

Aviation in Australia.

Paper read by Flight-Lieut. J. Renison Bell, R.A.A.F., before the Institution in the Lecture Room of the Junior Institution of Engineers, 39, Victoria Street, London, S.W.1, on 22nd February, 1927. Major F. A. de V. Robertson, M.A., in the Chair.

THE CHAIRMAN: I, personally, am looking forward with great pleasure to hearing what Flight-Lieut. Renison Bell has to tell us about Flying in Australia. I have never been to Australia myself, though I hope to do so one day in an airship, but I have studied flying conditions there as far as is possible from a distance, for the past five or six years, and my studies have forced me to the conclusion that Australia is the foremost country for aerial transport, not only in the British Empire, but in the world. It is therefore particularly interesting to hear about it from one who knows. In our own country there are difficulties in regard to climate and geographical conditions which rather keep us from progressing as much as we could wish, and whenever I feel a little depressed about the way things are going in Great Britain it is refreshing to turn to Australia and think: "This is British, and it is making good." and I feel it is going to make a great deal better in the future.

Introductory.

Flight-Lieut. J. RENISON BELL: If aircraft were animate bodies, all the world's aircraft would, by a natural process of selection, migrate to the country most suited to their environment; there is no need to suggest where they would go, for Australia is eminently suited for flying, fog is practically unknown, and the climate is ideal. It must not be thought, however, that Australia is a vast aerodrome, because we have some very bad flying country and the weather can be very nasty at times, especially on the hilly routes and at certain seasons in the tropical and sub-tropical regions. I cannot subscribe to the statement that one hears occasionally over here that "every day is a flying day." If you consider our population in relation to the area of the country—it is roughly two persons to the square mile—you might challenge the statement that it is God's own country for flying, and say that if it is such a wonderful country, why don't the people of the British Commonwealth flock there to fill our empty spaces? That is a question outside the scope of this paper, but suffice it to state that we have set our face against peopling the land with a mixed race and will have none but Europeans, preferably British, and at present 99 per cent. of the population is of British origin. However, the population is increasing steadily both by migration and natural increase.

Aviation is firmly established in Australia and has already proved a great benefit, not only in opening up the country, but in speeding up communication and providing employment for labour and capital. The area is so vast and the population so small and scattered, that it is beyond the public purse to construct all the roads and railways that are necessary, and I think that the more modern form of transport will increase out of all proportion to the increase in ground communication. Another factor favouring the development of the Aviation Industry is the irregular gauge of the railways. There is a different gauge in each state, some states having two or three and the break of gauge in long distance transport means delay in trans-shipment from one to another. Nearly all the railways are owned by the Government, the total mileage so owned is 24,000 and the privately owned amount to about 3,000 miles. Though there are ample lines running in the closely populated areas the main lines do not extend sufficiently to the more sparsely settled parts to provide adequate facilities.

Some idea of the cost per head of providing railways may be obtained when we compare a few figures. In the United Kingdom there are 194 miles of rail per 1,000 sq. miles, but in Australia only 8·5 miles per 1,000 ; but there are 1,000 people in Great Britain to every half-mile of railway, whereas we have 5·7 miles to maintain per 1,000 inhabitants.

The usefulness of air communication can easily be realised by a glance at the map, but the most striking example can be seen in Queensland, where three main railways go in from the coast rail, but they are not connected inland across country. The journey from Charleville to Cloncurry by rail means going out to the coast at Brisbane, up to Townsville, then inland again.

The Pioneers.

Australia has contributed her share to the development of aeronautics in the pre-war days. All are familiar with Laurence Hargreaves' experiments with kites and gliders in Sydney from 1892 onwards. Capt. Jack Duigan in 1911 built and flew an aeroplane of his own design fitted with a Green engine, the skeleton is now in the Melbourne Museum. Then there were Harry Houdini, the "Handcuff King" who imported and flew a Voisin biplane at Sydney, on 21st March, 1910 ; Henry Petre, who was engaged with E. Harrison (now S/L R.A.A.F.), as the first instructor for the Commonwealth Government Flying School ; Badgery, the late Col. Oswald Watt, and others, all of whom were prominent in the early days.

