S. Newman

FOR STAFF USE ONLY

R S R S NEWSLETTER

No. 88 August, 1968

Dr. J. W. King Merit Promotion

Staff are glad to learn that Dr. J. W. King is now Senior Principal Scientific Officer. Through the medium of the Newsletter may we offer our congratulations on this well-deserved promotion.

Dr. King, who was born in South Africa in 1930, has a distinguished academic record both in his native country and in Britain. Graduating with distinction in physics and mathematics from the University of South Africa, in 1949, he gained further distinction in the Honours Physics degree the following year. After gaining an M.Sc. at Rhodes University in 1952, he proceeded to Cambridge on a Rotary Foundation Fellowship where, in 1955, he was admitted Ph.D. and awarded the Hamilton Prize.

His career before and after the postgraduate research period was spent in lecturing in South Africa; just prior to his appointment at this Station, in 1961, he was Senior Lecturer in Physics at Rhodes University. In 1966 his work at R.S.R.S. gained him the Wolfe Award.

The results of Dr. King's researches in ionospheric physics, to date, are related in some 45 papers and he is a valued member of many committees both National, such as Royal Society committees, and International, such as C.O.S.P.A.R. and U.R.S.I. working groups and the E.S.R.O. Ion Group.

This present promotion marks most suitably a further stage in a skilful and successful career in science.

Satellite Orbits Group

The Satellite Orbits Group is sometimes known as "Predictions". If we dissociate this word from its astrological connections we see that it aptly describes a large and important part of our work. We predict the behaviour of a limited number of satellites by computing scientifically at what time each will appear over a given location. Three main types of predictions are distributed :

1. Predictions for satellites of geophysical interest

   These are computed weekly and cover about 40 satellites which are of interest for atmospheric density, rotation of the atmosphere or gravitational field studies. They are sent mainly to amateur and professional observing stations but also go to other Government Establishments and Universities who have requested them.

2. Predictions for geodetic satellites

   Echo 2 and Pageos predictions are sent to stations participating in the West European Triangulation Program. By making simultaneous observations of these two satellites the distance between two observing stations can be accurately determined. About 500 simultaneous events have occurred since the program was begun in August 1966. At that time predictions were also issued on Echo 1 up until its decay in May this year. The program has so far been very successful.

3. Special Predictions

   Predictions of meteorological satellites are sent to the Met. Office who receive cloud cover pictures from them. Other predictions are issued for radio propagation experiments and the national and technical press receive predictions for a few visible and transmitting satellites.

Thus a great number of people receive our satellite predictions, in return for which we are sent vast numbers of observations. During 1967 we received about 30,000 optical observations on about 150 different satellites, together with a few thousand radar observations. Some of the observations we receive are used immediately for correcting current predictions; the remainder are published as a monthly list and distributed to interested parties. This complete record of observations provides much of the data needed for research projects by R.A.E. and ourselves.

Over the past few years a lot of the group's effort has been spent in writing programs both for Atlas and our own computer. Of those written and in use we now have a comprehensive predictions program, an analysis program

and a program to transfer data received on paper tape from the teleprinters directly on to magnetic tape for future reference. Nearing completion is our own look-angle program and another to sort monthly observations into satellite and time order, a task previously done by hand.

A slight diversion from our usual work was brought about by the Ariel 3 spin-axis work. A program was written to calculate the position of the spin-axis, at a particular epoch, from flash observations of the satellite and corresponding solar aspect data. Results from this program have been most satisfactory.

With so much of our time spent on predictions work and programming there seems little left for research. Nevertheless we have played a part in European Geodesy and the Ariel 3 spin-axis determination and another project is under way with assistance from R.A.E. Once the routine work has been minimized by maximum use of the computer more time should become available for these other aspects of our work.

Barbara Greenfield

Theoretical Ionospheric Research at R.S.R.S.

To continue the account of the Theory Group's work: most of the ionospheric studies are concerned with the F region. It is well known that the F2 layer, particularly, displays very peculiar variations of electron density. The quantity most often studied is the critical frequency foF2, which is related to the peak electron density of the layer. The height of the peak, hmF2, is very variable but generally lies between 250 and 350 km altitude. Both foF2 and hmF2, and other features of the F2 layer such as its thickness, vary in a complicated way in local time, in latitude and longitude, and over the sun-spot cycle. The F1 layer, which is at 150-200 km, is observable only in the daytime (and not always then) but when it does appear it is more regular than the F2 layer.

