R.S.R.S. Newsletter

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An Experiment to Measure Daytime Winds in the Upper Atmosphere

At a recent R.S.R.S. information meeting, the Director-General of the Meteorological Office, Dr. Mason, mentioned the importance for weather prediction of knowing accurately the wind patterns in the lower atmosphere or troposphere. He also described a proposed method of improving wind (and other) data by the tracking of large numbers of balloons constructed so as to float at a fixed altitude indefinitely. Similarly, a knowledge of the magnitude, direction, and variability of the winds at various heights in the upper atmosphere is of great importance to the understanding of the "weather" in the ionosphere, i.e. to ionospheric physics. These upper atmospheric winds can have speeds rather greater than those commonly experienced at the earth's surface, exceeding 200 mph at an altitude of about 150 km. At ionospheric heights, the atmosphere is too tenuous to support balloons, which have a practical ceiling of about 35 km, so several other methods have been devised for measuring winds there. The most successful of these methods, and the only one at present capable of giving results above about 120 km, is the artificial trail or cloud technique. In a typical experiment of this type, a trail of sodium vapour is ejected from a rocket over that part of its trajectory above about 60 km, during twilight, when the trail is illuminated by the sun's rays, but most of the earth's atmosphere is in shadow. Under these circumstances, the trail is clearly visible and photographable against the dark sky due to resonant scattering, by the sodium atoms, of the solar light at the wavelength of the D-lines. From the observed movements of the trail under the influence of upper atmospheric winds, the wind profile can be deduced. The technique can be extended into the night-time by the use of chemiluminescent trails, which emit light as a result of chemical reactions between the trail constituents and the surrounding atmosphere. However wind measurements by the vapour trail technique have not so far been possible in the daytime, because the faint trail is no longer visible against the much brighter Rayleigh-scattered skylight "background".

Although the aggregate skylight brightness is much greater than that of the sodium trail, nevertheless within sufficiently narrow intervals of wavelength centred on each of the D-lines, the sodium trail should be brighter than the sky. Thus if the trail could be observed with a detector sensitive only to such narrow wavelength intervals, it should be rendered visible, even in daylight. Such a narrow-band detector is a glass cell filled with sodium vapour. The sodium atoms in the cell will resonantly scatter only light of wavelengths within the line-width of the D-lines (about 0.01 Å at the temperature at which it is proposed to operate the cell), light of other wavelengths passing straight through the cell. One type of sodium resonance cell has been used by French workers to detect the "sodium dayglow", the resonantly scattered light from the naturally-occurring layer of sodium at about 100 km above the earth's surface, during the daytime. In their experiment, the faint light scattered from the cell was recorded with a photomultiplier tube.

The instrument which is being constructed at R.S.R.S. for an attempt to record the movements of an artificial sodium trail in the daytime (see Fig.1) incorporates a thin, flat, circular sodium cell, onto which an image of the sodium trail is focussed by an objective lens L_1. Some of the light forming the trail image is resonantly scattered by the sodium atoms in the cell, so that the image in the cell acts as a luminous object for the lens L_2, which focusses an image of it onto the photocathode P of an image intensifier. The bright image which appears on the output screen of the image intensifier is photographed. The image intensifier is necessary because the image in the cell will not be sufficiently bright for direct photographic recording, using reasonable exposure times. The amount of skylight entering the instrument is minimized by means of a polarizer and an interference filter placed in front of the objective lens. The amount of resonant scattering of D-line light in the cell is determined by the density of sodium vapour in the cell, which is controlled by heating elements. A suitable cell temperature is about 160°C.