The post-war pioneers have carried out many notable flights in Australia, and contributed considerably towards bringing aviation into its own there, to say nothing of the usefulness of the survey work carried out for Service and civil purposes. Of these pioneers one could speak at length, but there is little need to do more than mention their names, *viz.*, the late Sir Ross Smith and his party ; Parer and McIntosh ; Bert Hinkler who flew a baby Avro 1,200 miles non-stop in 1920 from Sydney to Bunderberg ; Wing Commander Goble and Flight-Lieut. McIntyre, Col. Brinsmead and Capt. Jones, Group Capt. Williams and his sea-plane crew, and many others. One cannot refrain from mentioning two other

flights of which little is known, I mean Wrigley's flight to Darwin and Anderson and Stutt to Tasmania. Capt. (now Squadron Leader) Wrigley flew in an old B.E. with a mechanic from Melbourne to Darwin (2,600 miles) to meet the Ross Smiths and to prepare the way for them to fly across the country, it was a gallant effort and a pioneer flight, both he and his mechanic (Flight-Lieut. Murphy), were rewarded with the A.F.C. In the other flight, Squadron-Leader Anderson and the late Capt. Stutt, set out at short notice, each in a D.H. 9A, across the Bass Strait some 300 miles in search of a ship that was missing in the locality. In this flight (1920) Capt. Stutt and Sergt. Dalziell disappeared, near the Tasmanian coast on the way over; Squadron-Leader Anderson carried out a search lasting about two weeks at great risk, probing into every valley of the mountainous coast, and into every bay, for his companion and the missing ship, but no trace of either has ever been found.

During the war period private flying ceased. The New South Wales Government had a flying school where training for active service was carried out, but the main centre was the Commonwealth Government's station at Point Cook, near Melbourne. It is at this point that I had better refer as far as I intend to, to the Royal Australian Air Force.

The Royal Australian Air Force.

The origin of the Air Force dates back to a few months before the war of 1914-18, when a small flying school was opened in Victoria as part of the Permanent Military Forces of the Commonwealth. The matter had been under consideration for some time since 1911, but it was not thought then that aircraft would be of much use in war apart from reconnaissance. The flying school was increased when war broke out, and early in 1915 a small unit was despatched to Mesopotamia at the request of the Indian Government. Later on we formed complete units and in 1916 the Australian Flying Corps became part of the Australian Imperial Force. By 1918 we had a large training school in Victoria, four squadrons in England, three in France, and one in Egypt. The total personnel who went on active service amounted to about 900 officers and 3,000 airmen. In March, 1921, the R.A.A.F. was formed by Proclamation pending the passing of an Air Defence Act. This small force consisting of only about 50 officers and some 300 airmen, did a lot of valuable work for civil aviation in selecting aerodromes and blazing the air routes throughout the Commonwealth, in addition to laying the foundation of the air defence of Australia. Many of the aerodromes and landing grounds surveyed are used by the civil companies operating to-day. The Service has not discontinued this work, and photographic surveys and reconnaissance for government departments form part of the normal activities of the R.A.A.F.

We train civil pilots and give refresher courses to those about to engage in commercial flying, but no doubt this work will cease when facilities for this class of training are more generally provided by the private schools and light aeroplane clubs. In September, 1923, the Air Defence Act was passed constituting the Air Force an autonomous arm of the Defence Forces of the Commonwealth. Since then the service has expanded gradually, but will not complete the development

considered adequate for home defence for some time to come. We have units now in Victoria and New South Wales, with the usual depots, etc., necessary for training and maintenance and an Experimental establishment. Our training and organisation are on similar lines to those of the R.A.F.

Experimental.

The Experimental Establishment was opened at Sydney, N.S.W., in January, 1924, in commodious premises, but with only a small staff, the object of setting it up was, *inter alia*, for the following purposes :—

- (a) Design of experimental aircraft to meet local conditions.
- (b) Investigation of Australian timber and materials for aircraft.
- (c) Standardisation and modification of Australian Air Force aircraft and equipment.
- (d) Development of manufacturing methods to enable local concerns to undertake R.A.A.F. contracts.
- (e) Training of unskilled personnel in aircraftmanship.

The establishment has been working away steadily and has carried out much useful work on the above lines both for service and civil purposes. The scope of its activities may be expected to increase in the near future and contribute largely towards establishing the aircraft industry more firmly in Australia by providing a laboratory where designs and ideas may be tested and developed.

Citizen Air Force.

There is a Citizen Air Force now in training. This is conducted on similar lines to the Special Reserve Air Force in England. Training centres have been established at Melbourne and Sydney only, so far, but the movement will be extended to other centres later on. This system should do a great deal to further Civil operations apart from its value as an Air Force Reserve for defence.

