R. S. R. S. Newsletter

No. 57 January 1966

NEW YEAR'S HONOURS

All members of the Station will wish to join me in congratulating Mr. A. G. Wilson on the award of the M.B.E. in the New Year's Honours.

Wilson joined the Station in 1929 as an instrument maker and in his early days here he helped to design, and himself constructed, several of the instruments which were used in the original experiments on radar, including some which were used in the first three operational stations. He left the Station to work in Industry in 1955, and re-joined in 1962.

Since he came back to us he has played an important part in designing and constructing some of the mechanical devices used in the Station's rocket and satellite experiments.

It is encouraging for us to know that the work of the Station has been so fully recognised by the award of six honours to its members during the past five years.

J. A. Ratcliffe

Mr. Haxton

On December 31st we said goodbye to one who had spent longer on the staff than most of us. Mr. Haxton joined N.P.L. in December, 1917 at the age of 16 and became a member of the Radio Section N.P.L. when it was formed in 1920. Since then he has helped with many of the Station's activities, including, in later years, the work on radio noise.

I first got to know Haxton about 1927, in the days when I was helping Appleton at his field station at Peterborough, and Haxton was running the transmitter for us at the N.P.L. Through the night we were in telephonic communication and he used to make the smooth changes of frequency required for the Appleton-Barnet frequency change method of ionospheric exploration. It was a pleasure to meet him again when I joined the Station recently.

We all owe a debt of gratitude to one who has served the Station so loyally over so long a time, and I am sure all will join with me in wishing him every happiness and success in his retirement.

J. A. Ratcliffe

TECHNIQUES OF TEMPERATURE AND WIND SOUNDING WITH THE SKUA METEOROLOGICAL ROCKET

By R. ALMOND

(The following is extracted from an article in the Meteorological Magazine; H.M.S.O. copyright).

History:- Firings of the first development rounds of the SKUA Meteorological Rocket commenced in March 1963. Initial failures were associated with the delayed ignition of the sustainer motor, and this trouble was rectified by October of that year. It had been planned that firings would start in the Outer Hebrides at the commencement of the International Years of the Quiet Sun period in January 1964, and with this end in view development firings were completed at this station.

The first signal from a payload ejected from the rocket at apogee was heard on 10 November 1963, from about 35 kilometres altitude, and the first temperature measurements from a sonde were obtained one month later on 9 December 1963, from an altitude of 42 km. Production round firings started in January 1964, and continued until March when the programme was halted because of a dramatic increase in failure rate. A further development stage covering June to November 1964, was held at the Ministry of Aviation range in Wales, and was based on deliberate spinning of the vehicle up to a maximum rate of 12 rev/second. Five good trajectories were obtained from six rounds, the failure being due to motor trouble and not to instability. This was considered good proof that the Hebrides failures attributed to a rocket instability phenomenon called 'roll yaw lock-in', i.e. destructive interaction between the roll and yaw features of the vehicle, had been overcome.

The spin feature was therefore incorporated in the rounds prepared for the second Hebrides campaign, covering the period January to April 1965. Although a few failures resulted during this period, it is felt that a very successful sounding rocket has now been developed.

The rocket vehicle:- SKUA I which has been used for all soundings to date, will carry a 4.5 kilogram payload to an altitude of 70 km for an 85°-elevation firing. It has a payload section volume of 8.2 decimetre^3, is 2.3 metres long and 13 centimetres in diameter, and has an all-up weight of 37 kg. The motor is a solid propellant end-burning type. Low dispersion is achieved by launching the rocket from a steel tube, 10 m long and 53 cm in diameter, using a boost rocket. The latter forms the central portion of a carriage structure and piston, on top of which the fins of the main rocket rest, under gravity only, in special wedges. The forward end of the rocket is aligned axially by a foamed-plastic sabot. The carriage has wheels which contact the inner surface of the launcher tube, and houses fins and two 2-m parachutes for guidance and safe return to ground, ensuring its usability for further firings. The boost thrust is 1800 kg for 0.2 seconds, yielding a tube exit velocity of 107 m/s. The main rocket is ignited at the same instant as the boost and burns for 30 s, after which time a height of 16.5 km and a speed of 1220 m/s have been reached. A thermal switch operates at this point, starting a delay clock with a 105-s running period, at the end of which a small rocket is fired applying thrust to a piston which separates the payload from the rocket body at a speed of 7.6 m/s having sheared the nose-cone retaining pins. This timing of 135-s from launch coincides with the 70-km apogee of the rocket.

Launcher settings to achieve effective 85°-elevation firings are determined from ballistic wind correction data. Wind structure is measured over the full burning range, i.e. 16.5 km and weighting factors are applied to the mean winds of six appropriate layers within this depth of atmosphere. This gives a total ballistic wind to which the unit wind effect of 0.598° per m/s is applied. Half the 'weighting' is taken up in the first 370 m of the 16.5 km considered.

The rocket can be 'skin-tracked' by the standard Meteorological Office wind-finding radar to a slant range of 50 km, and this is sufficient to define the trajectory and supply accurate 'laying-on' angles for parachute acquisition at apogee.

