For the use of R.R.S. Staff only

R.R.S. Newsletter No. 12 — 15th April 1962

Miss Chaplin will be leaving us on 13th April. The following article has been written by some of the people who have known her for many years.

Editor

MISS B. K. CHAPLIN

Readers of recent editions of the Newsletter will be aware that the story of the Radio Research Station can be traced back through the Radio Department of the N.P.L. to the Wireless Section of the Electricity Department of that establishment. There are very few members of the present staff who have first-hand knowledge of all these changes, and none who has been more personally involved in them than Miss Chaplin. With her departure yet another of the few remaining links with those early days will be broken.

Even some of those who have been in Radio long enough to see the office build up gradually from small beginnings, under her leadership, may have forgotten that she started her career in a technical capacity, in the grade now termed scientific assistant, when she joined the Physics Department of the N.P.L. in 1919. About nine years later she was selected for transfer to the Administration section of the Laboratory to be assistant to the then Secretary, Mr. F. J. Selby. Here she gained experience of establishment office work, and was encouraged by the Director, Sir Joseph Petavel, to equip herself for clerical duties. She soon qualified as a shorthand-typist, and in this capacity she joined the Electricity Department in 1932, and the then newly formed Radio Department in 1933 under Dr. Smith-Rose who later became its Superintendent.

From that time the story of her official career is that of the Radio Department of the N.P.L. which ultimately became detached and absorbed into the Radio Research Station with its direct responsibility to D.S.I.R. Headquarters. Her experience in four sections of the N.P.L. was most valuable in dealing with the post-war reorganisation, the move to Slough, the subsequent expansion and the development of the overseas stations. The separation from N.P.L. brought promotion, first to Executive Officer and then to Higher Executive Officer, with increased responsibility for accounting procedures, filing systems, interpretation of Estacode, and many other matters which few of us know about, and fewer still understand. One of her main concerns has been that whatever the technical merit of the documents emanating from the station (for which she could not be held responsible), the typing, illustrations and general presentation should measure up to the highest standards. In 1957 her work received official recognition by the award of the M.B.E.

Then there have been the "fringe" duties of welfare officer, secretary of the canteen committee, etc., which in theory should not involve a great deal of time and effort but which in practice invariably do, besides presenting some of the biggest headaches. These many activities were only made possible by her willingness to give her time unstintingly. Little time was left for leisure, but in any case leisure for "Chappie" usually meant working just as hard at something else. Miss Chaplin was for many years a prominent figure on the N.P.L. tennis courts, and on occasions was in the winning partnership in the Mixed Doubles championship there.

But the most important "something else" was the N.P.L. Amateur Dramatic Circle of which she was a founder member and in which, following her debut in 1922 as Dinah in "Mr. Pym passes by", she has distinguished herself in more than forty roles. Her enthusiasm and ability as a player, and her willingness to pass on her wide experience to the newer members leave the A.D.C. greatly in her debt, a debt which continues to grow, for she still "treads the boards" and performed as recently as last month. Those who have witnessed her innumerable successes over the past forty years bear witness to her remarkable versatility and remember particularly her Ann Whitefield in "Man and Superman"

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and Rummy Mitchens in "Major Barbara". Also remembered, with gratitude, are the occasions when she took over leading roles, at a few days' notice, when the principals were taken ill.

During her career in Radio, Chappie has helped very many members of the staff with their problems when they have travelled abroad but, to her regret, has never been abroad officially herself. An opportunity has now arrived and she is to have a short term in Paris with the Scientific Attache to the British Embassy. The good wishes of all the staff will go with her.

RADIO RESEARCH AT DITTON PARK IV

RADIOLOCATION

The report of the Radio Research Board for 1933 was the last to be issued for a period of fifteen years, a hiatus due to anything but inactivity on the part of its members, or the staff at Ditton Park. Work throughout 1934 continued much on previous lines; but in January 1935 Watson-Watt was approached by H. E. Wimperis of the Air Ministry with a question concerning the possibility of radiating energy at a sufficient flux density to cause damage to an aircraft or its occupants.

This was to be an attempt to realise the 'Death-Ray' beloved of fiction, and Watson-Watt suggested to A. F. Wilkins that he should examine the problem, the initial question being: what energy needs to be radiated from a dipole to raise the body temperature of a man 600 yds. distant by 2°C in 10 minutes? The answer proved to be about 5000 Megawatts!, and even if practicable transmitter powers were considered, the size of an aerial system, to give the same effective radiated power, was prohibitive.

