleven months.

There is also a base training flight for attached Naval Officers. They are kept separate because of the difference in the nature of their subsequent duties.

It is an interesting fact that teaching pilots to fly is of relative unimportance beside their ground studies. Almost anyone can learn to fly, provided he is medically fit. But it is not everyone by any means who is capable of assimilating the knowledge necessary to a Service Pilot. The syllabus is carefully arranged so that ground subjects keep pace with flying instruction. For instance, a pupil is not taught navigation before he has flown an aeroplane solo.

The progress of a pupil in his flying instruction depends very largely on his instructor. All instructors are carefully selected and highly trained at the Central Flying School. They must have a temperament particularly suited to the work; able to inspire confidence from the start; with sympathetic natures which can understand and appreciate the separate difficulties of each beginner.

Teaching in the air is carried out through speaking tubes, the "phones" of which are attached to the flying helmet. Machines are fitted with dual control, so that at any moment the instructor can take over and correct any error into which his pupil has fallen. The first step is to get the pupil accustomed to the feel of the machine.

Later, he attempts simple turns, following this up with practice in " taking off " from the ground and landing.

Of all manœuvres in flying, landing is the most difficult to grasp. Looking down from a height of even a few hundred feet, the aerodrome seems to have shrunk in size. Obstacles and undulations in the ground appear flat. With the wind varying in strength and direction, it is hard to judge at first precisely when to shut off the engine at various heights. These difficulties are gradually overcome by experience, until the precise moment is almost a matter of instinct.

An aeroplane is merely a mechanical device. It will only act according to the way the man in charge of it handles it. At no time is it the master. That is the first lesson to be drummed home. Once the pupil appreciates that his powerful machine will answer instantly to his lightest touch on the controls confidence rapidly increases, and it is then only a matter of time before he is proficient.

Every aeroplane in the air is subject at all times to the force of gravity. If the engine stops, or is throttled down, there is an immediate tendency for the machine to fall. It is the same when attempting to climb too steeply. The engine has not sufficient power to do what is required of it, and the plane falls away. The same effect is obtained by trying to keep the machine on a level keel or at too flat an angle when gliding.

The planes are designed so that without the engine the aircraft will glide smoothly. If, through mistaken judgment, the machine is not put into a glide the moment the engine ceases to function, either deliberately or by accident, the aircraft will stall and plunge earthwards. Given sufficient height, this alarming happening can be corrected and equilibrium regained. But it is obvious that all pupils must be taught how this recovery is effected before being entrusted in machines on their own.

The actual reason for a " stall " is explained more fully in the chapter on the theory of flight. It is almost the worst mishap that can happen to a pilot. Temporarily, the machine is completely out of control. It has lost the minimum speed at which the planes are supported in the air, and it plunges earthward like a stone. If such an emergency were met by anyone who did not know how

to counteract it he would certainly be killed. Whoever he is, experienced or not, he must have sufficient altitude in which to recover. Some of the larger machines require a dive of as much as a thousand feet before flying speed is regained.

The contingency is guarded against, as far as is humanly possible, by the regulations which are impressed on every one. Pupils are forbidden to practise aerobatics at altitudes under two thousand feet. This includes spinning, although a spin is specially catered for in a separate warning. Pupils are also ordered not to attempt even a simple turn until they have risen five hundred feet from the ground.

One of the most stringent cautions concerns the possibility of an engine failure immediately after "taking off." Instinctively the pupil thinks he should turn back so as to make a landing on the aerodrome, part of which is probably still below him. He is expressly forbidden to do so. He must put down the nose of his machine and continue in a straight line to make a landing as best he can. This because, inexperienced, alarmed by the crisis, without his engine to help him, and with the wind further reducing his air speed, he is apt to turn without keeping his machine pointing sufficiently far down to maintain flying speed. If a stall should occur at such a moment nothing can save him from a crash.

Spinning and stalling are practised constantly under the instructor's command, until his pupil is so familiar with them that his reaction is automatic and any fear he may have had of a stall is conquered.

Our pupil is now progressing. But, before he attempts his first solo, there is one other evolution he must be competent to perform. It may happen that he has an engine failure. He must thoroughly understand how to execute a forced landing.

All landings are normally made into the teeth of the wind. This is to use the force at which the wind is blowing as a brake. Because, in a forced landing, the pilot may have to come down in a field very much smaller than his normal landing ground, it is essential that he should always be aware of the direction from which the wind is coming. There are many ways in which the direction of the wind can be ascertained—smoke blowing from

chimneys, the wave of growing crops; paper or other loose objects being carried across the ground.

After a time a pilot becomes accustomed to noticing such things subconsciously, and the bearing into which he must turn is one of his least difficulties. Far more perplexing is the nature of the country below him. At a height of several thousand feet country has the appearance of a flat patchwork quilt; the patches being various irregular-shaped fields. The largest space is not necessarily the most suitable. It may contain shrubs, boulders or other obstacles which cannot be detected until too late. Ditches can usually be seen and avoided; inequalities of surface often cast a shadow; the presence of a stream usually indicates that the ground is low lying. The most difficult obstacles are wire fences and telegraph wires, although the presence of the latter should be spotted from the poles which carry them.

Again, experience is the best teacher, combined with the exercise of common sense. For instance, land bearing growing crops is usually bare in the winter. A general knowledge of the country in the particular neighbourhood will also reveal what to expect. Once the landing ground has been selected, the pilot should glide to leeward of it and concentrate on studying his method of approach. He should have an appreciable time at his disposal whilst gliding down, according to his altitude when the forced landing occurs, to consider all factors. Again, as in stalling, forced landings lose their terrors the greater the amount of practice indulged in.

Engine failures can be so easily simulated at any moment by the instructor throttling back the engine. He often surprises his pupil by doing this when he least expects it. In this way the pupil becomes accustomed to selecting a suitable site with the confidence that his engine is ready to be opened up again should he make a mistake.

At last comes the day when his instructor considers him sufficiently advanced to embark on his first solo. This point may occur after only four or five hours' tuition in the air, or it may not arrive for eleven or twelve hours. It is according to the temperament and capabilities of the individual, although a quick solo is by no means a criterion that the pupil will make a better pilot than one who takes longer. Some people are quicker at grasping

things than others. On the other hand, a lesson soon learned may be quickly forgotten. The pupil who carries out instructions perfectly whilst under the eye of his teacher may become slipshod and careless when left to his own devices. The other pupil, who requires considerably more guidance before he grasps what is expected of him, may take an equally long time to forget what he has been taught.

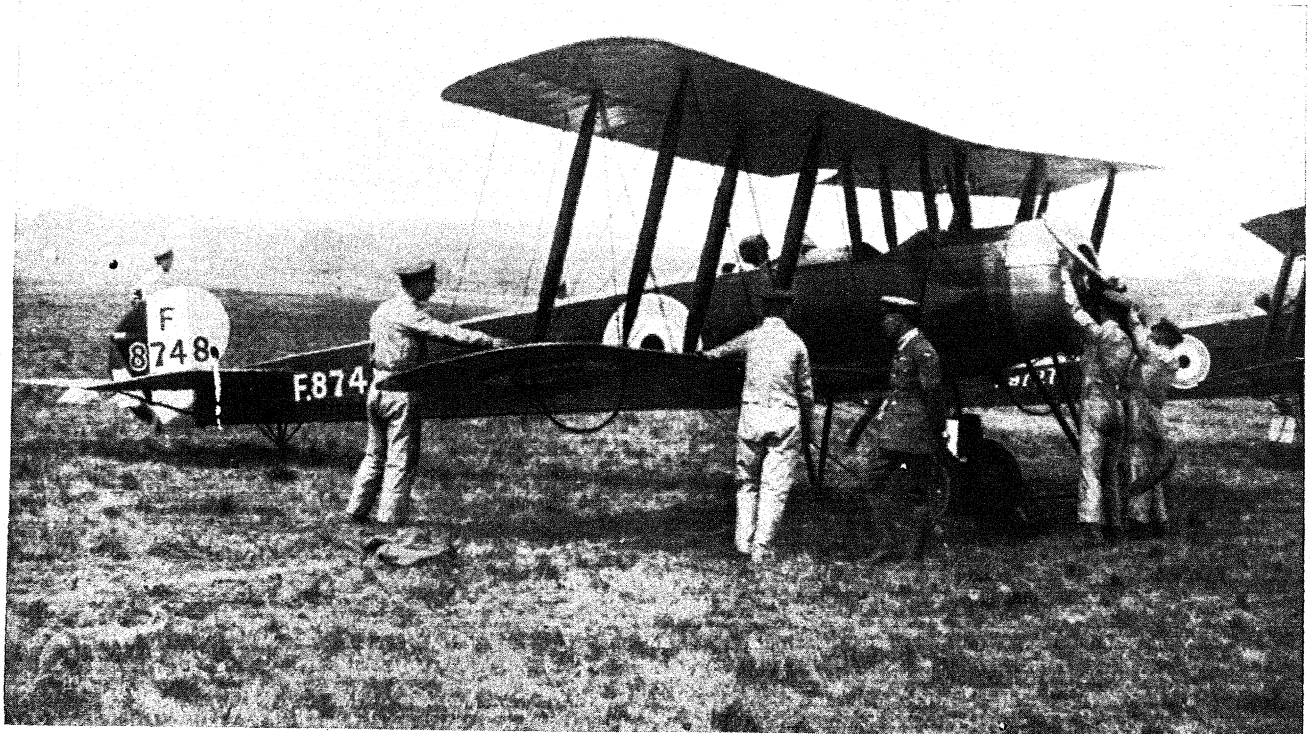
First solos are always carried out after a short period of dual instruction to accustom the pupil to the feel of his machine. He is then expected to " take off," make a circuit or two of the aerodrome, and land near a mark selected by his instructor.