Civil Aviation.—General.

Organised flying commenced in 1920 when in December the Department of Civil Aviation was formed under the Department of Defence, and the Air Navigation Act was passed in the Federal Parliament.

The Department of Civil Aviation is administered by the Controller, Col. Brinsmead, who is answerable to the Minister of Defence. Though there is very close liaison with R.A.A.F., it is a separate Department.

This department has made tremendous efforts, and successfully, to develop aviation on a sound basis with the maximum of safety to the public. The Controller has a staff of about four officers and some clerks who with a very few ground engineers are responsible for the administration and supervision of the civil activities of the entire Commonwealth. I do not think one could find a parallel anywhere.

Aerodromes, Landing Grounds and Air Routes.

Amongst the earliest activities of organised aviation were the acquisition and preparation of service and civil landing grounds on approved routes throughout the Commonwealth. As I have already mentioned, much of this work was done by the Air Force. There are chains of these sites between all capital cities, along the coast and through to Darwin, besides many interior lines in addition to those regularly used by the mail companies, most of them belonging to the Commonwealth, and are maintained and have the conventional ground markings (with wind sleeves in many cases) and with petrol and oil facilities adjacent. There are eleven private aerodromes licensed and 134 provided and maintained by the Government.

We have recently prepared and printed air route strip maps of a very useful kind, and others are in course of preparation; these are available to the public. I have a sample here for your inspection. The markings conform to those laid down by the Aeronautical Convention to which the Commonwealth is a signatory.

The Subsidised Air Services.

In addition to providing regular and speedy transport in localities where the older forms of communication were wholly or practically non-existent, the Government considered that the granting of contracts for subsidised services would give an impetus to the development of civil aviation in Australia while the trained flying and ground personnel would provide a technical reserve for air defence in case of war.

The Department prepares and maintains the landing grounds over the subsidised routes, but the contractors must provide their own hangars and workshops. In practically all contracts that have been let, the service has to be performed once weekly in each direction, and provision is made for the deduction of a portion of the subsidy in the event of failure to complete any trip. Contractors carry up to 100 lbs. of mail free each trip, and the surcharge of 3d. per half ounce received on letters is credited to revenue. All the pilots and mechanics of the companies have to become members of the R.A.A.F. Reserve.

Originally all contracts were for one year, but now the companies are working under three year agreements with the subsidy reviewed annually. Up to date the following subsidised companies are operating :—

- (a) *Western Australian Airways.*—Perth-Derby, W.A., with a route of 1,442 miles.
- (b) *Queensland and Northern Territory Aerial Service.*—Charleville-Camoo-weal Route, 825 miles.
- (c) *Larkin Aircraft Supply Co.*—Adelaide-Cootamundra service with branches Mildura-Broken Hill and Hay-Melbourne. Route, 1,000 miles.

I will deal with these routes in the order named.

Perth-Derby.

The original service was started in December, 1921, and ran from the railway terminus at Geraldton to Derby, a distance of 1,189 miles each way. In January, 1924, the service extended south to Perth—total 1,442 miles each way. The company employs seven pilots, and the aircraft in use are D.H.50's and Bristol Tourers all fitted with 240 h.p. Siddeley Puma engines. The Tourers are being replaced early this year by D.H. 50's. The subsidy has been reduced to 3s. 3d. per mile flown.

A varied quantity of freight is carried, consignments regularly include on the northern trip, live chickens, medicine, newspapers, motor and machinery parts, wearing apparel; and southward, valuable packages of pearls for Broome (as much as £6,000 worth have been carried in one trip). The number of letters carried the first month was only 577, but has now increased to 20,000 per month. With the exception of one serious accident to one of the members of the staff at the inception of the service, Western Australian Airways, Ltd., have maintained their operations very successfully, and the facilities provided have been readily availed of by the public, in fact, in order to ensure transport passengers have to book well ahead.

Landings are made at the following places : Perth, Geraldton, Carnarvon, Onslow, Roeborne, Whin Creek, Port Hedland, Broome and Derby.

Charleville-Camooweal.

This route links up the western termini of three main railway lines running inland from the seaboard, *i.e.*, Charleville, Longreach, Cloncurry, thence on to Camooweal, and an extension is about to be opened up from Cloncurry to Normananton, 225 miles, a seaport in the Gulf of Carpentaria.