These facts were summarised by Watson-Watt, and communicated to the Air Ministry at the end of January. In a final paragraph he said 'Meanwhile attention is being turned to the still difficult, but less unpromising problem of radio-detection ..... and numerical considerations on the method of detection by reflected radio waves will be submitted when required'.

These 'numerical considerations' were required as soon as possible by the Committee for the Scientific Study of Air Defence. Wilkins and Watson-Watt calculated the amount of energy capable of being reflected from an aircraft when it was illuminated by realisable transmitter powers. The answer gave grounds for supposing that a detection scheme was workable even if results were an order of magnitude smaller than predicted. On 12th February 1935 Watson-Watt prepared a draft memorandum entitled 'Detection and Location of Aircraft by Radio Methods'.

This communication, though only some 2000 words, has been called one of the most prophetic scientific documents ever produced. It stated the case for detection by reflected radio energy; showed the importance of pulse techniques in determining distance and proposed the use of rotating beams to provide a system showing range and direction on a cathode ray oscilloscope display at a single station. The cruder but more immediately available method needed three stations to give an accurate 'fix'. The eventual desirability of shorter wavelengths and a possible means of distinguishing between friend and foe were also considered.

It says much for the author's appreciation of the situation, in the military sense, that he emphasised the need for proceeding at once with the cruder systems, rather than delaying in order to achieve more elegant but less well developed solutions.

The memorandum seemed almost 'too good to be true' to the defence experts, and an ad hoc experiment was arranged to take place on 26th February 1935, when

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apparatus from Ditton Park, installed in the Station's Morris Van, was to be operated in front of Watson-Watt and A. P. Rowe from the Air Ministry.

This demonstration was conducted by A. F. Wilkins with the help of A. J. Dyer who acted as driver, scientific assistant and general factotum. Late on the 25th the equipment was placed in position near GSA, the B.B.C. 50m. transmitter at Daventry, which provided the energy to illuminate an aircraft due to fly on a pre-arranged course the following day.

At 0945 hours on 26th February the aircraft appeared; more or less on course, rather less than more it would seem; but sufficiently near to reflect detectable energy into the receiver. It was primitive but it worked, and a detection range of eight miles was estimated. To quote Mr. Wilkins: "Considering the crude nature of the apparatus used and the small amount of preparation, the results of this experiment were regarded as quite creditable. Whatever the results we obtained, Rowe was moved to exclaim that the experiment was the most successful one he had ever witnessed. It was clear to all of us who watched the tube on that occasion that we were at the beginning of great developments in the art of air defence".

The original apparatus, rescued from obscurity in a store hut at Ditton Park and refurbished by our workshop staff a few years ago, is now in the Science Museum. It was, essentially, a spaced aerial phase comparator receiving system and was arranged so that the Daventry ground wave was minimised by a phase shifter in one aerial circuit. The reflected energy from the aircraft arrived at a different angle to the aerial system hence was not phased out, and a signal appeared in the receiver which was then displayed on a cathode ray oscilloscope.

A more detailed account of the doings at Daventry on 25th and 26th February 1935 are given in Mr. Wilkins' own words in an article in 'Electronic Engineering'*. An immediate result was that the cloak of security which had hidden the work of Admiral Jackson forty years before, now descended upon the organisation he had helped to create. No further R.R.B. reports were published, certain staff were moved away, first to Orfordness and then to Bawdsey where they formed the nucleus from which sprang the vast complex of radar.

Details of these events do not concern our site at Ditton Park. The actions of such men as Tizard, Blackett, Rowe and Lindemann, who were involved in fostering the work, have quite recently formed the background to a discussion on cultural unity, or the lack of it, and the role of the scientist in modern Government and Administration. Such matters are part of History on a very different scale from these brief notes.

G. W. Gardiner

* Elec. Eng. 30 1958 p.140 et seq.

STORMS

It is not proposed to discuss in this article details of current research in the wide field of the so-called "earth storms" because such a discussion would be more appropriate to a research journal. I will try instead to show what the whole subject is supposed to be about, to indicate a few facts which may be of general interest, and to show how the R.R.S. fits into current research in the subject.