It is a thrilling moment when he first finds himself alone and in sole charge. At last he is an airman ! His heart thrills with the knowledge that the powerful machine which bears him will answer to his lightest whim. He lands, taxies back to the hangars, switches off his engine and leaps down to the ground. He feels an entirely different individual from a few moments before when he had never flown by himself. He is, indeed, entitled to a degree of elation.

Thousands of youths in the War, no older than himself, went to join service units at the front with considerably less tuition and experience than he. In some cases they actually met the enemy in single combat before they had so many hours' flying to their credit. He should be thankful that the practical knowledge gained by those who went before him is at his disposal. He is prevented from making their mistakes and falling into their pitfalls. Later, when he is fully qualified, he will be as nearly perfect as human ingenuity can make him.

But, in the thoroughness of post-war tuition, that is not yet. He has a long way to go before he is regarded as other than " half-baked." He has entered, however, into a period of extreme danger—that of over-confidence. He can fly. He is young and adventurous. Twenty-two is the maximum age of entry. The urge is strong within him to run before he can properly walk.

It is only natural that this should be so. If flying instructors adopted the line of always preaching caution they would destroy the dash and initiative that is so essential to an aerial fighter. The question of danger



By the courtesy of "Flight"

AVRO 504K
The famous service training machine.

must never be mentioned. Indeed, it is an actual fact that nothing a pilot may do is dangerous, provided he attempts it at a sufficient height to leave him room to recover from a mistake, and he understands in advance what he is attempting.

Almost all accidents are caused through ignorance or foolhardiness. Someone in the school, seeking to outdo his fellows, executes a "stunt"—let us say loops the loop—at a low altitude. He is successful. Other pupils see him do it, or he boasts about it in the mess. Immediately the spirit of rivalry is aroused. Others seek to emulate the example, or go one better. One commits an error of judgment, or loses his head at a critical moment. The result is a crash and a brief obituary notice in the paper.

Of course, there are accidents due to structural defects, but they are very few and far between. The regular and systematic examination of aircraft, carried out thoroughly and meticulously, practically eliminates all faults. However good its performance on the previous day, each machine is "run over" every morning by both fitter and rigger. Before a pupil is allowed to handle it, it is taken up by the instructor on a short test flight. His experience is able to detect if anything is not in absolutely perfect order. The slightest irregularity, either of trim or in the smoothness of the engine, is reported and adjusted. A trivial fault might cause a breakdown at a critical moment, resulting in a serious accident.

I have mentioned earlier the strict regulations that are issued to pupils governing their conduct of machines. If they are observed in any irregularities they are severely censured, but it is impossible to keep them in sight during the whole of their flight. If a lad with a daredevil spirit wants to break a rule he will do so. No blame can be attached to the authorities, who take every possible precaution. Almost a hundred per cent of accidents are due to the human element.

The best way to deal with a venturesome pupil is to keep pace with his desire to experiment. Instructors are always ready to explain and demonstrate every manœuvre that a pupil wishes to attempt. In this way, by pushing forward those with a natural aptitude, and carefully encouraging the more backward, a balance is maintained.

Aerobatics are not only extremely satisfying to the ambitious, but are of definite practical value. Their constant execution makes a pilot so familiar with the handling of his machine that everything becomes second nature. They are also a groundwork for success in aerial fighting, of which more anon.

As in all other forms of instruction, first impressions are of the utmost importance. However strong the nerve of the individual, flying, in its early stages, is an unusual experience. One has to acquire an entirely fresh set of values in relation to the earth. Everything appears so different. It holds, at the same time, a sense of security and a menace. When on it, one is safe. When near it, one is in danger. The further one is away the more secure one feels. There is a constant rush of air from the propeller which is muddling. The roar of the engine is deafening. One can speak, sing, shout without being able to hear the sound of one's own voice.

All these circumstances have an effect on the individual, according to his temperament. Time alone enables him to become accustomed to them, to ignore them. But it is in the initial period that first impressions are formed. If a pupil is gradually acclimatised by a careful instructor, so that he is able to settle down before being called upon to attempt too much, it will react in his favour later on.

The all-important question of flying weather will exemplify what I mean. On a windy, stormy day it may appear to the uninitiated to be impossible to leave the ground. The man of experience would "take off" without hesitation. A sympathetic instructor would first take up his pupil as a passenger, so that he can discover by practical example that the terrors he had imagined were really non-existent, or were considerably less than he had anticipated. Another time he would be prepared to handle the controls himself without question. On the other hand, were the instructor to magnify the dangers from gusts when leaving the earth, the pilot might be spoiled for flying in that type of weather for the rest of his career.

Instructors are born and not made. Unfortunately, the supply of natural ones is not sufficient for the demand. This is got over as far as possible by an intensive course of

instruction for flying instructors carried out at the Central Flying School. What they lack in natural aptitude is instilled into them by training. A very high standard is set, and anyone who falls below it, is not employed as an instructor in the Service. The result is in keeping with the remainder of the careful provisions of the Air Ministry. It is another reason why our Air Force is the most efficient in the world.

When pupils reach a stage where they pass out on training machines, they move on to service types. The particular type selected depends on several factors. Officers attached from the Royal Navy and the Army are taught the particular types in use with the Arm to which they belong. Other pupils are graded according to their temperaments; any particular wish they may express being taken into consideration. Those who show extraordinary natural aptitude are selected for single-seater fighters, where their skill and delicacy of control will show to best advantage. Others are taught twin-engined or single-engined bombing planes, or Army co-operation planes, according to the allotment which will be made to fill up vacancies in squadrons at the end of the course.

I have mentioned earlier that flying training is considered of relative unimportance beside ground studies. Once a pilot has learned to fly, he will go on improving in his technique the more practice he puts in. But the Service does not exist merely for the pleasure that its personnel gets from flying. Its purpose is a definite preparation against the possibility of war. Every subject included in the syllabus at the training schools has a bearing on the pupils' ultimate competence.

Air pilotage and meteorology are of obvious significance. No pilot is of any use if he does not know where he is nor where he is going. I am not devoting any space to the subject here, as it is fully covered in the chapter on "How airmen find their way."

Instruction in airmanship keeps pace with advancement in flying training. It is divided into two parts:

Airmanship in the air, which explains the theory of flight, and the effect of the various controls, and such matters as the course to be followed in the event of a forced landing. Every pilot is responsible for his machine and

must see it is properly protected from damage by over-curious sightseers. Such subjects as aerial fighting, and reconnaissance, and co-operation with the artillery are left to be dealt with after the pilot is fully qualified and has passed on to his squadron.

Airmanship on the ground includes the care and maintenance in respect of aeroplanes, parachutes, oxygen apparatus for high altitudes, the organisation of an aerodrome for night flying, and other subjects which it is essential that a budding officer should understand.

There is a tremendous lot to learn, and a relatively short space of time in which to learn it. The great majority of the pupils come under instruction straight from civil life. They have not the slightest conception of conduct and discipline in the Service, beyond perhaps what they have picked up in a school cadet corps. A start has to be made in moulding them into officers able to lead and control the men under their command. They are given a general idea of the organisation of the Royal Air Force and the other Services, which illustrates the differences between them. Air Force Law is treated at some length, as it is an essential groundwork to discipline. Drill and physical training are other necessary subjects which have to be included.

It can be readily understood that many youths in the early twenties do not appreciate such dry topics at their full value. Their primary object in enlisting in the Service is to learn to fly. To them their flying training is all-important. Lectures and confinement in a class-room can be irksome, when the weather is perfect and the hum of the engines can be heard overhead.

Such people as are inclined to believe that the standard of discipline in the Royal Air Force is inferior to that of the Senior Services, should take these facts into consideration. No individual can reach perfection hurriedly. It takes years of gradual development to mature raw material, high-spirited and mettlesome, into a desired pattern. The Royal Navy and Army have centuries of tradition behind them to aid them in their work. The Royal Air Force has been established less than twenty-five years. In that time, tens of thousands of pilots have passed through. Every year sees a definite improvement in the criterion established. To-day the Air Force

contains as fine a body of personnel as can be found anywhere. Considering the short time it has been in existence, the responsible authorities have worked miracles in the way they have raised the Force under their command to such a high standard of good order. It is invidious to make comparisons, but they have nothing to fear when paraded beside either of the older Arms.

There are some subjects, however, which are pursued with avidity. The mechanical intricacies of the high-powered aero engines excite an interest which never flags. The rigging of the machines is also followed with commendable zeal. Although pupils are not taught all the technical complexities to enable them to do the work themselves, they must understand the action of the controls which they will operate on the various parts of the machine ; the loads to which they are subjected under varying conditions ; and the parts which are most likely to break down through faulty workmanship. They must also understand which parts are likely to fray and wear in use, so that they will know where to look when conducting inspections later on. This is combined with a rudimentary knowledge of the theory of flight, and is of the utmost practical value. Other subjects which are always taken in with keenness are photography and armament. Wireless telegraphy and telephony are confined, at this stage, mostly to acquiring a knowledge of the Morse Code, with a general smattering in the theory of wireless transmission.

In short, the whole programme of training at the schools aims at laying a general foundation upon which a more particular knowledge of each subject can be built during the intensive training which is the daily work of any particular squadron. Examinations are held at the end of each term. Passing these, entitles a pupil to receive his " wings," which are the badge of a pilot.

He is now sent on leave with instructions to report to his squadron at the end of it. When he does so, he will take his place as a cog in the war machine which is ceaselessly preparing for the protection of our Country, should it ever be called upon.