The original contract provided for a weekly return service between Charleville and Cloncurry, 577 miles, and operations commenced in November, 1922. In February, 1925, the extension to Camooweal came into operation, making a total run of 825 miles. The Company only employs four pilots on the route, the machines used are D.H.'s (50 and 9's), and one Bristol Tourer, and mail and passenger bookings are increasing rapidly. The freight carried is even more varied than in Western Australia, and the service is so regular and efficient that residents set their clocks by the mail aeroplanes, and the subsidy is about to be reduced if it has not already been done.

This month the Company commenced a service (unsubsidised) from Brisbane to Toowoomba, 75 miles. The latter being an important town with a large business connection with Brisbane. Full details of the service have already been published in the Press.

The stopping places on the Charleville service are : Charleville, Tambo, Blackall, Longreach, Winton, Mackinlay, Cloncurry, Mt. Isa and Camooweal.

Cootamundra-Adelaide and Branches.

This service ran from Sydney to Adelaide (790 miles) from June 1924, but without any branch services. In July, 1925, it was re-organised and ran Cootamundra-Adelaide with branches Melbourne-Hay and Broken Hill-Mildura.

This was due to the very hilly country between Cootamundra and Sydney and consequently the lack of landing grounds, the bad visibility in winter, and the facility for quick travel provided by the Sydney-Melbourne night express train, it was found more practical to commence from Cootamundra where the train arrives daily at 5 a.m. on its Southern journey. Passengers westward bound from Sydney change at Cootamundra and arrive at Adelaide, a distance of about 900 miles in eighteen hours or thereabouts. Similar conditions apply on the eastward journey.

The Cootamundra route is 578 miles long, and the journey is made by air once weekly each way. From Melbourne to Hay the route is 233 miles ; service twice weekly each way. Broken-Hill to Mildura 189 miles, twice weekly each way also.

Broken Hill is an important mining centre and one of the largest inland cities of the Commonwealth. The journey to Sydney takes 69 hours by train, and only 19 by air.

Five pilots are employed on the routes and the machines are similar to those on the other lines. The subsidy is 4s., with a probable reduction early this year.

Statistics of all services are appended.

From the foregoing you will see that the total length of the three regularly operated routes is 3,267 miles, and the normal mileage flown by the companies per week over these routes is 7,378 miles. With the additional trip Perth-Geraldton and Brisbane-Toowoomba daily service, the weekly total will exceed 8,000 miles.

Non-Subsidised Enterprise.

In addition to the companies engaged in subsidised air mail operations there are numerous firms and individuals engaged in aviation in one form or another. There are several firms in Victoria who own and fly aircraft for civil work, some of them finding business in taxi work and photography, and half a dozen firms who are on quite a good footing who get service contracts for repair and overhaul of equipment.

In the other States the activities are rather less, due partly, no doubt, to the main R.A.A.F. units being near Melbourne, but firms and individuals are operating, and the tendency is for them to find increased avenues for business particularly as the Aeroplane Clubs are growing.

On November 30th, 1926, there were 66 private aircraft registered, of which about twenty belong to the mail companies, and 133 Ground Engineers' licences in force.

Local Manufacture.

No civil company has commenced the complete design and manufacture of aircraft, the work to date has consisted chiefly of reconditioning and repair of imported machines and engines.

The contractors for the aerial service in Western Australia and Queensland have laid down a plant sufficient to construct a limited number of aircraft, and

both companies are now building de Havilland machines for their own requirements. Several local firms of good standing and several English firms have been investigating the possibility of manufacture of aircraft, one of the latter has actually gone out this year and will shortly commence operations. There is every indication that local manufacture could commence immediately the Commonwealth Government is able to place orders in sufficient quantity to justify the capital outlay that would be involved, but even without Government orders it is only a matter of a little while before the public demand will be sufficient to induce manufacture. There is no lack of skilled and experienced local labour, but so far as I am aware there are no competent designers of aircraft or engines in Australia apart from the few employed in the Air Force. One is inclined to think that firms do not realise that in the aircraft industry, as in many others, it is largely the provision of the commodity that creates the demand rather than the converse.

I have no evidence to indicate whether there is any tendency to lean towards metal construction in Australia rather than wood, we have a large and progressive steel works and the extensive electrical undertakings that have been completed in Tasmania and on the mainland are giving an impetus to the production of alloys.

The construction of the Wackett Widgeon proves the suitability of local timber for flying boats, and the efficiency of Australian workmanship. Most of the propellers used in the country are of Australian manufacture from local timbers.

