# RSRS NEWSLETTER

No. 127

December 1971

The year ahead will be one in which the Station begins to see the effects of the implementation of the recommendations of the RSRS Review Panel which have been approved by the Council. The times are therefore likely to be challenging for us: the more so because of possible effects stemming from Government policy decisions which may be taken in the light of the recent Rothschild and Dainton Reports. However, I believe that the thorough examination of the role of RSRS carried out by the Station Review Panel provides us with an excellent base from which to adapt ourselves to any consequences of those two Reports, and I am sure that we can face 1972 confident in the knowledge that RSRS has important and worthwhile tasks to accomplish.

It is with the same confidence, and with great pleasure, therefore, that once again I wish all members of the Staff and their families a very happy Christmas and a prosperous New Year.

J.A. Saxton

## ARIEL IV

UK-4, the second all-British built scientific satellite, was launched successfully by the US National Aeronautics and Space Administration (NASA) from the Western Test Range in California on Saturday, December 11, 1971. Now that it is in orbit the satellite is known as Ariel IV.

Launched at 2047 GMT by a four-stage Scout rocket the satellite is now orbiting the earth once every 95 minutes at a height of approximately 330 miles and at a speed of around 17,000 mph. The satellite transmits on a frequency of 137.05 MHz. It is unlikely to be observed optically in the United Kingdom before late January or early February. It may then be observed with binoculars and, possibly, even with the naked eye.

The British experiments from the universities of Sheffield and Birmingham, and from the Radio and Space Research Station jointly with Sheffield University have now been switched on and all are in operation. The experiment from Manchester University/RSRS will be brought into operation within the next few days and the American experiment, from Iowa University, in about three weeks' time.

Within the U.K. the satellite has been commanded regularly since its launch from the Winkfield Tracking and Data Acquisition Station, Berkshire, which is operated in collaboration with NASA and under the general direction of SRC's Radio and Space Research Station. On command the satellite has transmitted stored data from the experiments in operation.

All information from the satellite will be analysed by the experimenters, the data having been processed at the Radio and Space Research Station with final reduction at the SRC's Atlas Computer Laboratory.

The satellite should continue to transmit information from all its experiments for at least a year before being switched off.

(Extract from SRC Press Notice)

## CHANGES TO UK STANDARD FREQUENCY AND TIME SERVICES

Everyone is familiar with leap years, and knows of the unfortunate child whose birthday officially occurs only once in every 4 years, but what of the infant born during a leap second, positive or negative as maybe, or, worse, during the last few milliseconds of AD 1971, 107.7577 ms to be precise - but read on.

For thousands of years the measurement of time has occupied the attention of men but not until the 17th century did Galileo realise that the Earth did in fact travel in orbit round the Sun and not vice versa. We depend for the Sun on our existence so it is perhaps natural that the human race should make use of the Sun to indicate the time of day and the seasons of the year. In the past the Sun has served us well as a timekeeper, and still does, but modern atomic standards of extreme accuracy and stability have revealed certain inconsistencies in Universal Time (UT) based on the average length of a day.

Measurements of Star transits across the meridian at Greenwich Observatory, with corrections for various astronomical phenomena give rise to Sidereal Time (ST). Further corrections for the relative motion between the Earth and the Sun lead to the well known scale of Greenwich Mean Solar Time (GMT) on which UT is based.

In 1967 the International Committee of Weights and Measures, formally defined the second in terms of an Atomic Standard as the duration of 9,192,631,770 periods of the radiation corresponding to the hyperfine transition of caesium 133, thus the ICWM finally dissociated AT from solar measurements. It follows that UT is now free to drift in relation to AT.

At present the Earth is rotating at such a speed that UT is slow compared with AT by some 300 parts in $10^{10}$ or approximately 1 second/year. Atomic clocks which are used to generate UT are therefore at present given a frequency offset of -300 parts in $10^{10}$ and the resulting time scale is known as Co-ordinated Universal Time (UTC), to which, at present, GMT is aligned.