CHAPTER FIFTEEN

HOW AIRMEN FIND THEIR WAY

IN these days of long-distance flights, the subject of aerial navigation is becoming more and more important. Prior to the War, when a pilot who succeeded in reaching Manchester from London without having to alight for a replenishment of petrol was considered something of a hero, the question of an airman finding his way was not regarded as possessing any great difficulty. No one flew at any great height; no one ventured off the ground when the weather was at all unfavourable; it was quite easy to see and recognise the features of the landscape over which one was passing.

Right up to the end of the War, the majority of pilots had but the vaguest knowledge of air pilotage. During trench warfare they became so familiar with the country within their radius of action that they had no need of it. When the line moved rapidly forward in 1918, they merely adjusted themselves to the new landscape. It was only the units engaged in bombing raids on objectives well behind the enemy lines who required any real understanding of the subject.

Even now, no one needs to know anything about navigation to find his way about Great Britain. The country is so criss-crossed with railways and main roads that it is practically impossible to get lost. A pilot flying from London to Edinburgh has only to pick up the rail-track and follow it to be sure of an ultimate arrival at his destination. If, for any reason, he wanders to right or left, he is bound to encounter the coast line, which will at once re-establish his position. In the Royal Air Force, this method of getting about the country is popularly known as "flying Bradshaw."

When foreign countries have to be negotiated, however, or large stretches of water, it becomes necessary to resort to other methods. Maps, charts, compasses, instruments

and an elementary knowledge of meteorology all have their part. Unfortunately, no maps, charts, compasses or aerial navigational instruments are exactly correct and the weather does not always behave as it is forecasted. So the way of the would-be aerial navigator bristles with problems which constantly threaten to discomfort him.

Maps and charts are representations of the earth's surface. But since the world is a globe and, for practical use, a map must be flat, we are immediately faced with a difficulty. It is an impossibility to portray accurately a round world on a flat piece of paper. Several people have tried, and we are indebted to them for the maps which are in general use. The best-known projections are the Ordnance Survey, the Polyconic, the Mercator and the Gnomonic. The whole of the British Isles is on the Ordnance Survey and, since it is a comparatively small area of the earth's surface, its degree of error is infinitesimal. Maps and charts on Mercator's Projection are the most popular for navigation.

Owing to the development of aviation, special maps have been designed for the use of airmen. They depict distinctly those landmarks which an airman would generally look for—the shape of a town or village ; the curves of a river ; roads, railways, towns and lighthouses. The conventional signs stand out in proportion to the value of what they represent as viewed from the air.

A pilot about to start on a cross-country flight from one place to another will draw a line on the map between the two points and thoroughly examine the features of the ground, over which he will pass. This is especially important for deciding the height at which he must fly to clear the highest ground he will encounter. When he is in the air frequent reference to the map on his knee will enable him to steer an absolutely straight course to his destination by recognising the most insignificant topographical details.

Navigation by map-reading is only possible when weather conditions are ideal. It is obvious that if the pilot flies into cloud or fog, or the country is covered in mist, landmarks, however prominent, will be blotted out. The flight must then be continued by compass. This involves certain calculations relating to distance and strength and direction of wind which vary according to

latitude and longitude and the speed of the aeroplane through the air. Finding the way by employing such data is known as Dead Reckoning as distinguished from the more scientific methods of navigation which require a sextant for taking observations and a working knowledge of advanced mathematics.

The compass is one of the most remarkable scientific instruments in everyday use. It is of inestimable value to the navigator by air, sea or land, yet he can never be quite sure that it is not playing a trick on him and giving him erroneous readings.

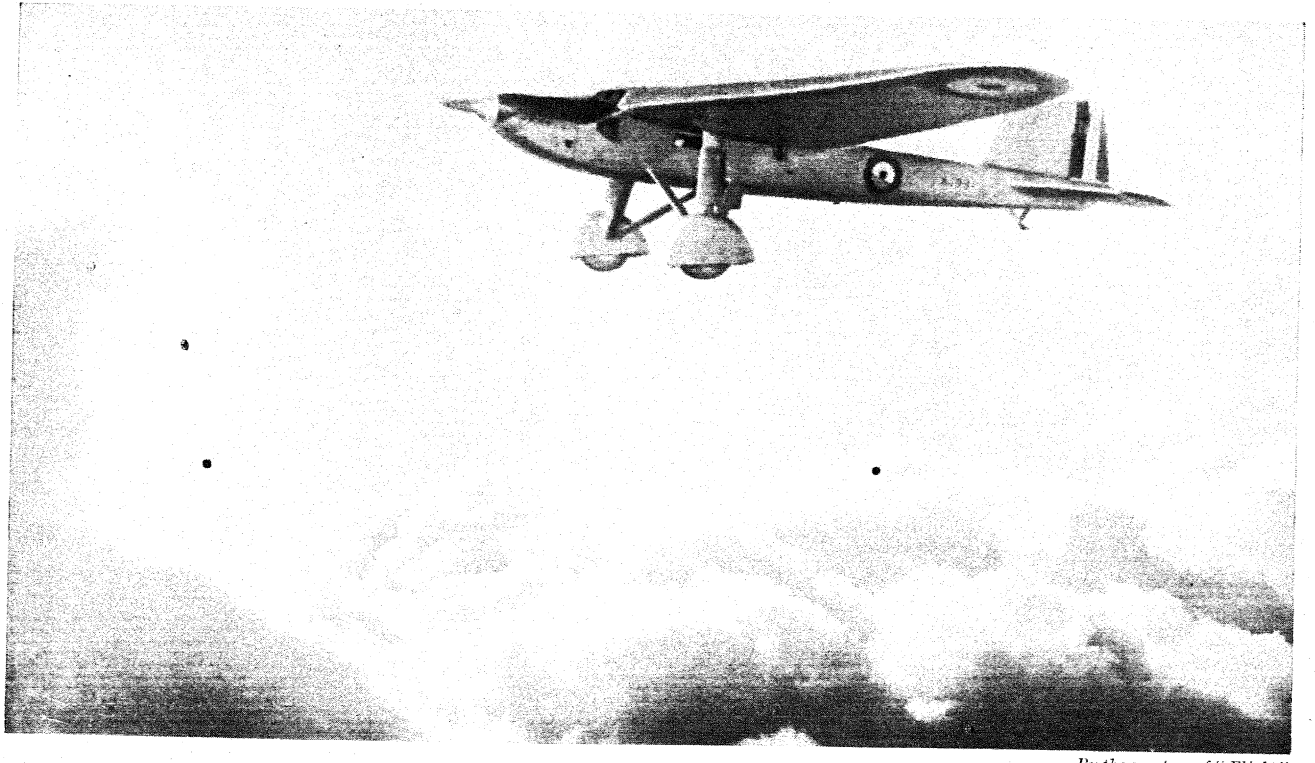
Its action is in accordance with the laws of magnetism. Without going too deeply into an explanation of what magnets are and how they work, they all have one property in common. If freely suspended in such a way that no other influence can affect them, they will all point North and South.

North and South are purely arbitrary terms. The Earth is a globe almost completely round, but flattened slightly at the top and bottom. It is constantly revolving on an imaginary axis, the extremities of which are referred to as the North and South Poles. But these poles, which are known in navigation as True North and True South, do not coincide with the North and South of magnetism.

There are several degrees difference between them, which is one of the first snags the navigator is up against. Maps are prepared in relation to True North and South so that when he wants to consider a compass reading he has to make an allowance of the difference between the True and Magnetic bearings.

This difference is not the same all over the World. It is also constantly changing year by year. At present, in England, the variation is about fourteen degrees West of North. So that the allowance must be made according to the part of the World where the reading is taken.

The earth is itself a natural magnet and influences all other magnets, whether natural or artificial, to lie North and South in conformity with its magnetic field. Thus a freely suspended compass needle in England will point downwards at its northern end at an angle of approximately sixty-seven degrees. In practice this dip is compensated so that the compass needle will be parallel. But



By the courtesy of "Flight"

FAIREY LONG-RANGE MONOPLANE
Which flew 5309 miles to Walvis Bay, South Africa.

if the compass were taken from the northern to the southern hemisphere, the compensation would have to be adjusted to the other end of the needle.

Another influence which affects the accuracy of a compass needle is the proximity of the metal parts of the aeroplane in which it is fitted. Some of this metal is naturally magnetised, and the resultant effect on the compass is to cause it to deviate from the line of magnetic north and south. The permanent magnetism of the aircraft causes a different deviation on each of the cardinal and quadrantal points. The amount of this error is found when the compass is " swung " and corrected by placing small compensating magnets in receptacles provided in the compass frame.

I have touched very briefly on the causes of variation and deviation because a certain understanding of them is necessary if all the difficulties of aerial navigation are to be thoroughly appreciated. The aircraft compass is a delicate instrument and, unless the navigator is well versed in the principles governing its behaviour, he may lose faith in its readings, with disastrous results. There are several types of compasses in use in the Service, but there is still considerable room for improvement. There are a great many other influences acting on the compass in addition to the two I have mentioned—the vibration of the engine, the strain of aerobatics; errors during turns due to the necessary balancing of the needle to counteract dip; to mention a few of them. But as long as these difficulties are understood and due allowance is made for them, full value can be obtained from the instrument.

Before passing to a consideration of how the compass is employed the following is a short description of some of the other instruments used in air pilotage:

The air-speed indicator records the speed of the aircraft through the air. Air Speed must not be confused with Ground Speed. If an aeroplane, capable of a speed of eighty miles per hour through the air, were to fly in the teeth of a gale of forty miles per hour, its actual rate of progress over the earth would be forty miles per hour. Conversely, the return journey would be made at a ground speed of one hundred and twenty miles per hour. If the wind were blowing from one side or the other, the ground

speed would be affected according to the angle between the wind and the track of the machine.

As the altitude increases, the density of the air decreases, and since the air speed indicator is worked by air pressure, when the aircraft rises, the instrument records less than the true air speed. An air speed computer exists for correct adjustment, but the difference is roughly an increase of $1\frac{3}{4}$ per cent of the speed indicated for every 1000 feet of rise.