Now what happens in an earth storm? We believe something like the following: A solar event occurs which may be accompanied by enhanced emission of electromagnetic radiation (that is, X-radiation and solar radio noise), by solar cosmic rays, and by a solar corpuscular stream. This stream of solar corpuscles travels to the earth where it becomes polarised by the earth's magnetic field; some particles may be expelled from this polarised stream and become trapped in the earth's magnetic field which causes them to set up an electric ring current circling the earth's equator in a westerly direction at a distance of several earth radii from the earth. Such a ring current could, however, be set

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up by some alternative acceleration mechanism acting on some other particles. The region surrounding the earth in which the solar corpuscular stream interacts with the earth's magnetic field is called the magnetosphere and extends outwards to about ten earth radii. The magnetosphere contains the Van Allen belts which are regions containing high energy particles trapped by the earth's magnetic field. It is all the complicated phenomena which may occur in the magnetosphere which result in the events which are actually observed such as magnetic storms, ionospheric storms and auroral displays. Specifically, the ring current is believed to be responsible for the main phase of a magnetic storm observed on the earth, but the mechanism by which this operates is not yet known; it seems likely that the effect is an indirect one the study of which lies in the field of magnetohydrodynamics.

Some of the higher energy solar particles may penetrate as far as the lowest region of the ionosphere, the D-region, where they ionize some of the many molecules there present to produce extra D-region ionization. This extra ionization causes extra absorption of H.F. radio waves; quite often in major events the extra absorption is sufficient to cause a polar blackout.

An interesting relationship between some of the phenomena mentioned above is illustrated by work recently done at Imperial College, London, which shows that during the main phase of a magnetic storm observed near the equator the variation of the earth's magnetic field was, right down to its fine detail, a very good mirror image of the variation of the intensity of solar cosmic rays measured at high latitudes.

Whilst one is fairly happy that the general theoretical picture presented above is true, it is interesting to record that satellite experiments aimed at verifying the theory are producing conflicting but interesting results. Explorer XII launched in August 1961 showed that there appears to be only one large magnetospheric trapping region rather than several individual Van Allen belts. Explorer XII, and also Explorer X, did not find any evidence of the ring current which was, however, found by Pioneer V and Explorer VI.

As far as the R.R.S. is concerned our work on earth storms falls into two groups. Klozenberg and Willis are working on the interaction of the solar stream and the magnetosphere, while Miss Scott and Rishbeth, Thomas and King are more concerned with the consequences of the interaction as far as they affect the ionosphere. This latter problem is very statistical and it is difficult to establish any clear-cut primary facts; the answer to the question "What causes an ionospheric storm"? appears to be very elusive indeed. Rishbeth is investigating possible relationships between the behaviour of magnetic elements on the ground and phenomena observed in the F-region. Miss Scott and I have worked on problems mostly involving height changes during storms. Thomas has found that during a storm the so-called equatorial "trough" can either fill up and disappear or else become more pronounced. Such opposite types of behaviour by the ionosphere result in the appearance of many apparent contradictions in the literature, for example, the Cambridge workers have said that the height of the F2-layer tends to increase during storms, but workers at the Pennsylvania State University have claimed the opposite. Another example of such a contradiction is that Maeda and Sato find the opposite seasonal variation to that found by Appleton and others for storm effects at Tromso at sunspot maximum. It is possible that such contradictions arise partly because ideas about what constitutes "normal" behaviour are rather hazy; it has not yet proved possible to find a satisfactory definition of an ionospheric storm other than that a storm occurs when we have a substantial departure of foF2 from normal.

There is one simple fact which may be of general interest, namely: It is often very dangerous to draw conclusions using daily values of Δ foF2 for a month, where Δ represents the departure from the monthly median value. The quantity Δ foF2 is often misleading, for example, at Slough at noon on 29th Sept., 1957, foF2 was 11.3 Mc/s. which was 1.4 Mc/s greater than the monthly median for September, but two days later on 1st October, the noon foF2 was 11.1 Mc/s. which was 2.8 Mc/s less than the October montly median. Δ foF2 may be misleading for another reason also; by day the median foF2 seems to correspond to magnetically quiet conditions, but at night either the highest (in summer) or the lowest (in winter) foF2 values correspond to magnetically quiet conditions. Thus it is difficult to attach significance to night-time values of Δ foF2. Appleton and Ingram years ago did not realise this and concluded that at night in summer for a small amount of magnetic activity foF2 was above normal; what they ought to have concluded was that foF2 was above the median, but slightly below normal.