Although the material which has been used most frequently for artificial vapour clouds is sodium, the other alkali metals are equally efficient scatterers of light at their resonance wavelengths, and potassium and lithium have also been used in twilight releases. A disadvantage of using sodium is that, because of Fraunhofer absorption, the exciting light from the sun is only about 5% as intense at the centre of the D-lines as it is in the nearby continuum, and consequently the trail is only 5% as bright as it would be in the absence of Fraunhofer absorption. This difficulty also occurs with potassium, for which the intensity at the centre of the Fraunhofer line is about 7% of the continuum intensity. However for lithium the Fraunhofer absorption is negligible, and so lithium trails are considerably brighter than sodium trails. This feature makes lithium a theoretically superior chemical to use for the daylight wind measurements. However a lithium cell to detect the light presents greater practical difficulties than a sodium cell. Firstly, because of the lower vapour pressure of lithium, a lithium cell would have to be heated to much higher temperatures (about 360°C) than a sodium one. and secondly, lithium rapidly attacks glass at such temperatures, so that the cell windows would have to be

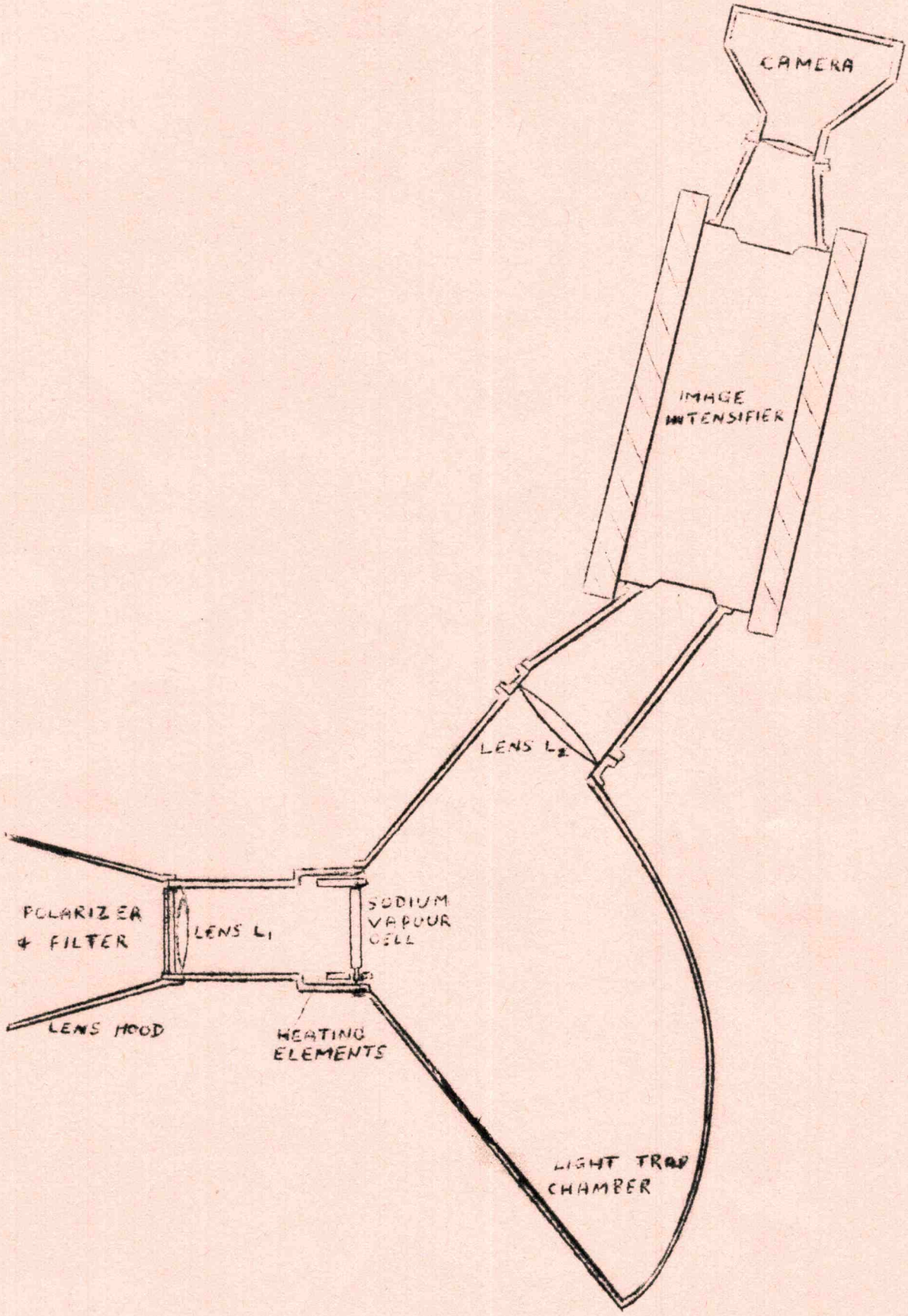

Fig.1. RESONANCE SCATTERING CAMERA

made out of some chemically resistant material, such as sapphire, which makes fabrication more difficult. If these practical difficulties can be overcome, it is hoped finally to use lithium instead of sodium in the daytime wind measurements.

R. Fitchew

Staff News

Congratulations to:

Dr. and Mrs Burrows on the birth of their daughter on December 31st.

Marilyn Evans and David Harrison who were married on 29th December at Derby.

Richard Messias on his engagement to Miss Alison McCluskey of Hillingdon.

Ian Parkin on his being granted the degree of Ph.D.

Jenny Wood on her being granted the degree of M.Sc.

Welcome to:

Mrs M. B. Colbourne	Perm. A.E.O.
F. E. Evans	Non-Perm. Executive Officer
Mrs P. D. Gisby	Non-Perm. Machine Operator Part-time
P. T. Bhakta	Perm. A.E.O.
D. F. Bampton	Perm. Technician III
Mrs E. Elliott	Non-Perm. Cleaner Part-time

Resignations

G. W. Paltridge	Non-Perm. S.S.O.
I. L. Freeston	Perm. S.S.O.
Mrs E. Williams	Non-Perm. Typist II (Winkfield)
H. L. Foo	Non-Perm. Technical Officer (Singapore)

Sports and Social Club News

The Truth about The Bar