The altimeter is nothing more than an aneroid barometer graduated to show changes of altitude instead of changes of pressure. It is an extremely unsatisfactory instrument for its purpose for several reasons. The aerodrome at the point of departure may not be at the same altitude as that at the point of arrival, nor of the country in between. The height recorded on the altimeter always refers to the point of the departure, and unless the pilot constantly bears that fact in mind he may become involved in a serious accident. In fog especially, unless he is thoroughly conversant with the country over which he is flying, he may reach an entirely erroneous conclusion as to the proximity of the ground. In India, it is not uncommon for Service pilots to start from sea-level and land on an aerodrome at 6000 feet.

Changes of weather, and consequently of barometric pressure, may also affect the instrument, although they are not likely to be significant on a flight of only a few hours' duration.

Another, and more serious, complication is that the instrument is extremely sluggish in its operation. A pilot quickly descending through several thousand feet will outstrip the recording needle. In this way he might believe himself to be higher than he really is.

These two instruments, the air speed indicator and the altimeter, are permanently fixed on the dash-board of the aircraft. Other instruments are sometimes fitted, whilst some used are not fixtures at all.

Amongst those sometimes carried are the bearing plate, the course-setting bomb-sight and turn indicators. As the term indicates, the last-named indicates to the pilot when the aircraft is turning and also gives a rough idea of the rate of turn. It operates with a gyroscopic

action and is particularly useful for flights in thick weather or when flying blind.

The bearing plate is a simple instrument for finding the amount of drift of an aircraft from which can be readily calculated the track made good. The ground speed can also be worked out from it. The course-setting bomb-sight is a considerable elaboration of the ordinary bearing plate or drift indicator. It will accurately calculate course, windage, drift, ground speed and, in war, tells when a bomb should be released to hit the target.

The course and distance calculator provides a simple means of solving the triangle of velocities. Put baldly in words, that may seem very complicated. In reality it is very simple.

When an airman wishes to fly from one place to another he first draws a straight line between the two points on the map and measures the angle or bearing it makes with true north. That is the track to be made good, and if the flight were to be made in still air, the compass course to be followed could be easily determined by allowing for the variation between the true and the magnetic bearings. It is the wind that introduces the complication. It is still true, as recorded in the Bible, that "the wind bloweth where it listeth." At one time, it is helpful; at another, it is a very definite hindrance. Unless it happens to be blowing directly along the track which the pilot wishes to follow, he has to point the nose of his machine to one side or another to counteract its influence.

Wind allowance is a constantly varying factor. The wind may be blowing at one speed on the ground, at another at 2000 feet, and yet another at 4000 feet. It may be blowing from one direction at the point of departure and from the opposite direction at the desired destination. It may change half a dozen times *en route*. Its variations are endless.

It used to play a considerably more important part in marine navigation in the days of sail than it does to-day. In the early part of the nineteenth century, Rear-Admiral Sir Francis Beaufort prepared the famous Beaufort Scale, whose twelve points give a rough-and-ready estimate for different forces of wind. For instance:

Number 4. Moderate breeze. Good working breeze,

smacks carry all canvas, with good list. On land: raises dust and loose paper; small branches are moved.

This extremely graphic description applies to a breeze at an average velocity of between thirteen and eighteen miles per hour.

Whilst a knowledge of the Beaufort Scale is extremely useful to an aerial navigator, in practice he can obtain an accurate report of the strength and direction of the wind, both at his point of departure and of arrival, from the Air Force Meteorological Office before he commences his flight.

He now has sufficient detail to prepare his triangle of velocities. The three sides consist of the air speed of the aircraft and the course to fly; the ground speed and the track to be made good; the strength and direction of the wind. The air speed, ground speed and the strength of the wind are related to one another in miles per hour and determine the lengths of the sides of the triangle in some convenient scale. The course, track and direction of the wind also have a common unit in the points of the compass, and the two known components are laid off from the same point at their correct angles.

When the triangle is completed the navigator knows the correct course to steer and the speed at which he will travel in relation to the ground.

In practice the course and distance calculator enables these seemingly terrifying computations to be made in a matter of seconds. In point of fact, despite all the considerations and difficulties I have outlined above, flying by Dead Reckoning is a comparatively simple matter. The pilot of an aircraft has a tremendous field of vision; he can pick up a landmark several minutes before he reaches it. If he has estimated that he should pass dead over it and yet it appears on one bow or the other, then he knows, assuming his calculations to be correct in the first place, that the wind has altered in force or direction. Should his watch tell him that he has arrived at that particular point, either before or after his estimate, again he is warned of a change in conditions. At the end of the flight, he may be five or even ten miles out of his reckoning, but, because of his height, still spot the landing ground which is his destination.

Throughout the flight, on long flights especially where

a qualified navigator is carried, it is usual continually to check the Dead Reckoning position by means of bearings taken on any objects which come within the range of vision. Churches, lighthouses, the junction of two railway tracks and other things which show equally clearly on the map and the ground are the most suitable objects to choose. By laying off two bearings on different objects on his map the navigator knows his exact position is at the point of intersection. Further bearings on the same objects taken at a definite time later—say ten minutes—enable him by a simple calculation to estimate his ground speed. The track is the line between the two points of intersection of fixes as they are called. The minutes the aircraft has taken to traverse that distance on the ground and the angle the line makes with the nearest meridian on the map give the angle of true bearing.

The compass reveals the course on which the aircraft is flying, and the air speed indicator the speed through the air. A quick reference to the course and distance calculator will show at once whether the wind has changed in speed or direction.

Whilst air pilotage by night is naturally more difficult than by day, it is generally far easier to steer a steady course at night as fewer bumps are encountered. Once a pilot has set his correct course by means of his instruments he utilises a star or a bright light in the distance to fly on. Lights indeed are the night-flying pilot's principal aids. Each town, large railway station, port or dockyard possesses a characteristic arrangement of lights, and may thus be recognised by night as it is known by day from its shape and general appearance.

Lighthouses also, with their distinguishing flashes, are as useful to aircraft as they are to ships. Water of any description, lakes, rivers and reservoirs show up amazingly well, even from high altitudes. Other ground features which are useful landmarks are woods, untarred roads, railways, huts and camps.

Wireless is playing an increasingly important part in aerial navigation. The rapid development of the wireless telephone has made communication between aircraft and base a matter of ordinary routine within definite limits, but the range of wireless telegraphy is considerably greater. The refinement of special wireless apparatus

for direction finding is at present mostly confined to the larger machines because of the weight factor; an important item in all aircraft design.

Fixing the position of an aircraft by wireless can be done in several ways, though the principle remains the same in each. Every owner of a portable wireless receiving set knows that he has to turn his set about to get maximum reception. If he places it at right angles to the maximum position the signals will be scarcely audible. This is because the aerial is wound round a drum with the wire all running in one direction. Wireless waves can only be picked up one way.

Direction-Finding Wireless Stations work in pairs. Each has a large coil which is capable of being revolved round a central axis. The apparatus is also fitted with a compass card. A pilot who wishes to know his position sends out messages, a necessary part of which is the identification number of his machine to distinguish it from others that may be in the air. The two stations revolve their coils until signals are received at minimum strength; minimum, because the arc of variance is smaller than at maximum. Bearings are then read off from the compass cards.

These bearings are laid off on a map from the positions of the D.F. Stations and the point of intersection fixes the whereabouts of the aircraft at the moment the bearings were taken. Both pilot and ground stations are in possession of maps divided into squares which enables the operator on the ground readily to communicate the co-ordinates of the aircraft's position.

Should the pilot wish to know the track he is making good, he continues on the compass course he is flying for an agreed time—five or ten minutes is sufficient. A fresh fix is then taken and the line drawn on the map joining the two points gives him his exact direction. The length of the line represents the distance he has travelled in the agreed time, from which a simple calculation will give him his ground speed. A comparison between his compass course and the bearing of his track shows the amount of his drift. In other words he has established the triangle of velocities. He now has all the data necessary to work out a fresh compass course which will bring him to his destination.

One great impediment in the employment of the above method is that it can only be used for comparatively short flights. The wireless-sending apparatus fitted to an aircraft—restricted in size because of its weight—can only be picked up over a limited range. Greater radius is obtained by placing the coil in the machine and sending out from the ground.

Another way in which wireless is used to help the pilot is the employment of a powerful wireless beam which is rotated at a fixed rate of one revolution per minute. Twice in every revolution—once when facing north and once when facing east—the beam dies away for a brief pause. A fixed coil fitted in the aircraft will record a maximum strength once in every revolution. The pilot is provided with a stop-watch and, starting from one of the periodic blanks, he counts the number of seconds until maximum is reached. From this information he can estimate the bearing on which he is flying. The object of having two pauses at right angles is to allow for a machine flying on such a course that the blank in the beam would coincide with the dead part of the coil in his aircraft.

Air pilotage is a technical subject which requires practice and training for its proper application. The most I have been able to do here is to explain it in a general way. Those who look deeper will realise how great a scope there is for invention in aerial navigational science. In the meantime the wind still " bloweth where it listeth."

CHAPTER SIXTEEN

SOME AERIAL FIGHTERS

EVERY aircraft in the Service, whatever the duty for which it is designed, must be provided with armament. That is a fundamental principle, and it sums up in a sentence the lesson which the War taught us. However efficient pilots may be at co-operating with the Army or Navy, at bombing or reconnaissance, they must also be able to fight when called upon to do so.