The earlier references to the manufacture of aircraft apply to aircraft engines. There are none made locally, though the several firms that have been employed on reconditioning aero engines have gained valuable experiences which should make it easier to start manufacture if sufficient inducement offers. English Aero engine firms are now exploring the prospects in Australia.

Of course, there have been quite a number of individual aircraft built for light aeroplane competitions and experimentally, and in 1921, the Australian Aircraft and Engineering Company of Sydney were flourishing, but they went into liquidation. I am not sure of the cause, but it was not only lack of demand.

Foreign Activities.

As far as I have been able to ascertain there are no foreign aircraft companies operating, though many of them have agents who sell accessories. There are only a few American and French aircraft in the country. There is no prohibition against import of foreign aircraft or engines, but before any can be used they must obtain a British Airworthiness Certificate.

Several foreign firms have been making overtures quite recently and I have no doubt that owing to the excellent qualities and comparative cheapness of some of their products, they will shortly obtain a substantial footing, as has been done with motor cars. About 70 per cent. of our cars are imported from foreign countries.

The Aeroplane Clubs.

The evolution of low-powered aircraft has had a beneficial effect in Australia as well as elsewhere, and we now have Aeroplane Clubs in most of the States. We are indebted to the de Havilland "Moth" and "Cirrus" engine for facilitating

such rapid progress in this direction as all the Clubs are equipped with these machines and engines. Other types are now coming along, and their appearance in the Commonwealth may be expected shortly.

The Clubs are formed under the Australian Aero Club, of which there are sections in each of the five States in Australia, but so far Tasmania has not formed a Branch. Briefly the conditions under which the Sections are assisted by the Government are as follows :—

- (a) The Department lends the aircraft, engines and spares to the Club.
- (b) The Clubs provide expert instructors and mechanics and conduct the training and maintenance activities.
- (c) The Department has agreed to pay the Club a bonus of £20 per pupil trained to a standard that will enable the issue of a private pilot's licence under Air Navigation Regulations.
- (d) The Clubs are granted free hangar accommodation at Departmental aerodromes where suitably situated.

So far Clubs have been registered and are operating under the scheme in Melbourne, Geelong, Sydney and Adelaide, and I understand Brisbane is following suit. Flying schools are being started if not actually started by each of the subsidised companies. The conditions are slightly different here, for the companies are to provide the aircraft and the Department is to pay £50 per graduate with a maximum of 50 graduates per annum. The Melbourne and Sydney Flying Clubs have approximately 1,000 members each, though these are not all receiving flying training.

These clubs and schools have already stimulated the Australian Aero Club in all States (which I understand will shortly be granted the title of Royal Aero Club of Australia), and the increase of private pilots throughout the Dominion will surely give a great impetus to the development of aviation.

Educational.

Aeronautical subjects are included in the curricula of the Universities and public and other schools. There is an aerodynamic laboratory with a wind tunnel at Melbourne University and an engineering shop, another I think at Sydney University. There is also the Oswald Watt Memorial Prize awarded annually.

Proposed Routes.

The proposed routes are indicated by the dotted lines on the slide. There are three main proposals likely to come to fruition in the near future :—

- (a) Melbourne-Tasmania, 250 miles.
- (b) Perth-Adelaide, 1,470 miles.
- (c) Cloncurry-Normanton, 225 miles.

Melbourne-Tasmania is a flying boat service and a company has been formed recently with £100,000 capital. The personnel are amongst the most reliable in

the aircraft world of Australia, and if the Government mail subsidy is forthcoming, operations will commence at an early date. Details have already appeared in the aircraft Press, so I will not burden you with them.

The Perth-Melbourne service will do much to bring Western Australia nearer to the eastern centres of population as well as save a week in the communication between all places east of Adelaide and Western Australia, as well as India and the United Kingdom. Close attention is being paid to the example set by U.S.A. in the establishment of a long distance day and night flying mail service, which will not require the annual disbursement of developmental funds in the form of subsidy. Such a route is that between Perth and Adelaide. There is ample first class mail matter delivered in Fremantle for eastern States by every incoming overseas mail liner, and from data available there is good reason to estimate that a paying load would be available for multi-engined aircraft to transport the mail eastwards.

The third route between Cloncurry and Normanton will serve a large area with a prosperous cattle industry. Normanton is a seaport with only one ship per month calling. The air mail will bring it about three weeks nearer Brisbane.

There are no other routes likely to be opened at present though there are several surveyed, and with landing grounds available and flown over at irregular intervals.