SKUA 2, now undergoing development trials, is an improved performance version of SKUA 1. It has an apogee of 100 km for an 85°-elevation firing, achieved by only 3 s extra burning time, necessitating a motor elongation of only 11 cm and increased all-up weight of 2 kg. The initial meteorological payload is high-altitude radar chaff (85 to 60 km) plus temperature sonde with parachute (65 to 15 km). A standard chaff load for SKUA 1 is already fully developed and tested, forming an alternative payload to the sonde.

The meteorological payload:- The meteorological payload is almost invariably the temperature-measuring sonde and parachute yielding wind/temperature/height data between 65 and 15 km. It must be capable of rocket ascent to 70 km, full deployment, and finally yield the telemetry data for at least one hour with negligible circuit temperature and voltage coefficient errors. The parachute must give reflected primary radar pulses of sufficient strength to produce automatic range, elevation, and azimuth presentation data at the ground station to at least 140-km slant range.

Sonde circuit:- A low-power (30 milliwatt) single transistor oscillator coupled to a quarter-wave aerial provides the radio frequency carrier operating at a pre-set frequency in the 27.5 to 28-megacycles/second meteorological band.

This carrier is frequency modulated with a deviation of $\pm$ 20 kc/s by an audio-frequency signal within a band 700 to 1000 c/s. The variation of the audio frequency is a measure of atmospheric temperature. This variation is produced by the temperature element which forms a variable resistance arm in a twin-T bridge oscillator.

A resistive dividing network across a stabilized voltage supply is capacitatively fed from the output of the oscillator emitter follower, yielding the correct bias and A/F signal for a variable capacity diode which produces the F/M swing of the carrier.

A two-section dry battery provides separate supplies for A/F and R/F sections, the A/F supply being stabilized by Zener diodes.

The R/F circuit has two tuning facilities, one capacitative for frequency setting, and one inductive for power matching into the quarter-wave aerial.

Construction:- The temperature element is a flat double open spiral of spiralized tungsten wire supported by plastic monofilament spokes, in an aluminized resin-bonded fabric 8.9-cm diameter ring. The wire, of diameter 13.5 microns, has a pitch of about 90 microns and a spiralized diameter of about 200 microns. This enables a resistance of 3100 ohms (at $0^{\circ}C$) to be mounted compactly and safely. The resulting actual length of wire is 7.72 m. The element ring is grooved on the inside to take a spring clip, which forms a resilient mount and is attached to a spring-loaded telescopic deployment shaft.

During the ascent the temperature element is held on a foamed-plastic cushion protected by an element cap which carries a cord harness and release pin. These are removed when the rocket nose-cone has separated 1 m from the sonde on parachute deployment, since the cord is attached to an eye-bolt in the apex of the nose cone.

The temperature element is then carried by its deployment shaft to a point 13 cm from the main sonde body and at the same time power is applied to the circuit. The exposed temperature element is now the lowest point of the sonde assembly as it descends by parachute. The canopy of the parachute is 4.5 m in diameter and has alternate panels of metallized and unmetallized silk making it a passive radar target. A strop between the apex of the

shroud lines and the sonde suspension point houses the quarter-wave transmitter aerial.

The average parachute fall rates from different heights are given in Table 1.

TABLE I-AVERAGE PARACHUTE FALL RATES

Height kilometres	Fall rate metres/second	Time elapsed minutes	seconds
70	225	zero	
65	160		10
60	125		50
55	90	1	40
50	65	2	40
40	32	6	15
20	4.5	40	
14	3.7	60	

The main circuit components are housed in an all-metal chassis and protected with a silicone rubber coating before being completely encapsulated in rigid poly-urethane foam. To prevent twisting of the strop and parachute shroud lines a small swivel link is placed between them. This is required because of the spin feature of the rocket which also necessitates the dynamic balancing of the sonde.

(To be continued)

STAFF NEWS

Congratulations to:

Mr. and Mrs Z. Kutylowski on the birth of their daughter Caroline

Mr. L. Lui (Singapore staff) on his marriage to Miss Monica Yeo.

Mr. J. Gourlay and Miss K. Sumner on their engagement.

Welcome to:

Miss B. Turner	E.O. (transferred to R.S R.S.)
Mr. P. A. F. Hobbs	T/A E.O.
Mr. M. D. Austin	T/A.E.O.
Mr. J. W. Murray	T/E.O. (Chilbolton)

Resignations:

Mr. R. W. Tucker	E.O. (transferred on promotion)
Mr. R. A. Amey	S.A.
Mr. J. A. MacDonald	S.Tel.Op.
Mr. A. C. Haxton	S.A.

SPORTS AND SOCIAL CLUB

Ice Skating

Back in November some members of R.S.R.S. went over to Richmond ice rink where they sampled the hardness of the ice. It seems that they also very much enjoyed the evening skating, and it is proposed that a second visit be made on Wednesday 2nd February. There will probably be sufficient cars to offer a lift to anyone requiring it.