If ever there is another war it will undoubtedly open with a sharp struggle for air supremacy. The co-operation, photographic and tactical machines may never come into employment. The bombers will, both day and night, with the object of destroying the enemy's aircraft, hangars, workshops and munitions of war on the ground. They are our chief offensive weapon. But, right from the moment of the declaration of hostilities, fighting aircraft will assume a tremendous importance. They must win and maintain a definite superiority over the enemy. If they fail, if the enemy has the command of the air, all other arms will mobilise in vain.

The war will be virtually won when the enemy's air service is dominated. Complete mastery of the air can never be attained until every machine the enemy possesses is destroyed and ground operations control enemy factories and make it impossible for them to build more. The element air, having three dimensions, is so enormous in extent that it is impossible to guarantee that isolated aircraft or small formations will not penetrate the most resolute system of patrols and the most extensive barrage of anti-aircraft fire. But when enemy pilots have it brought home to them that they can only reach their objectives in small parties of survivors instead of in overwhelming force, their *morale* will be undermined and they will hesitate to " take off."

Since the principles of aerial fighting are based on the experience gained in the War, a lot can be learned from a review of actual combats, not only with regard to the tactics employed, but also as to the individual qualities which make up the temperament of a fighter. Because there were far too many fighters of exceptional ability on our own side to make it possible to include everyone in this account, I have confined myself to the select band of nineteen who were awarded the Victoria Cross.

The first air V.C. in the War was won by Second Lieutenant William Barnard Rhodes-Moorhouse on the 26th of April, 1915. During the confusion which followed the first German gas attack, aircraft were sent to bomb railway tracks and concentrations of enemy reserves behind their lines to prevent them from exploiting their initial success. Rhodes-Moorhouse was detailed to Courtrai and told to use his own discretion regarding the height at which he released his 100-lb. bomb. Accordingly, in face of heavy machine-gun and rifle fire, he came down to 300 feet to make sure of hitting the railway, which was his objective. He was wounded in the abdomen and later in the thigh and in the hand, but he flew back to his own aerodrome at Merville. The following day he died of his wounds.

Rhodes-Moorhouse, who was twenty-eight and married, was one of the pioneers of flying in England. Although he received his pilot's certificate in 1911, he had been flying ever since he went down from Cambridge two years before. In 1912 he established the record of being the first pilot to cross the Channel with two passengers. He enlisted in the R.F.C. in August 1914 and joined No. 2 Squadron at Merville on the 20th of March, 1915, a month before his death.

This exploit reveals the training which teaches a man to play for his side instead of himself. In view of the intensive fire from the ground he could easily have released his bomb from an altitude out of range and returned in safety. He deliberately sacrificed himself in an attempt to delay the movement of German reinforcements.

A few weeks later Flight Sub-Lieutenant Reginald Alexander John Warneford destroyed single-handed the first Zeppelin of the War to be brought down by an aeroplane.

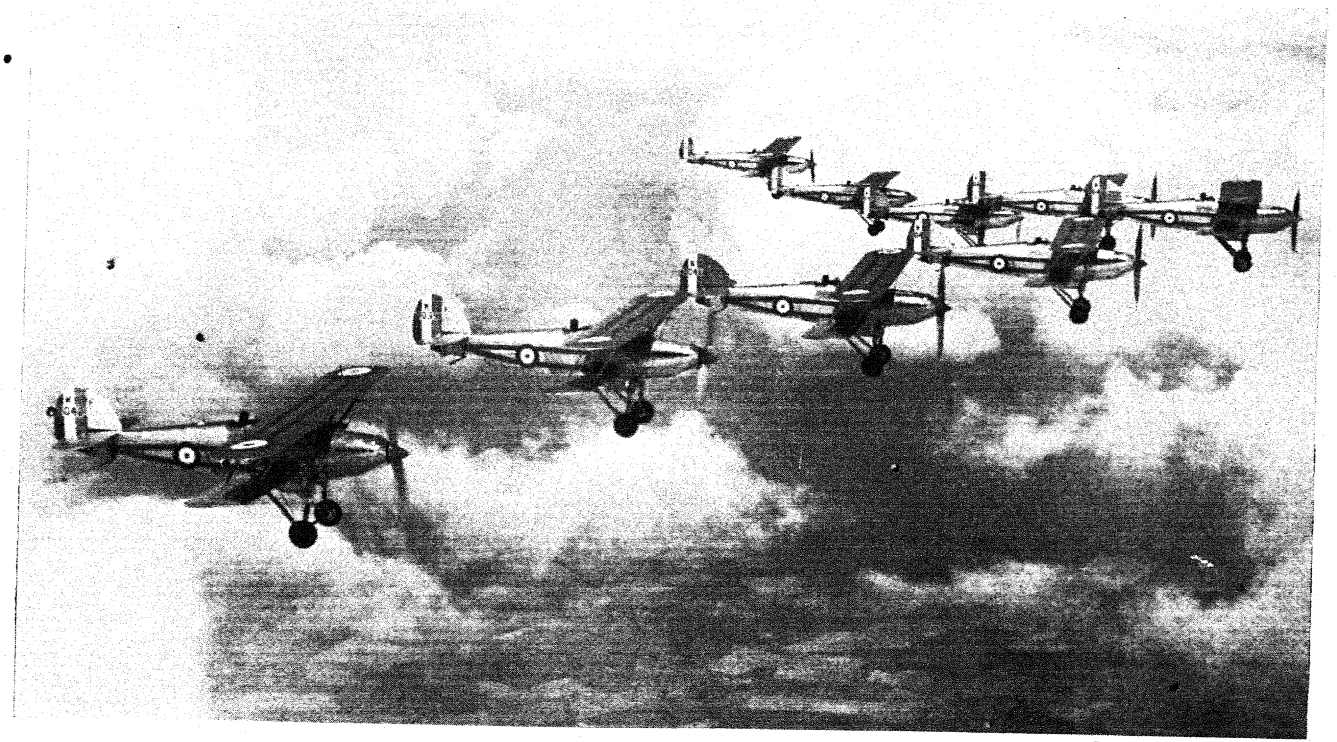
The event was significant as it proved a theory held by the British Authorities long before the War. The incident has already been touched on in an earlier chapter. Warneford came across the Zeppelin on the night of the 7th of June when he was on his way to bomb the Zeppelin sheds at Berchem Ste. Agathe. The airship's crew evidently believed he was incapable of harming them or they would have climbed out of his reach. Zeppelins, in those days, could climb both faster and higher than any aircraft. Warneford stuck to it and after a time succeeded in getting his heavily laden Morane above his objective. He flew along the envelope and dropped his six 20-lb. Hales bombs at intervals from a distance of 150 feet. Five of them went right through before they exploded harmlessly in mid-air. The sixth detonated the gas and set the Zeppelin on fire from end to end. The explosion upset Warneford's machine and broke a joint in his petrol pipe. He managed to regain control and forced landed safely in enemy territory, whilst the L.Z.37 crashed in flames.

Though expecting to be surprised every minute, Warneford succeeded in effecting a temporary repair and flew back to our lines, landing eventually at Cape Gris-Nez.

He was born at Darjeeling, Bengal, India, and educated at the Grammar School, Stratford-on-Avon. He entered the Merchant Service at the age of thirteen and joined the R.N.A.S. in February 1915. Unfortunately he was killed at Buc Aerodrome, near Paris, on the 17th of June, when a Henri Farman in which he was flying with Mr. Henry Needham broke up in mid-air.

When Captain Lance George Hawker, D.S.O., won his V.C. for defeating three German machines in one day, on the 25th of July, 1915, aerial fighting was in its early infancy. At the beginning of the War it had been the exception rather than the rule. Machines on both sides went about their work with a naïve disregard of one another's proximity. Occasionally some aggressively minded individuals took up rifles, pistols and even shot-guns in search of sport rather than for defence.

But during the summer of 1915, when the work of the air began to be felt, the opposing Commands realised that the less aerial observers gleaned of their dispositions, the



NO. 1 SQUADRON (HAWKER "FURY")

By the courtesy of "Flight"

greater chance their operations had of success. Consequently each side attempted to prevent hostile aircraft from crossing their lines.

Captain Hawker was flying alone on patrol when he fought three enemy aircraft, one after the other. All were two-seaters and all were armed with machine-guns, which made them extremely formidable opponents at that period of the War. The first eventually managed to escape, the second was sent down damaged and the third crashed in our lines.

Born in December 1890, Captain Hawker was educated at the Royal Naval College, Dartmouth, and the Royal Military Academy, Woolwich. He was commissioned in the Royal Engineers in July 1911 and transferred to the R.F.C. in October 1914. His D.S.O. was awarded for a bombing raid against the airship sheds at Gontrode. He was killed by Richthofen in single combat on the 21st of November, 1916.

On the 31st of July, Captain John Aidan Liddell of No. 7 Squadron was on a reconnaissance near Bruges with Second Lieutenant R. H. Peck as his observer, when they were attacked by a German. Liddell's right thigh was broken and he fainted from shock. The machine fell 3000 feet out of control, before he regained consciousness. Despite his wound, he brought the aircraft back on an even keel and flew it to a Belgian aerodrome near Furnes. The control wheel and one of the undercarriage struts were smashed. Liddell died of his wounds a month later.

He was educated at Stonyhurst and Balliol College, Oxford. He joined the special reserve of officers of the Argyll and Sutherland Highlanders, but also took a pilot's certificate in June 1914. When he transferred to the R.F.C. in May 1915 he had already been awarded a Military Cross whilst serving in the machine-gun section of his battalion.

The next officer is still serving in the Royal Air Force. Wing Commander—then Second Lieutenant—Gilbert Stuart Martin Insall was patrolling in a Vickers fighter on the 7th of November, 1915, when he attacked a German two-seater near Achiet. The German pilot tried to manœuvre him over an anti-aircraft gun, but Second Lieutenant Insall got within close range and his observer,

First-Class Air Mechanic T. H. Donald, knocked the German engine out of action with a burst of fire from his Lewis gun. They pursued their quarry through a cloud and saw it forced land in a ploughed field. Second Lieutenant Insall descended to 500 feet and Donald put the enemy pilot and observer to flight. Despite heavy fire opened by other Germans, Second Lieutenant Insall circled round and destroyed the enemy machine with an incendiary bomb.