J. W. King

STAFF NEWS

Congratulations and best wishes for the future to Miss J. A. Bignell and guardsman R. Murray, who were married at Datchet Church on 31st March.

Congratulations to Mr. & Mrs. Randolph on the birth of a baby daughter at Old Windsor Hospital on 7th April.

Resignations: Mr. E. F. Plummer, Laboratory Mechanic 9.3.62

Visits

Mr. Wilkins visited Paris 25-29th March to attend an IQSY Meeting of the International Committee for Geophysics (C.I.G.)

Dr. Pressey is to attend a COSPAR Meeting in Washington from 30th April to 9th May.

Mr. Meadows, or Mr. Lane, will be visiting Geneva from 24th April to 5th May to attend a Study Group V Meeting of C.C.I.R.

Farewell to Molly Smith who is leaving at the end of this month.

SPORTS AND SOCIAL CLUB

Camera Club

In view of the complaints about the continuing inclemency of the weather it was perhaps appropriate that our recent display of 'Winter Prints' should have reminded us of the worst hardships suffered at the beginning of the year. Some members of the staff, however, appear to enjoy skating on thin ice.

Later this month we hope to show some prints 'Taken at Work' which may prove quite an eye-opener!

W. S. Newman

Bridge Club

A match was played against the N.C.L. at Teddington on the 16th March. The R.R.S. won by 6 I.M.P.s., their team being A. C. and K. Gordon-Smith; E. N. Bramley and G. F. Fooks; K. and W. C. Bain; C. Nicolson and M. Smith. The result was in doubt until the last hand, in which our pair bid 3 No Trumps and Molly Smith made the contract with overtricks.

W. C. Bain

Car Rally

At 1930 GMT on Sunday 8th April at a map location rendered a little vague by a blustering wind, nine vehicles lined up on a temporarily disused car park awaiting a starting signal. The story of the following 8 hours is too full of incident to be reported at short notice by this correspondent, who arrived at succeeding control points too late to meet any of the other participants. The rally was won by Geoff Fooks and a happy band of navigators in a Ferrari (I don't really believe it was a Ford), who accumulated only 7 penalty points, and who, at a location $4\frac{1}{2}$ miles west of Basingstoke, Hants, were presented appropriately enough with a fire extinguisher as first prize. It is hoped a balanced account of the event will be available for the next issue of the Newsletter. Meanwhile, the Club owes a debt of gratitude to David Froome and certain untiring members of the 1st (Machiavellian) Troop Egham Boy Scouts.

V. Owen

LETTER TO THE OUTSTATIONS

Slough

15th April 1962

Dear Colleagues,

I usually leave the writing of the Outstation letter until the typist tells me how much space is available for it - in other words I leave it until the last moment. This time I've been caught out and presented with a full sheet of foolscap to fill! And this, I don't have to tell you, is one way of doing it.

Apart from the news of Miss Chaplin's departure, which is fully covered on the first page, the main news here is that Spring has at last arrived. It would be an exaggeration to say that by avoiding all forms of muscular activity and refraining from looking in mirrors youreditor feels young again, but at least the prospect of an early grave seems to be postponed, by about a fortnight.

I know you would want me to wish Molly Smith on your behalf a very happy future. We shall all miss her cheerfulness, efficiency and readiness to help.

At the moment Maureen Armstrong is working part-time in the library until a more permanent replacement for Molly becomes available.

Best wishes to you all.

Yours sincerely,

The Editor

FILLER

WANTED - ON ANY TERMS

A reward is offered for information leading to the arrest of Eddy Current, charged with the induction of an eighteen-year-old coil, called Milli Henry, found half choked, and with the theft of valuable joules.

This unrectified criminal, armed with a carbon rod, escaped from Weston Primary cell, where he had been clapped in ions. The escape was planned in three phases. First, he fused the electrolytes; he then climbed through a grid, despite the impedance of the warders, and finally ran to earth in a nearby magnetic field. He has been missing since Faraday.

Watt seems most likely is that he stole an a.c. motor. This is of a low capacity and he is expected to change it for a megacycle and to return ohm by a short circuit. He may offer series resistance, and is a potential killer.