Some advantages of Richmond are that it is near to R.S.R.S., that it has both a large rink and a small quieter rink, that it has a bar and buffet, and that both entrance and the hire of quite adequate skates may be had for less than five shillings.

Martin Hall

The Smith-Rose Cup Table Tennis Tournament

This was played on 24th November 1965 and resulted in a resounding win for Spurs A and B, Workshop and Admin.

One of the star attractions was the match between Brian May for Spur A and Paul Dickinson for the opposing team (Spurs C, D and Winkfield).

J. Willsher

Christmas Dance

On Saturday December 18th, the Sports and Social Club held its annual Christmas Dance. About 90 people attended and thoroughly enjoyed themselves. Mrs. Ratcliffe very kindly presented the Smith-Rose Cup for the year 1964-65. This was received by Kathy Sumner on behalf of the winning team - North.

I'm sure all of us who were present on that festive occasion would like to express our grateful thanks to the many willing helpers behind the scenes, especially to John Juleff - without whom we should have had neither bar nor band - to Peter Hall, the M.C. for the evening, to Audrey Jones - who so ably organised the catering - and last, but by no means least, to Clare Seabrook who spent many hours creating and erecting the excellent decorations.

I regret to have to add though that, with attendance down and the cost of living up, the evening made a loss of about £10.

Veronica Lovell

Christmas Party

On the afternoon of Thursday December 23rd all those members of the station who were not already on leave gathered in Spur B Main Lab. to wish each other a Merry Christmas, in the customary manner. With the assistance of generous donations from the now defunct Spur coffee clubs, and the resale after Christmas of unopened drinks, this event was able to make a small profit which has since been sent to OXFAM.

Bridge Club

Sixteen people played at the Christmas club evening on Monday December 20th; the next evening will be held on Monday January 17th instead of on Friday 14th as originally planned. Our next match is against the Road Research Laboratory on January 26th and the next NPL League match will be played on February 1st.

Jean Fooks

Camera Club

We plan to hold slide shows twice monthly for the rest of the winter. They are on Tuesdays, at 1300 in the Projection Room. All are welcome - if there is room!

January 25: JAMAICA.....David Owen
February 8: FALKLAND IS.....John Juleff

Henry Rishbeth

Snooker and Billiards

The Snooker section of the Smith-Rose cup starts on the Monday 17th January in the lunch-hour. Will all those interested please sign their names on the list on the Sports and Social Club notice board or contact me in Room 7.

K. Slater

Chess

There will be a chess evening held on Tuesday 18th January. Will anybody who is interested please sign their names on the appropriate place on the notice board as soon as possible.

Tony Lowe

Intelligence from the Far East

This year's useless facts

1. Molten gold is green
2. 1 cu. mm of molecular sieve has a surface area of $\frac{1}{4}$ acre.
3. A velocity of 1 parsec a million years is equivalent to 1 Km. per sec.
4. The country with the greatest consumption of Scotch whiskey per head of population is New Zealand.
5. Rin-tin-tin was ginger.

J. Tyler (Singapore)

LETTER TO THE OUTSTATIONS

Dear Colleagues,

It may surprise you to know that rough notes are kept to provide information for this letter. Such notes do exist though, and even if on looking at them, the writer is puzzled by such mysteries as 'Moat - fish boiling - power cut?' etc.), some events remain in mind and need little prompting. One such note is 'Hax. retired'.

You will see from the Director's remarks that Mr. Haxton served science for many years. When his career started, techniques and components now taken for granted were just emerging from the laboratory stage. He recollects the early triode, then a newly-discovered and temperamental source of oscillation as well as amplification. Another memory is of making sure that the crystal receiver; a splendid engine of brass, huge inductances and sliders; was ready to receive the daily time signals from the Eiffel Tower transmitter, the WWV of its day. An enthusiastic sportsman, Mr. Haxton played hockey, tennis, cricket and soccer for many years, and continues to play bowls for the London area Civil Service team. We all wish him well in his retirement.

Another departure, a transfer on promotion, is Mr. Tucker. For some years, as accounts officer, his was the unenviable task of acting as a sort of lightning rod for all our fiscal grumbles. He survived this and, what is more, managed to keep on good terms with us all, so that when he moved to Establishments we felt that we had a friendly guide through the mysteries of ESTACODE. Our good wishes go to him at the London Office.

Mr. Tucker's place at Ditton Park has been taken by another friend already familiar with our curious little ways. Miss Turner, formerly a member of the Establishment staff, has now returned to head that office and we welcome her once again.

To some at R.S.R.S. who have served terms overseas there are certain characters we meet in our travels. These familiar spirits, so-to-speak, help us in our translation from home surroundings to the initially unfamiliar environments where we choose to ply our trade. Well-known to all who go to the Falklands is Captain Freddie White of R.M.S. Darwin. The news of his recently having been awarded the O.B.E. will please all who have enjoyed his hospitality afloat and ashore. The curious feeling that the motion of the Darwin has been imparted to the roads of Stanley, a testimony to his abilities as a host, has been experienced by many including,

Yours sincerely,
The Editor