Five weeks later, on the 14th of December, he and his observer were brought down behind the enemy lines and taken prisoners. On three separate occasions, Insall succeeded in breaking free from different prison camps in which he was incarcerated. Twice he was recaptured, but on the third occasion he succeeded in winning through to Holland and liberty.

He was born in Paris on the 14th of May, 1894, and educated at the Anglo-Saxon School, Paris, and Paris University. In September 1914 he joined the Public Schools Battalion, but transferred to the R.F.C. in March 1915, reaching France in July.

Squadron Commander Richard Bell Davies of the Royal Naval Air Service won the Victoria Cross at Gallipoli for a deed of chivalry such as has thrilled the world since its genesis. A Henri Farman, piloted by Flight Sub-Lieutenant G. F. Smylie on a bombing raid over Ferejik on the 19th of November, 1915, was hit by rifle fire. Smylie knew he would have to forced land, but, nevertheless, released all his bombs. When he reached the ground he discovered that one bomb was still in the rack. As enemy infantry were approaching, he set fire to the aeroplane and prepared to give himself up.

It was then that he realised that Squadron Commander Davies, superbly indifferent to the personal risk to himself, was landing to rescue him. Smylie detonated the bomb with his pistol in case it should explode and injure his rescuer. With the enemy rapidly approaching, he climbed on to Davies' single-seater Nieuport on which the two flew home to safety.

Flight Sub-Lieutenant Smylie was awarded the Distinguished Service Cross. Both these officers belonged to the famous No. 3 Naval Squadron commanded by Commander Samson. Squadron Commander Davies had

previously received a D.S.O. for a bombing attack at Dunkirk on the 23rd of January, 1915.

It was towards the end of 1915 that Lieutenant Max Immelmann began to make his presence felt. He was the first of the German pilots with a really big name, claiming his seventh victim on the 15th of December, a remarkable record for those days. He was in the German Imperial Flying Corps when war broke out and began to secure his victories before the majority of aeroplanes carried armament of any sort.

The advent of the Fokker monoplane gave him his great chance, but it was not only the superiority of his machine that was responsible for his success. He used his brains and evolved a scheme of tactics which was absolutely sound in its conception. He believed in approaching his quarry from the cover of a cloud or with the sun behind him, thus exploiting to the full the element of surprise. He also realised that all aeroplanes have blind spots where the vision of the pilot is shielded by the wings or the tail unit. By making full use of such cover he was often able to approach within effective range before opening fire.

His name will go down to posterity as the man who first rolled off the top of a loop. The Immelmann turn, as the manœuvre was called for years, enables a pilot quickly to regain height after a dive thus obviating a long climb. It is exceedingly useful in an aerial combat where time and height are two of the most important factors.

Immelmann was a typical pre-war German officer, arrogant to a degree and inclined to treat all his inferiors as the dirt beneath his feet. He was killed on the 18th of June, 1916, after a brief fight with an F.E.2b of No. 25 Squadron, piloted by Second Lieutenant G. R. McCubbin, with Corporal J. H. Waller as his observer.

Major Lionel Wilmot Brabazon Rees, who commanded No. 32 Squadron, won the Victoria Cross for the extraordinary achievement of defeating a formation of ten enemy bombing aeroplanes single-handed. The enemy crossed our lines near Festubert on the 1st of July, 1916, in a raid against some objective in our back area. One of Major Rees' squadron, Second-Lieutenant C. J. Simpson, first attacked them, but was killed.

Major Rees, who caught sight of them from a distance, believed them to be one of our own formations returning from enemy territory. He did not hesitate when he realised his mistake, but flew straight at them. He sent two down and broke up the formation, but three of them still carried on. Rees followed, and despite the fact that he was wounded, forced them to give up the raid.

Major Rees' history is another proof of the fact that neither numbers, nor superior performance of machines, count beside the indomitable will to win. He had already won the Military Cross in 1915. On one occasion he attacked a German biplane which had greater speed and power than his own machine. Despite its superiority, and the fact that it mounted two machine-guns to his one, he sent it down.

He was a regular soldier before the War, being commissioned in the Royal Garrison Artillery on the 23rd of December, 1903. He transferred to the R.F.C. on the 10th of August, 1914, survived the War, and retired with the rank of Group Captain in August 1931.

The defeat of the Schütte-Lanz S.L.11 by Lieutenant William Leefe Robinson has already been described in an earlier chapter, so I will not repeat the story here. Apart from the extreme courage required to attack an armed airship, single-handed, at night, after running the gauntlet of our anti-aircraft fire, the deed was tremendously important tactically. It showed the Germans that Warneford's exploit in Belgium was not merely a flash in the pan, but that Zeppelins were definitely vulnerable to aircraft handled with resolution. It was the turning point in the Zeppelin air raids against Great Britain.

Robinson was born in India on the 14th of July, 1895, and educated at St. Bee's School. He entered Sandhurst on the outbreak of war and was commissioned in the Worcestershire Regiment. He was seconded to the R.F.C. as an observer on the 29th of March, 1915. He was wounded on active service and learned to fly after convalescence. After winning the V.C. he again went to France with No. 48 Squadron and was shot down and taken prisoner. Shortly after he returned to England he died of influenza on the 31st of December, 1918.

When the Battle of the Somme was at its height the

German Air Service made its second bid for aerial supremacy. We had managed to survive the temporary superiority of the Fokker with its machine-gun firing through the propellor by means of an interruptor gear. Now they produced the exceptionally fast Halberstadt and Albatros aircraft equipped with two machine-guns each. They also adopted new tactics, and concentrated the best of their fighting pilots in special pursuit squadrons known as Jagdstaffeln.

Jagdstaffel 2, the first of these units to appear on the Western Front, was commanded by Hauptmann Oswald Boelcke. Boelcke was the son of a Saxon schoolmaster. Although contemporary with Immelmann he was a very different type of man. He disliked killing, and his contests were always fought against the opposing machine rather than the man flying it. He very much preferred to drive his adversary down out of control, than to destroy him, and he would afterwards entertain his victims in the Mess before they went on to their prison camp.

Boelcke was a magnificent pilot, although like so many other outstanding airmen of the War, his instructors did not believe he would ever learn to fly. He was never defeated in combat, having forty victories to his credit when he was killed accidentally on the 28th of October, 1916. Whilst diving on an enemy he collided with another machine of his command. His aeroplane broke up and crashed.

On one occasion he had a most extraordinary experience. He attacked and killed the pilot of an aircraft, but, to his astonishment, the machine, instead of crashing, continued to fly round in circles. The dead man had fallen on the controls in such a way that the aircraft continued on its course.

Sergeant Thomas Mottershead was awarded a posthumous V.C. for bravery on the 7th January, 1917. The following is the record in the *London Gazette* of the 12th of February

" For most conspicuous bravery, endurance, and skill when attacked at an altitude of 9000 feet, the petrol tank was pierced and the machine set on fire.

" Enveloped in flames, which his observer, Lieutenant Gower, was unable to subdue, this very gallant soldier

succeeded in bringing his aeroplane back to our lines, and though he made a successful landing, the machine collapsed on touching the ground, pinning him beneath wreckage from which he was subsequently rescued.

"Though suffering extreme torture from burns, Sergeant Mottershead showed the most conspicuous presence of mind in the careful selection of a landing place, and his wonderful endurance and fortitude undoubtedly saved the life of his observer.

"He has since succumbed to his injuries."

The next V.C. is an Australian one. In preparation for the assault on the Turkish position in front of Gaza during January 1917, the R.F.C. carried out a series of intensive bombing raids behind the enemy's lines. Whilst taking part in an attack on an enemy train, Captain Rutherford of No. 67 Squadron, flying a B.E.2c., was obliged to forced land with engine trouble.