Ideally one would like (A) to have enough data to know in detail how the F2 layer behaves; (B) to be able to predict its behaviour for practical communications purposes; (C) to explain it all theoretically. Clearly the prime object of F region theory is (C), using the facts discovered from (A) and hopefully throwing up results which will be of interest to (B).

(A) is a matter of data analysis, which is of course undertaken by other groups on the Station besides the Theory Group. A vast amount of information on foF2 is available; the Slough ionosondes have been turning out hourly values

since 1932 and the numerous other ionospheric stations in the world bring up the total of observations to around 10^8. However, critical frequencies and the other quantities obtainable from ionograms, even though measured at a hundred or so sites around the world, provide a very inadequate description of the F2 layer. Just how inadequate has only become clear in recent years, from the study of data obtained from satellites, notably the Alouette Topside Sounder and (more recently) Ariel III. New facts about the F region are indeed still coming to light.

As already mentioned, the job of F region theory is to explain the data. The customary way of attacking the problem is to write down a mathematical equation called the "continuity equation" or "equation of balance". This equation is a mathematical representation of the various physical causes acting on the F region. To mention some of the most important: electrons and ions are produced by solar ultraviolet and X-radiation, and perhaps by fast particles; they recombine by way of various chemical reactions; they diffuse through the air, and are moved about by winds and electric fields. Mathematical formulas giving the effect of each process can be worked out by theory; they contain many numerical coefficients whose numerical values depend on the various processes mentioned above, and have to be estimated from the best available data.

Having constructed the equation, the next stage is to solve it. One knows that if all the formulas and if all the coefficients in the equation are right the solution must correspond to the observed behaviour of the F region. Needless to say this situation is not achieved in practice, partly because the various coefficients are not well enough known, and partly because the equation is too complicated to be solved by present techniques. One cannot even be sure that every important process has been included in the equation. To meet these difficulties, it is often possible to break the problem down into a number of pieces, using much simpler equations which correspond to the effects of just one or two processes, and which may be applied to particular parts of the F region. For instance, quite a good representation of the F1 layer can be obtained from equations with only production and loss, all the other processes being neglected. Using this idea, some recent work on F1 layer ionograms showed up seasonal changes in the production and loss rates in the F1 layer. Another investigation is concerned with the effect on the F2 layer of the day-to-night changes of temperature which are known to occur; and in particular, whether the thermal

expansion of the F2 layer in the daytime can explain the fact that foF2 is often smaller at noon than in the morning and evening. Another piece of work is concerned with the well-known "equatorial trough" or "Appleton anomaly" in the low-latitude F2 layer. The anomaly is thought to be caused by electric fields in the ionosphere, which drive a kind of electrical "fountain" that moves electrons away from the magnetic equator. The theory of this process has largely been developed on this Station, and at present the work consists of a detailed comparison between the theory and experimental data. It now seems likely that the theory can explain (amongst other things) the perceptible dependence of foF2 upon the phase of the moon.

A complicated calculation, being undertaken in co-operation with Sheffield University, concerns the "feedback" between the motions of F region ionization and the winds in the neutral air. As mentioned before, the movement of ionization by the winds can affect the F region electron density; the "feedback" takes place because the ionization offers resistance to the neutral air wind, thereby controlling the speed at which the wind blows. These processes give rise to a very complicated set of equations, and progress has been made in solving these equations and finding out what determines the behaviour of the system.

All these investigations keep the Theory Group well occupied. Nevertheless, the Group's objective is, quite generally, "to carry out research on theoretical problems within the Station's field of work", and the Group is always open to suggestions about other topics on which it might do useful work.

Henry Rishbeth

STATION NEWS

At the recent meeting of C.C.I.R. Study Group V at Boulder, in the absence of the Chairman and Vice-Chairman, Dr. Saxton became acting Chairman.

Dr. Horner is to attend the interim meeting of C.C.I.R. Study Group IV at Geneva in late September.

The Institution of Electrical Engineers has elected Dr. Saxton to be Deputy Chairman of the Electronics Division Board, and Dr. Horner to Membership of the same Board.

The World Data Centre, formerly housed in the main building is now removed to the new building near A Spur, where it is hoped, greatly increased accommodation and facilities will be available to users.

On 12th September at R.S.R.S. there will be a Colloquium on the Metrology of large Radio Reflectors. It is hoped that representatives of Government, the Universities and Industry will attend to describe and discuss the several methods of measurement relating to this subject.