Conclusion.

There are many other matters on which one could dwell such as the Air Force Displays and Tattoos, Aerial Derbys and light plane competitions, that we have held ; the frequent utilisation of aircraft for medical aid, an aspect likely to become a definite organisation under the auspices of the Australian Inland Mission ; but I think I have occupied enough time already. I hope I have painted the picture and given some idea of what we are doing. We realise that we have not developed the flying industry nearly enough, but our position to-day is not one to be ashamed of ; as a matter of fact, there is no other country in the world with aerial communications developed to the same extent in proportion to the size of population, and we hold first place amongst the Dominions including India.

I have not referred to airships. Our position in this regard has been clearly defined in the Press, and we are ready to co-operate to the fullest extent when the time is ripe. I do not think I can conclude better than quote the Prime Minister of Australia, who after an extensive air tour in Queensland, said :—

“ The Flight I have just completed has further impressed on me the great importance of aerial transport to a country such as Australia with its enormous areas and great distances. Such an amazing advance has been made in this arm of transport during the last few years that it is difficult to visualise what may be accomplished in the future, but I am confident that air transport will become an increasingly important factor in our national life with each succeeding year.”

STATISTICS OF REGULAR AERIAL SERVICES IN AUSTRALIA.

From December 5th, 1921 to November 30th, 1926.

	Perth Derby (W.A.)	Larkin Ser- vices. x.	Charleville Carnooewel. (Queensland).	Totals.
Length of route ...	1,442 miles	1,000 miles	825 miles	3,267 miles
Date inaugurated ...	Dec. 5, 1921	June 2, 1924	Nov. 2, 1922	—
Frequency of service..	Weekly in each direction.	Part weekly ; part twice weekly.	Weekly in each direction.	—
Machine flights ...	4,136	2,481	3,033	9,650
Machine miles ...	694,021	309,936	304,076	1,308,033
Hours flown ...	9,189 : 25	3,996 : 50	3,904 : 20	17,091 : 35
Paying passengers car- ried over single stages	3,342	1,428	3,471	8,241
Paying passenger miles	600,169	164,091	332,643	1,096,903
Paying passengers fat- ally injured on scheduled trips ...	Nil.	Nil.	Nil.	Nil.
Letters carried ...	840,826 (to end of Oct., 1926)	18,028 (to end of Oct., 1926)	65,561 (to end of Oct., 1926)	924,415
Freight carried ...	73,008	394½	34,723	108,125½

All companies fly 7,378 miles weekly, thus :—

Western Australian Airways, Ltd.	2,884 miles
Larkin Aircraft Supply Co.	2,844 miles.
Queensland and N. T. Aerial Services, Ltd. ...	1,650 miles

 7,378 miles.

DISCUSSION.

The CHAIRMAN (Major F. A. De V. Robertson): I am sure we are all very much obliged for the exceedingly interesting information the lecturer has given us. He has told us very many facts—not surmise or prophesy, and I am afraid that sometimes we get all prophesy and not much accomplishment. I now have pleasure in throwing the meeting open for discussion.

Mr. W. E. GRAY : I think it would be of interest, since Australia seems to offer great possibilities for private flying, if the lecturer could give us some idea as to the formalities required from private people before they can fly, as compared with conditions here, and, similarly, as regards the construction of private machines.

Mr. DUDLEY WRIGHT : I should like to know whether the lecturer can tell us if air-cooled or water-cooled engines are best for flying in Australia.

Dr. THURSTON : I know nothing about Australia, but I must express my very great appreciation of the paper we have had to-night. I had the privilege immediately after the war of lecturing on aeronautics to many thousands of Australians on Salisbury Plain, and I found them most intensely interested. They gave me a very good time which I shall always remember with the greatest pleasure, and it is gratifying to hear that in Australia you have taken up flying with an enthusiasm which you would not find from an equal number of people in this country.

Could the lecturer give us some particulars as to the state of the atmosphere when flying in Australia ? For instance, what kind of bumps do you get in the air ? Is it in any way comparable to the bumps we get here ? It is seldom we find a strata in which we can fly with perfect comfort. At times when flying over London I have seen the south coast of the Isle of Wight, but you can fly over London a hundred times without being able to do that.