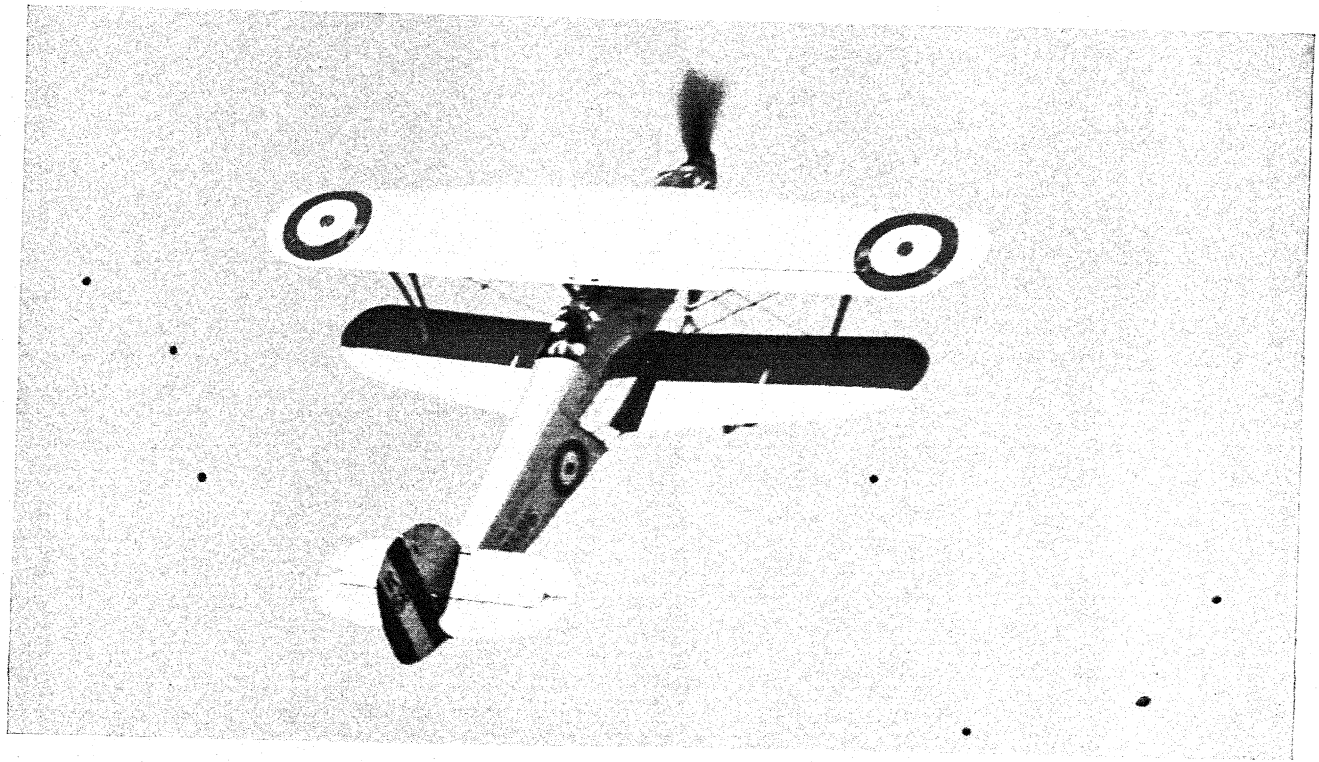
Lieutenant Frank Hubert McNamara of the Australian Flying Corps saw what had happened and immediately landed to help. Hostile cavalry were approaching, and he was fired at from the ground. He was also severely wounded in the thigh.

Rutherford climbed on to his machine, a Martinsyde Scout, and McNamara commenced to "take off." Owing to his wounded leg he was unable to keep straight and the aircraft turned over.

The two crawled out, set fire to the Martinsyde and attempted to start the B.E.2c. They were fortunately successful, and with McNamara at the controls, flew seventy miles back to the aerodrome.

One of the greatest British air fighters was Albert Ball. He was born at Nottingham on the 21st of August, 1896, and joined the Sherwood Foresters on the outbreak of War. He learned his flying at Hendon during 1915, when the Cyclist Corps to which he was transferred was stationed at Ealing and, afterwards, Luton. He used to get up at dawn every morning for his lesson so as to be back with his unit in time for parade. He was seconded to the Royal Flying Corps on the 29th of January, 1916, and joined No. 13 Squadron in France on the 18th of February.

At first he was chiefly engaged on artillery reconnais-



HAWKER "SUPER FURY"
One of the latest models in the Service.

By the courtesy of "Flight"

sance, but in April he destroyed an enemy machine and drove down two more. On the 7th of May he was transferred to No. 11 Squadron, which was equipped with the new French Nieuport Scout which had a 110-h.p. Le Rhone engine and was armed with a Lewis gun, fired over the top plane by means of a Bowden cable. The Nieuports were first used in the Flying Corps in March 1916 and were at that time ten miles an hour faster than the best British machine. They could also reach an altitude of 10,000 feet in ten and a half minutes.

During his career as a fighter Ball was officially credited with forty-three German aeroplanes and one kite balloon, although there were many others that he sent down too damaged to fly.

Ball was quiet and unassuming by nature, but was the personification of the fundamental principles of aerial fighting. Like Boelcke, he fought not the man, but the machine. He achieved his victories by pressing home every attack on which he embarked with the implacable determination to defeat his opponent. Whenever possible, he introduced the element of surprise by attacking with the sun behind him or from the shelter of clouds. Every time he " took off " from the ground the only thought in his mind was to seek out enemy machines, with an entire disregard for the numbers of their formation and send down as many as possible. That is the true offensive spirit.

He was a clever pilot and a dead shot, but his success was mostly due to an exceptionally quick brain. One of his favourite tricks when engaging a two-seater was to dive from behind and slightly to one side. As the German observer got his gun into position, he would continue his dive and come up under the fuselage. He would then be out of sight and could aim deliberately into the pilot's cockpit. Against single-seaters he would often approach head-on, as though about to ram his enemy. Always it was the German who banked to avoid a collision. That was the moment for which Ball was manœuvring. As the opposing machine swung away the pilot was momentarily without cover. Ball's deadly aim did the rest. With two aircraft rushing towards one another at over one hundred miles an hour, it will be appreciated that such tactics necessitated an iron nerve.

He was killed on the 7th of May, 1917, although no one can say whether it was during his last combat with Lothar von Richthofen, by anti-aircraft fire, or a crash from a damaged machine. He was awarded a posthumous Victoria Cross " for most conspicuous and consistent bravery from the 25th of April to the 6th of May, 1917, during which period Captain Ball took part in twenty-six combats in the air and destroyed eleven hostile aeroplanes, drove down two out of control, and forced several others to land."

Contemporary with Ball and opposed to him on the same front was Manfred Freiherr von Richthofen. Richthofen's first success against the Royal Flying Corps was with Boelcke's new-formed Jagdstaffel 2. Later he commanded the first Jagdgeschwader, which was a concentration of four Jagdstaffeln. This huge formation led by Richthofen in an aeroplane painted red was promptly nicknamed Richthofen's circus, but, consisting as it did of picked and experienced fighting pilots, it was a very formidable fighting force to come up against.

Richthofen was a killer by nature. Unlike Boelcke he took a delight in sending his enemies to their deaths. When he was eventually killed he had the huge total of eighty victories to his credit. Without in any way belittling his prowess as a fighter, which was exceptional, quite a large proportion of his victims were artillery, reconnaissance and photography machines, and not fighters. He followed the line of least resistance and his tactics in war were perfectly correct.

He was killed on the 21st of April, 1918, during a " dog-fight." He was diving on the tail of one of our machines when Captain A. R. Brown, of No. 209 Squadron, dived after him. His death had a tremendous effect on the *morale* of the German Air Service, as he had always been considered invincible.

Captain William Avery Bishop, D.S.O., M.C., won his V.C. on the 2nd of June, 1917. He was flying alone in a Nieuport Scout when he visited an enemy aerodrome. There were no machines about so he went on to another one some twelve miles behind the enemy lines. Here, there were seven machines, some with their engines " ticking over," so he dived to fifty feet to attack them with his machine-gun. One of the aeroplanes " took

off," but Captain Bishop crashed it at a height of sixty feet. He treated a second machine in the same way. Then two more " took off " together. He engaged both these at a thousand feet. One he sent down; the other escaped him after he had emptied his last drum of ammunition into it. On the return journey four enemy scouts flew in formation above him, but made no attempt to attack.

Bishop was another successful fighter who was not, at first, considered as a pilot. He was born at Owen Sound, Ontario, on the 8th of February, 1894. He was originally in the Canadian Cavalry, but transferred to the Royal Flying Corps and, to his disgust, was trained as an observer. His service in France in this capacity was extremely useful to him later when he got his wish. He was made a pilot on the 7th of March, 1917, and at once proceeded to pile up a score of forty-nine enemy aircraft and kite balloons. He survived the War and is at present in Canada.

Second Lieutenant Alan Arnett McLeod, of No. 2 Squadron, was another Canadian V.C. He was flying an Armstrong-Whitworth with Lieutenant A. W. Hammond, M.C., as his observer on the 27th of March, 1918, when they were attacked at a height of 5000 feet by eight enemy triplanes. " By skilful manœuvering he enabled his observer to fire bursts at each machine in turn, shooting three of them down out of control. By this time Lieutenant McLeod had received five wounds, and whilst continuing the engagement a bullet penetrated his petrol tank and set the machine on fire.

" He then climbed out on to the left bottom plane, controlling his machine from the side of the fuselage, and by side-slipping steeply kept the flames to one side, thus enabling the observer to continue firing until the ground was reached.

" The observer had been wounded six times when the machine crashed in ' No Man's Land,' and Second Lieutenant McLeod, notwithstanding his own wounds, dragged him away from the burning wreckage at great personal risk from heavy machine-gun fire from the enemy's lines. This very gallant pilot was again wounded by a bomb whilst engaged in this act of rescue, but he persevered until he had placed Lieutenant Hammond in

comparative safety, before falling himself from exhaustion and loss of blood."

Lieutenant McLeod returned to his home at Stonewall, Manitoba, on leave when convalescent, but unfortunately he died of his wounds shortly afterwards.

Lieutenant Alan Jerrard, of No. 66 Squadron, won his Victoria Cross in Italy on the 30th of March, 1918. Whilst on patrol with Captain P. Carpenter and Lieutenant H. Eycott Martin, he attacked a formation of five Albatross D.III.'s and shot one down in flames.

The patrol then attacked an enemy aerodrome and engaged nineteen enemy machines. Carpenter shot one down and Jerrard another. Whilst Jerrard was engaging six machines on his own, Martin, who had also shot one down, got into difficulties. Jerrard at once went to his assistance. When the patrol withdrew he acted as a rearguard until he was eventually driven down and made prisoner.

He survived the War and served in the Royal Air Force until last year, when he retired.

Captain McCudden's decoration was granted for an exceptionally high and remarkably consistent standard of performance instead of for a single deed. He had a career of success which is a model for every apprentice airman who enters the Service by way of Halton at the age of fifteen.

He was the son of a quartermaster-sergeant of the Royal Engineers and was born at Gillingham, Kent, on the 28th of March, 1895. He joined the R.F.C. in May 1913 and crossed to France in August 1914 as a mechanic in No. 3 Squadron. He was a good mechanic, but when he expressed a wish to fly, permission was granted and he started observing in June 1915. He learned to be a pilot in the following spring, and in July 1916 he was posted to No. 29 Squadron (D.H.) as a sergeant pilot. He sent down his first enemy machine on the 6th of September, 1916, the first of a long string of successes.