In view of certain rumours which have been circulating recently I felt it might be helpful to use this opportunity to explain what is happening to The Bar.

Until very recently the Sports and Social Club had been in the very privileged position of being able to run a Club Bar, without the necessity of applying to the Local Magistrates for their blessing. However, this happy state continued only so long as the Members were Crown Servants and the men of our Legal Department, aided and abetted by D.E.S., have decided after much consideration that Science Research Council employees are not covered by that description.

In order to satisfy the Local Magistrates that we are fit persons to sell intoxicating liquor, we have spent some weeks in putting our house in order. I hasten to add that this mainly consisted of altering the Club Rules to comply with the Licensing Act of 1964.

The Application has now been made for a Club Registration Certificate and we have duly been inspected by the Public Health Inspector, the Police and the Fire Brigade. We are keeping our fingers crossed for the hearing, which is likely to be in early February.

E. Dunford

Bridge Club

We have played two matches so far this season. We were successful against I.C.I. for the first time for two years but lost by a narrow margin in the match against Road Research.

There is indication of strong potential support around the station for our evening games, but the first attempt in 1968 to gather in supporters was vitiated, perhaps by 'flu or post Christmas dinner lethargy. We hope to play at least once every three weeks in the Spring and plan to finish up with the ex D.S.I.R. tournament on March 31st.

Martin Bowman

Christmas Dance

On Saturday, December 16th, the Sports and Social Club held their annual Christmas Dance in the Canteen at R.S.R.S.

A superb job had been made of the Canteen decorations and all credit to those who were responsible. It never ceases to amaze me how the variation in the decorations is continued from year to year.

Traditionally Dr. and Mrs Smith-Rose were present and Dr. Smith-Rose took the opportunity to present the Smith-Rose Cup to the winners of the 1966-7 competition. The winners were the team representing the North and the cup was presented to Miss V. Lovell on behalf of the team. Mrs Saxton and Mrs Smith-Rose were presented with bouquets by Miss E. Buckner and Miss N. Stacey on behalf of the Sports and Social Club.