Can the lecturer also give us particulars of the various aircraft woods—strength in compression and bending and in sheer ? I had on one occasion in searching the possibilities of certain machines made from Australian woods, to go to the Library at Australia House ; I got certain particulars there, but it did not seem to me substantial enough or detailed enough from a mathematical point of view, to enable a designer here, if he wished to design a machine for construction in Australia, to utilise the data to be quite certain that the machine would be up to the calculated strength. Such information would be very valuable from the designer's point of view.

Another thing one would like to have further information about from an interest point of view, is the possibility of small aeroplanes on up-country stations for keeping up friendly communication with one's neighbours. I have myself been ranching, and although it is a most glorious life, one is very lonely. The distances covered are immense, and it would be a great convenience if one could get in a light aeroplane and visit their neighbour.

Mr. WEAKLEY : One of the things that struck me was that with such a tremendous coast line as Australia has, the seaplane has not been developed as it might be.

Has the climate any particular effect on doped fabrics ?

With regard to water-cooled *versus* air-cooled engines, what are the chief types of engine in use in Australia at the present time ?

I should also like to know what is the reason for so very many types of gauge in a new country.

Mr. N. J. HANCOCK : With regard to fabric covering, I would say that the chief trouble is the fact that it will not withstand the large climatic variations encountered on the Australian Mail Routes. For instance, in the temperate climate of Perth the fabric is quite taut, but when the machine has got as far north as Port Headland, the fabric has so slackened, that the bulge between the ribs (about 18 inches apart) has become at least three-quarter inches. The loss of efficiency due to this must be quite considerable. Of course, as the machine travels south on the return journey, the fabric slowly tightens up again, and is once more normal at Perth.

I think that the all-metal machine would be much more satisfactory for Australia than the composite structure type, and as the climate is fairly dry, corrosion troubles should not be great. The incessant truing up, necessary with a composite structure in which the wood is perpetually seasoning, would be obviated, also the metal covering would solve the fabric problem.

With reference to engines, I think the air-cooled engine will prove the most satisfactory for Australia. I remember once going from Port Headland to Broome, a trip just over five hours, against a 20 m.p.h. wind. For the first hour the thermometer registered about 98°, and it was nearly impossible to climb for fear of boiling the water away. The best method is to climb up by steps, *i.e.*, climb from the aerodrome until the water temperature is about 20° C. below boiling point; then throttle back as much as possible so as to just maintain level flight, then the temperature will slowly drop; when it has reached about 75° C, the procedure is repeated until about 5,000 feet is attained, where the atmosphere temperature is low enough to give efficient cooling. With an air-cooled engine (where the cylinder temperature is about 280°-260° C.) it would be possible to climb at once to about 5,000 feet without doing the engine any harm. Air-cooled engines would, I think, save the Air Mail Companies a number of forced landings.

With regard to cutting down the subsidy as soon as the Air Mail Companies pay their way, I think that though this has happened, they have, thanks to efficient management and organization, paid a 10 per cent. dividend since they first started.

I would like to thank Lieut. Renison Bell for his very interesting paper.

Mr. MICHAEL TERRY : I have had a slight experience in Queensland and Western Australia, and I was impressed with the wonderful flying conditions; the pilot just had to steer, and the machine flew itself.

I should like to say what a wonderful boon aircraft are to the people living in the bush. I am also very interested in the future of aircraft as regards aerial survey and mapping, and I think they will play a very large part in that direction in the near future.

FLIGHT-LIEUT. BELL'S REPLY.

The formalities for private flying in Australia are practically the same as in England; one must have the usual pilot's licence, and also an airworthiness certificate from the Civil Aviation Department. So far I do not think any machine has been completely stressed, though they can do it at the Experimental Station at Sydney. We are signatories to the I.C.A.N. and the regulations for safety of

aircraft and navigation are enforced. As a matter of fact, we issue the same certificate in our Australian Aero Clubs as here and apply the same tests for the "A" licence (five figures of eight, etc.). The tests for Pilot's "B" licences and ground engineers are carried out by an officer of the Civil Aviation Department in the usual way and for registration of private aeroplanes you simply apply for a licence, the Department does their best to see if they can find any weakness in the machine and then gives a certificate if everything is O.K. There are no petty restrictions but "safety first" is always studied.

The question of air-cooled or water-cooled engines is rather difficult. There is a school of thought in Australia that leans towards the air-cooled, and, most assuredly, in the more arid parts of the country it would be easier if we didn't have to get water for the engine, but I think that usually an aeroplane does not land where there isn't something to drink both for the pilot and the engine. It is open to doubt, especially if one has to taxi much in hot weather, whether an air-cooled engine has the advantage. With regard to light machines, such as de Havilland "Moths" with Cirrus engines, I have heard of no difficulty so far with the air-cooled engines; I would not, however, give an opinion as to which is better.