His Victoria Cross was gazetted on the 2nd of April, 1918, in the following terms:

"For most conspicuous bravery, exceptional perseverance, keenness and a very high devotion to duty.

"Captain McCudden has at the present time accounted for 54 enemy aeroplanes. Of these, 42 have been defi-

nitely destroyed, 19 of them on our side of the lines. Only 12 out of the 54 have been driven out of control.

" On two occasions he has totally destroyed four two-seater enemy aeroplanes on the same day, and on the last occasion all four machines were destroyed in the space of one hour and thirty minutes.

" While in his present Squadron he has participated in 78 offensive patrols, and in nearly every case has been the leader. On at least 30 other occasions, whilst with the same squadron, he has crossed the lines alone, either in pursuit or in quest of enemy aeroplanes.

" The following incidents are examples of the work he has done recently :

" On the 23rd of December, 1917, when leading his patrol, eight enemy aeroplanes were attacked between 2.30 p.m. and 3.50 p.m. Of these, two were shot down by Captain McCudden in our lines. On the morning of the same day he left the ground at 10.50 and encountered four enemy aeroplanes ; of these he shot two down.

" On the 30th of January, 1918, he, single-handed, attacked five enemy scouts, as a result of which two were destroyed. On this occasion he only returned home when the enemy scouts had been driven far east ; his Lewis-gun ammunition was all finished and the belt of his Vickers gun had broken.

" As a patrol leader he has at all times shown the utmost gallantry and skill, not only in the manner in which he has attacked and destroyed the enemy, but in the way he has during several aerial fights protected the newer members of his flight, thus keeping down their casualties to a minimum.

" This officer is considered, by the record which he has made, by his fearlessness, and by the great service which he has rendered to his country, deserving of the very highest honour."

His death was an anti-climax. He was killed in a trivial accident which occurred on the aerodrome at Auxi-le-Château on the 9th of July, 1918, when he was about to " take off " on a flight to assume command of No. 60 Squadron.

Captain Ferdinand Maurice Felix West of No. 8 Squadron won his V.C. on the 10th of August, 1918, whilst working in close co-operation with the IV. Tank

Brigade. With his observer, Lieutenant J. A. G. Haslam, he was flying an Armstrong-Whitworth in the neighbourhood of Rosières when he noticed a great deal of movement in the neighbourhood of Roye, which was the Tanks' objective. Descending to a low altitude for more precise observation, they were attacked by seven hostile aircraft. One of Captain West's legs was partially severed by an explosive bullet, and fouled the controls. He lifted the leg clear and regained control of the machine. Although he was also wounded in the other leg he handled the aeroplane with such skill that Haslam was able to drive the enemy aircraft away. Captain West succeeded in returning safely to our lines and insisted on making a report for the benefit of the Tank Commander before he was removed to hospital.

He is at present actively serving with the Royal Air Force as a Squadron Leader.

Another Canadian V.C. was obtained by Major William George Barker whilst patrolling in a Sopwith "Snipe" during a refresher course from England.

"On the morning of the 27th of October, 1918, this officer observed an enemy two-seater over the Forêt de Mormal. He attacked this machine, and after a short burst it broke up in the air. At the same time a Fokker biplane attacked him and he was wounded in the right thigh, but managed, despite this, to shoot down the enemy aeroplane in flames.

"He then found himself in the middle of a large formation of Fokkers, who attacked him from all directions, and was again severely wounded in the left thigh, but succeeded in driving down two of the enemy in a spin.

"He lost consciousness after this, and his machine fell out of control. On recovery he found himself being again attacked heavily by a large formation, and singling out one machine, he deliberately charged and drove it down in flames.

"During this fight his left elbow was shattered, and he again fainted, and on regaining consciousness he found himself still being attacked, but, notwithstanding that he was now severely wounded in both legs and his left arm shattered, he dived on the nearest machine and shot it down in flames.

"Being greatly exhausted, he dived out of the fight to

regain our lines, but was met by another formation, which attacked and endeavoured to cut him off, but after a hard fight he succeeded in breaking up this formation and reached our lines, where he crashed on landing.

"This combat, in which Major Barker destroyed four enemy machines (three of them in flames), brought his total successes up to fifty enemy machines destroyed, and is a notable example of the exceptional bravery and disregard of danger which this very gallant officer has always displayed throughout his distinguished career.

"Major Barker was awarded the Military Cross on the 10th of January, 1917; first Bar on the 18th of July, 1917; the Distinguished Service Order on the 18th of February, 1918; second Bar to Military Cross on the 16th of September, 1918; and Bar to Distinguished Service Order on the 2nd of November, 1918."

Major Barker, who was born at Dauphin, Manitoba, on the 3rd of November, 1894, returned to Canada after the War. He was killed in an aeroplane accident on the 12th of March, 1930.

The next record is that of Captain Andrew Weatherby Beauchamp-Proctor of No. 84 Squadron.

"Between the 8th of August, 1918, and the 8th of October, 1918, this officer proved himself victor in twenty-six decisive combats, destroying twelve enemy kite balloons, ten enemy aircraft and driving down four other enemy aircraft completely out of control.

"Between the 1st of October, 1918, in a general engagement with about twenty-eight machines, he crashed one Fokker biplane near Fontaine and a second near Ramicourt; on the 2nd of October he burnt a hostile balloon near Selvigny; on the 3rd of October he drove down, completely out of control, an enemy scout near Mont d'Origny, and burnt a hostile balloon; on the 5th of October, the third hostile balloon near Bohain.

"On the 8th of October, 1918, while flying home at a low altitude, after destroying an enemy two-seater near Maretz, he was painfully wounded in the arm by machine-gun fire, but, continuing, he landed safely at his aerodrome, and after making his report was admitted to hospital.

"In all he has proved himself conqueror over fifty-

four foes, destroying twenty-two enemy machines, sixteen enemy kite balloons, and driving down sixteen enemy aircraft completely out of control.

"Captain Beauchamp-Proctor's work in attacking enemy troops on the ground and in reconnaissance during the withdrawal following on the Battle of St. Quentin from the 21st of March, 1918, and during the victorious advance of our Armies commencing on the 8th of August, has been almost unsurpassed in its brilliancy, and as such has made an impression on those serving in his squadron and those around him that will not be easily forgotten.

"Captain Beauchamp-Proctor was awarded the Military Cross on the 22nd of June, 1918; Distinguished Flying Cross on the 2nd of July, 1918; Bar to Military Cross on the 16th of September, 1918; and Distinguished Service Order on the 2nd of November, 1918."

The last on the list is Major Edward Mannock, whose decoration was posthumously awarded in the *Gazette* of the 18th of July, 1919, a year after his death.

Major Mannock was commissioned in the Royal Engineers on the 1st of April, 1916, but transferred to the R.F.C. in August. He became a flying officer in February 1917, and two months later was posted to No. 40 Squadron (Nieuports).

His first success was against a kite balloon on the 7th of May, 1917, and his first enemy machine went down a month later on the 7th of June. Most of his victories were obtained whilst flying an S.E.5, and he was in a machine of this type when he was shot down and killed by an anti-aircraft gun on the 26th of July, 1918.

The following is the *Gazette* account of his record:

"On the 17th of June, 1918, he attacked a Halberstadt machine near Armentières and destroyed it from a height of 8000 feet.

"On the 7th of July, 1918, near Doulieu, he attacked and destroyed one Fokker (red-bodied) machine, which went vertically into the ground from a height of 1500 feet. Shortly afterwards he ascended 1000 feet and attacked another Fokker biplane, firing sixty rounds into it, which produced an immediate spin, resulting, it is believed, in a crash.

"On the 14th of July, 1918, near Merville, he attacked

and crashed a Fokker from 7000 feet, and brought a two-seater down damaged.

"On the 19th of July, 1918, near Merville, he fired eighty rounds into an Albatross two-seater, which went to the ground in flames.

"On the 20th of July, 1918, east of La Bassée, he attacked and crashed an enemy two-seater from a height of 10,000 feet.

"About an hour afterwards he attacked, at 8000 feet, a Fokker biplane near Steenwerke and drove it down out of control, emitting smoke.

"On the 22nd of July, 1918, near Armentières, he destroyed an enemy triplane from a height of 10,000 feet.

"Major Mannock was awarded the undermentioned distinctions for his previous combats in the air in France and Flanders:

"Military Cross. Gazetted on the 17th of September, 1917.

"Bar to Military Cross. Gazetted on the 18th of October, 1917.

"Distinguished Service Order. Gazetted on the 16th of September, 1918.

"Bar to Distinguished Service Order (first). Gazetted on the 16th of September, 1918.

"Bar to Distinguished Service Order (second). Gazetted on the 3rd of August, 1918.

"This highly distinguished officer, during the whole of his career in the Royal Air Force, was an outstanding example of fearless courage, remarkable skill, devotion to duty, and self-sacrifice, which has never been surpassed.

"The total number of machines definitely accounted for by Major Mannock up to the date of his death in France (26th of July, 1918) is fifty—the total specified in the *Gazette* of 3rd of August, 1918, was incorrectly given as forty-eight, instead of forty-one."

These nineteen records all sound the one distinctive note of determination. Aerial supremacy can never be won by quality of machines and preponderance of numbers alone. The aircraft must have the right men to handle them. Fighting pilots must be endowed with courage and a quick decision. But, as in every class of

combat since the world began, the man in the machine must know his weapons. He must be a crack shot and a skilful and resolute pilot.

In these essentials and in the general standard of efficiency of its personnel, the Royal Air Force has no equal in the world.

INDEX

United Service Institution of India
Library