STAFF NEWS

Apology

Apologies to Mr. S. J. Baker. Last month a mistake was made in his rank as shown in our retirement notice. In fact he retired with the rank of Craftsman, First Class.

Congratulations to :

Don and Joyce Mortimer, whose application to adopt Sarah Frances, a sister for Christopher, Alison and Simon was granted on 26th July.

John and Hazel Norbury on the birth of their daughter Katharine Sarah.

Mick Reid and Anne Taylor who were married on 27th July at Banstead.

Mike Quigley and Helen McCall who were married on 3rd August at Slough.

Peter Kermode and Valerie Munro who were married at Southampton on 14th June.

Martin Hall and Carol Fegley on their engagement.

Miss P. E. Mead now Shorthand Typist I.

Welcome to :

Miss M. Day	Vacation Worker
Miss D. I. Pole-Evans	Clerk Typist Falkland Islands
A. K. Marwaha	Sandwich Course Student
L. E. Board	Craftsman I

Resignations

Mrs. I. M. Moorat	P/T Clerk typist Singapore
R. J. Weston	A.E.O. Transfer to M.O.D.
A. G. Taylor	H.E.O. Transfer to Rutherford
R. I. Patterson	S.A.
D. E. Smith	S.S.O.
Miss P. Panchapakesan	A.E.O.
J. Garrett	Vacation Worker

SPORTS AND SOCIAL CLUB NEWS

Herstmonceux Return Sports Day

The next Sports and Social Club activity will be the Herstmonceux Return Sports Day, at R.S.R.S. on Sunday 8th September. Teams from the Royal Greenwich Observatory at Herstmonceux will come to play R.S.R.S. teams at cricket and tennis. The cricket teams will again be led by Sir Richard Woolley, the Astronomer Royal, and Dr. Saxton. Spectators will be very welcome, and there will be a social gathering in the bar after the matches, where light refreshments will be available.

Bob Fitchew

Concerts

The Sports Club has again bought six books of vouchers for the Royal Festival Hall for the six months September-February. The cost of tickets will be 7s. 6d. each, but, for this, seats value 12s. 6d. and upwards will be allotted. The system of booking is explained on the Sports Club Notice Board during each booking period, and I will answer any further questions. The next booking is due in early September so watch the Board.

The Industrial Concerts season starts again shortly, so again watch the Board for Royal Albert Hall notices and booking sheets.

Veronica Lovell

Cricket Section

A damp and dreary month draws to a close, and one wonders if it was really supposed to be July. The rain seems to have dampened the ardour of the mid-day cricketers, and generally the level of activity has been rather lower than usual.

The match against the Met. Office (ironically enough) was cancelled after being rearranged for 8th August. We took the field against A.C.O. on August 13th without having had much practice, in fact most of us hadn't seen a cricket ball for a month. Our regular bowlers were not available, and this made itself felt. A.C.O. made 82 for 8 and were seldom in trouble. When our turn came to bat it was a rather different story. What looked a good batting side on paper lost its confidence and collapsed to 26 for 8, before Hall (11) and Thomas (9 n.o.) made things slightly more respectable, taking the score to 40 before the last two wickets fell.

We shall need to do rather better than that against R.G.O. on September 8th. However, there is plenty of potential available on the station, so let's hope it shows itself at the right time. If anyone wishes to make use of the practice net in the meantime, equipment for this purpose is kept in Eric Dunford's office (Room 2).

C. R. Boulton

A.C.O. Sports Evening - Tennis

On Tuesday 13th August three couples again met A.C.O. for tennis, this time on their grass court beside the moat. Owing to last minute illness we were forced to send two men's pairs and only one mixed. However, some good tennis was played and the games were most enjoyable, despite the poor light at the end of the evening which led to one set being abandoned at three games all and another being cancelled. The final result was a win for us by 6 sets to 1. Members of our team were : Harry Meswani and Mike Peasley, Veronica Lovell and Bob Fitchew, Bob Slater and Mike Dick. Playing for A.C.O. were : Des Allen and Brenda Allen, Mrs. Lane and Ken Benton, Pat and Leslie Hepherd.

Veronica Lovell

R.S.R.S. S.S.C. Summer Hop

The Sports and Social Club organized a Summer Hop which was held in the Old Building on the evening of Friday 26th July. About 35 people turned up for a plentiful supply of food, drink and swinging live music supplied by "The High Fence" on their second booking for an S.S.C. Hop.