With regard to visibility, this is excellent, and fog is practically unknown. From five hundred to a thousand feet you can see from fifty to sixty miles, without any trouble, except when there are bush fires. As a matter of fact, you can sometimes see as far as that here. It is therefore a difficult question to answer. The visibility varies north or south and with the season of the year. You get some rather bad bumps sometimes, very much the same as over here. Up to about 4,000 or 5,000 feet you find the air very hot in the summer. Even at Melbourne I have had such a bad bump that I almost came out of my seat. I do not think that pilots generally feel there is anything different in the actual disturbed conditions, or otherwise, of the atmosphere.

Then again, in some parts—and particularly on the Western coast—you get "willy-Willies" and so forth, but in normal flying the atmosphere is about the same as here.

As I said very briefly at the outset, I am only a pilot, and have not studied timbers to any great extent. However, Australian woods for aircraft purposes have been investigated very thoroughly in Australia both in and out of the Air Force, and I know they have been studied officially here, the reports can be made available, if required. In Australia the timbers are being continually explored and many of our airscrews are made locally from mahogany and Queensland maple.

Dr. Thurston mentioned that there might be a good market for small cheap machines on outlying stations. I should like to emphasize the word "cheap" because I do think that when they come down perhaps 50 per cent. in price, you will get a big market for them. I know one city man in Victoria who goes to his home in the country every week-end in a de Havilland "Moth," and that will become more general. Machines are being bought privately, and many of the pupils of the aeroplane clubs will most certainly become private owners provided they can get machines cheaply. I am sure that the motor-cycle enthusiast with a pillion will want to have a machine with the passenger's seat near enough for them to be able to converse, perhaps side by side. One feels sure that there is a big future for

private flying not too far ahead, and I think that the man who at present travels perhaps 100 miles in a car for a week-end's enjoyment, would do it more readily by air.

The reason why we have not many seaplanes is that all the aircraft in the Royal Australian Air Force in the first instance were landplanes given by the Home Government, and we are still using many of those. We have bought some seaplanes and amphibians, but they are very few. The reason that we have not found much call for seaplanes on the commercial side is, I think, that most of the coastal towns and cities are so well served by steamer and rail that regular air services have not been started. The aeroplane has come into its own inland as on the Quantas route, where three separate rail heads are connected up.

With regard to doped fabrics, we mix most of our own dope, the components being proprietary products. I do not think there is a general complaint about the effects of the sun. We have had machines in the open to a considerable extent.

As to the types of engines used, in the Service there are the Le Rhone, Clerget, Rolls, Viper, Liberty, Napier Lion, Siddeley Puma. Cirrus engines are used in all "Moths."

With reference to railway gauges, the reasons why we have such a variety is no doubt because originally Australia was divided into six separate States (which were federated in 1901), and I think that it just happened that in the absence of any co-ordination the several States put down the railway to the gauge offered by the particular contracting company that had the best business ability to sell their goods. To make the gauge uniform from Melbourne to Perth would cost about £12,000,000, which is a very big charge on the taxpayer, but uniformity of the main lines must be carried out if we are going to develop to the best advantage unless aircraft can render this unnecessary.

The CHAIRMAN: It might be interesting if the lecturer could amplify his remarks about the seaplane. We quite see that at Quantas there is no question that it must be a landplane, but I have often myself wondered whether on the Western Australian route, where they are calling at ports all the time, they have considered the question of the seaplane.

FLIGHT-LIEUT. BELL: There are two reasons for not using them on this route. One is that the aerodromes are more suitably situated and it was not much trouble to clear them. The next reason is the big rise and fall of the tide; at Broome, it is about 40 feet, and ships are left high and dry at low water, which goes a long way out. At other places one has to land practically in the open sea. In other words, the coast is not suitable for seaplanes. The Queensland coast is better, but also rather poor for seaplanes and, as a matter of fact, we are not well off for suitable seaplane landing places. Even Sydney harbour is very crowded with shipping, and difficult. Actually there are no inland waterways except along the Murray and the Darling, so the landplane is more suitable generally.

The proceedings concluded with a warm expression of thanks to Flight-Lieut. Renison Bell for his lecture, and to Major de V. Robertson for kindly taking the Chair.