On the 1st January 1972 an event, somewhat unique in the annals of timekeeping, takes place. Following International agreement, the Standard frequency and time signal broadcasts in the United Kingdom will be adjusted on that date so that the rate is in agreement with International Atomic Time (I.A.T.), and the time signals differ from the I.A.T. reference by an integral number of seconds. This will involve a time step applied to the GMT time signal emissions, and also the elimination of the frequency offset where it still exists.

In accordance with the agreed procedures the Director, Bureau International de l'Heure (BIH) has announced the amount and incidence of the time step as follows:

"A negative time step of - 0.107 757 7 s will be applied to UTC when the date will be:
1971, December 31, 23h 59 m 60.107 757 7 s, (old) UTC
so that at this instant the date will become
1972, January 1, 0h 0m 0s, exactly, (new) UTC"

In practice this adjustment will be closely approximated in the time standard at Rugby Radio Station by delaying the emission of the minute pulse following 23h 59m 59s on 31 December 1971 by 0.107 760 s. In consequence the final 'second' of 1971 will have a duration of 1.107 760 s.

The new UTC system commencing at 1972, January 1, 0h 0m 0s will then differ from the IAT scale by precisely 10 s. Simultaneously with this change the offset will be removed in both time signal and carrier frequency generators.

MSF 60 kHz, 2.5, 5 and 10 MHz: The time step as described above will be applied to the MSF time signal emissions. All the carrier frequencies are radiated at present without offset and no change will be necessary.

GBR 16 kHz: The present offset of - 300 parts in $10^{10}$ will be eliminated from the GBR signal frequency coincident with the time step as already indicated. The effect of the time step will be first apparent in the time signal transmission at 0255-0300 GMT on January 1, 1972.

Droitwich 200 kHz: The carrier frequency is already adjusted to zero offset and no change will be necessary.

Future Time Steps: The present offset corresponds to an accumulated time difference of about 1 s in the course of a year. With the elimination of the offset the time difference between the radiated UTC signal and the astronomical reference UT1 will be maintained within the limits $\pm$ 0.7s by step changes of exactly 1 s made, when required, on the last day of a UTC month, preferably June 30 and/or December 31. If the present trend in the Earth's rate of rotation continues it is likely that the first such step will be applied on 1972 June 30 when the emitted time scale will be retarded by the insertion of an additional second in the last minute of the month. Provision has been made for such a 'leap second' to be either positive, as in this case when it is an additional second, or negative, when a second is eliminated and in consequence the time indication is advanced. This possibility may arise should the Earth significantly increase its rate of rotation.

Information on the introduction of leap seconds will be provided by the BIH at least two months in advance of the date of application of the change. In addition the Bureau will furnish values of the difference btween UTC and UT1 and this difference, denoted DUT1 = UTC - UT1 will be given to a unit of 0.1 s in the form of an internationally agreed coded announcement on primary time signal emissions. When the difference is positive its magnitude will be indicated by emphasising the appropriate seconds pulses immediately following the minute marker from pulse 1 to pulse 7, inclusive; a negative value for DUT 1 will make use of pulses beginning with pulse 9 and extending to pulse 15. In either case the magnitude of DUT 1 will be given by the total number of consecutive emphasised pulses. The absence of emphasised pulses will mean that DUT 1 has the value zero.

A common system of emphasis has been adopted for both MSF and GBR transmissions, and takes the form of an additional pulse radiated 100 ms after the end of the normal seconds pulse. This produces a distinctive double pulse which should easily be heard and identified in the presence of noise and interfering signals. And what of the infant? Perhaps, like Kipling, we can still say "If you can fill the unforgiving minute with 61 (59) seconds worth of distance run, yours is(still) the earth .....".

Thanks are due to Mr. D. J. Britton of AWRE, Mr. C. Buckle of the BBC transmitting station at Droitwich for an article in Proc. IEE and to the Division of Electrical Science NPL for the technical content of this article.

D. Howard

## THE COARSE BUT STILL UNASHAMED ACCOMPANIST

Do you play the piano, I wonder? If you do, then you'll know what I mean. It's all very well for the Gerald Moores to talk glibly about their experiences with Elizabeth Schwarzkopf and Fischer-Dieskau,but I wonder if they ever had to play for Annie Longbottom at the Masonic Hall? (at short notice) or been pianist to a local "variety" show or concert party, of the sort involving talent-spotting contests and "community" singing". ("Orl together, nah .....")