It appears on subsequent conversation with some of the 153 people who were present that a good time was had by all, and I am sure that all those present will wish to join me in thanking the Sports and Social Club Committee for their fine efforts.

Before closing I should like to mention that several people returned to the battlefield on the Sunday with the unenviable task of clearing up the mess left the previous evening.

Once again, thanks very much Committee for a very enjoyable evening.

Camera Club

Recently slide shows have been given by John Tyler on "Singapore - Mainly People" and Simon Newman on "A Random Selection of Colour Slides: 1957-1967". Further shows in this series will be announced on the Notice Board.

Henry Rishbeth

Letters to the Editor

This letter is included in the hope that it may give rise to constructive comment. As a general rule, however, the Editor must, in future, know the identity of contributors, though this need not be published.

Dear Editor,

Perhaps I am being a little feeble in submitting this anonymously, but when one listens to people on the station it makes one wonder a little whether it is not for the best.

I think it is about time that people about this station stopped grousing. I hope that you can use your columns to say so - I do not know what your terms of reference are.

Recently we had a meeting, at which people were freely invited to make useful suggestions. It was in my opinion a disgrace that nothing was forthcoming but feeble moans about filling in a few forms. And in all the destructive criticism that flows freely about, all day long in some cases, I have never heard a really useful constructive suggestion about what to do instead, or heard of one man who would stand up and say clearly what should be done except in such ridiculous terms as "close the place down","blow up the admin. block" or some such asininity. If a regulation is made, however trivial,.some genius is bound to know of some very good reason why it should be ignored, usually to obscure the fact that it is at the moment inconvenient to him, and not infrequently because he considers himself the only man able to arrive at a sensible decision on the matter, regardless of the wishes or requirements of anyone else on the staff.

In my view, Sir, this attitude is unworthy of any man who presumes to be an intelligent member of the community, and certainly of any man who professes to be a thinking man and useful scientific worker. If this attitude is typical, it is hardly to be wondered at that we are not wanted in administrative circles. What could we administer?

If people will not make verbal suggestions, what about written ones in your columns?

Letter to the Outstations

Dear Colleagues,

A blank sheet of paper once again confronts me, coincident with the absence of the muse. No natural fires having spontaneously kindled, I must see what is the best that can be done with artifical inspiration. The New Year's weather so far seems as good a way as any to begin and we have indeed run the gamut from hard frost, through glazed snowy roads to warm, almost springlike, conditions.

Early in January, the approaches to Ditton Park seemed to have more in common with Verkhoyansk than with Buckinghamshire. A few desolate figures could be seen trudging through the snow to the warmth of R.S.R.S., their sole diversion being the sight of seemingly more comfortable motorist friends involuntarily performing hair-raising evolutions on the icy roads, and, fortunately, getting away with it. We had a week or so of this sort of thing, then a quick thaw and the pleasure of quite a warm spell tempered with the occasional nip just to keep the true season in mind - and boost the sale of soup in the canteen.

'If they think that's going into the Instrument Stores, they've got another --- think coming'. So said one member of our staff who encountered the well-known D Spur 'Boiler' in transit. This stainless steel tank has been a feature of the main lab. landscape for some years now, though all that most of us recollect about it is that, when exhausted, the energy stored in the system is sufficient to lift the thing eighty feet into the air, pumps and all.

Problems inherent in moving this gear were overcome by less explosive methods, in fact, the contractors went about their work much as Galileo or even Archimedes might have done. With the aid of pulleys, beams and wheels the mass m was gently transported to its new home, a hut near the old building. It now forms part of a new and improved thermal vacuum apparatus wherein our various space experiments can be subjected to a hot and rarefied atmosphere, not unlike some literary environments glimpsed, through the viewing ports of Sunday newspaper criticism, by many of us, including,

Yours sincerely,
The Editor