It could be that the deplorable dearth of "unattached" females led to the equally deplorable reluctance of people to take to the floor. (The band played valiantly for two hours before more than two couples were to be seen simultaneously on the floor).

It could also be that these factors led to the fact that the bar did a thundering trade in draught beer and related beverages. There is certainly no doubt that this trade contributed to the festive atmosphere which eventually prevailed.

Camera Club

The Annual Outing took place on 25th August 1968. Eleven people and one dog, travelling in four vehicles, viewed the Roman Theatre at Verulamium, St. Albans : some also went to look at the Abbey. Proceeding thirty miles northward and returning to the present century, the party spent the rest of the day at Old Warden Aerodrome, Bedfordshire, home of the Shuttleworth Aircraft Collection. Apparently a thousand or so other people had the same idea; nevertheless we had a good view of the numerous ground-based exhibits (aircraft, aero engines, cars and cycles) before watching the flying display of military aircraft. This began with a display of aerobatics by a Bristol Fighter and S.E.5a of 1917, and ended with the fly-past of a Spitfire and Lancaster representing 1945. The excellent weather made even the homeward-bound traffic jams quite tolerable.

The Club has its own darkroom and runs an exhibition and slide shows each year. Anyone interested in joining should contact Paul Dickinson or myself.

Henry Rishbeth

Bowling Evening

The Ambassador Bowl at Hounslow was the venue for the Sports and Social Club's "Bowling Evening" on August 20th. The event was well attended, especially considering the distance involved.

After some preliminary shuffling we got sorted out and thereafter all attention was on the set of ten skittles waiting to be knocked down. Alas, it proved somewhat more difficult than it appeared at first sight. The balls - surprisingly heavy and reputed to be made of rubber - seemed to have a fatal fascination for the gutter. However, one got the idea after a while, and some good scores were made. Scoring taxed the brains of the more theoretically minded, while the more practical men (and girls) found plenty to interest them in working out just where to aim.

The event came to a natural end as players finished their games. Perhaps the accent of the evening was more on the 'sport' than the 'social' aspects of the game, but it was no less enjoyable for that. Many thanks are due to the committee, and more particularly to Pat Dadds, for organizing a refreshingly new activity, which one hopes will become a regular feature of the S.S.C. Calendar.

C. R. Boulton

Letter to the Outstations

Dear Colleagues,

This month sees the resignation, among others, of Dr. D. E. Smith who has accepted an appointment in the U.S.A. with the Wolf Research and Development Corporation. David Smith has been a gifted and popular member of R.S.R.S. Staff for the past ten years, during which time he has progressed from A.E.O. to S.S.O., playing a major part in running the Satellite Orbits Group, as well as pursuing his particular researches for which he recently gained a Ph.D. He and his wife, Veronica, formerly on R.S.R.S. Staff, have been welcome participants in the social life of the Station. We wish them and their family the best of luck in the States.

Tap ... tap ... the noise was somehow different, menacing in a way hard to describe, and the more so because of that. Though not, in truth, louder than those sounds familiar to the Admiral Jackson and the countryside round about, there was about this sound a fateful insistence. Tap ... tap ... louder and louder, the unseen origin of the rapping approached.

The seaman turned pale, 'Jim lad' he gasped, 'Tis Blind Pugh .....'

In fact it wasn't, it was only sheep which the other day strolled into the editorial office. Fearful of what might befall, we did not grant the animals an interview, but speedily ushered them out; just in time as it happened. Next day, however, they struck again. The Black Spot was well and truly delivered in the office of Messrs. Harrison and Thorpe. No doubt our woolly visitors thought to suit action to word, knowing by some animal telepathy that they had brought on a touch of the pseudo - Stevensons in,

Yours sincerely,

The Editor

List of Publications in Registry

The effect of diurnal temperature changes on the F2 layer. Part II temperature dependant loss rate. By G. R. Thomas
J.A.T.P. Dated 1968 Vol. 30 pp. 1429-1437

Ionization changes in the middle latitude D-region associated with geomagnetic storms. By J. S. Belrose and L. Thomas
Published J.A.T.P. Dated 1968. Vol. 30 pages 1397-1413

Application of impedance measurements in an investigation of a waveguide thermistor mount. By J. A. Lane
Published I.E.E. Dated 17.5.68 Vol. 4.

Ruby laser damage associated with a liquid Raman frequency change.
By A. J. Gibson
Published Applied Physics. Dated 1968 Series 2 Vol. 1.

Internal Memoranda - nil