Versatility, that's the thing. Everything from Russalka's Song to the Moon, through Perchance to Dream ("can you sort of run 'em all together without a break?") to My Lovin' Woman. (Wot? Don' know it! Blimey where've yer been, mate, it's dead old!"). There will be some tyro wanting to do the Rose Adagio with no music,

("my teacher usually plays it") innumerable sketches involving innumerable "cues for music", usually bungled, and a round half-dozen singers, complete with ear-marked copies covered in indecipherable pencilled alterations and all sublimely ignorant of their (and your) incompetence.

Then there's the one who's been talked into singing "for the experience", just down from the academy (studying under Maestro Bogliani, you know"). I had one only last month. "Just a couple of songs", murmured the organiser, "so-and-so of Prokofiev and that Divine song of Strauss; and so-and-so of Wolf". Ten minutes flustered inspection of the music in the bar did little to reduce the enormity of the undertaking, and the ensuing five minutes were the longest and hottest in my recollection. The Artiste left the platform after the Strauss, saying in answer to protests that she was too moved to go on with the Wolf. She said she'd never forget the experience if she lived to be a hundred.

Charity shows are the worst. You can't refuse, since "it's all for the cause", but you never know what you're in for, because the organiser has only just started bullying people into it and can't tell you. I remember one vividly a couple of years ago, when a charming young thing rang me and asked me if I could please possibly accompany her a fortnight on Saturday? I could, of course; where was it exactly? And then it came out. It was in a tent at a fête. It was to go on from 2 p.m. until they stopped coming in, "about nine". I was the Pianist, and had let myself in for the lot, talent-spotting and all. Later on I found that that wasn't all. The piano had spent the winter in a shed on the cricket field, and the day was so hot ..... There was a "run through", it seemed, at ten a.m. Narrowly escaping scalping by a swinging lamp, I approached the man who seemed to be in charge, and announced my arrival. "You might just put these chairs out", he said, "I suppose you are O.K. without music; vampin' an' that?" It seemed that there would be a "lot of kids" that afternoon. "An' there's a beauty contest at three-thirty, so you'll have a break for yer tea". He departed at once in search of the piano-tuner, who had been called for nine-thirty, and finding the field deserted, had gone on his way with quite a lot of profanity. "We shan't be doin' anythin' before lunch", said the organiser, "we'll have a run-through at a quarter-to-one". The temperature was decidedly uppity, I thought.

I felt better after an hour at the "Seven Stars", and went back to the tent. I soon found that I had made a mistake; the "Men" were accommodated two hundred yards away behind the pavilion. Moreover the heat inside the tent was tropical.

The tuner was with us and hard at it. "What do you think to it?" I asked. He laughed nastily. "Reckon somebody's a grudge against you", he said. He took the handkerchief from his neck and mopped his face, adding as an afterthought, "I expect it'll soon dry out in this 'eat". I made my way to the beer tent. The organiser had been doing likewise. "Come an' meet your drummer for the afternoon. Have a pint. Frank - Harry". He disappeared.

Harry absorbed the pint and ordered another! - "Ever done it before?". I said I hadn't. "Did it last year. Another bungle". He sank the pint. "Don't usually do this. Terrible. Jazz club usually". I followed his example with the pint. "Better get back. Startin'". We returned to the tent, where the air was now shimmering. Two ladies rose from a bench. One was the Rose Adagio, the other Perchance to Dream. Of my temptress there was no sign. "Is this all?" I asked in dismay. "Dunno! Not here for rehearsal, they take pot-luck". We went and reflected over another pint. "Surely you're not pro.?" he asked. I said I wasn't. "Thought not". He recollected a moment. "We had a good pianist last year", he said. "Thank you!" I said, "Why didn't you get him again?" "You've just got to be jokin!", he said. "Come on, you two", hissed Perchance to Dream, "we're starting". We went back to the tent. "Coats off", said Harry. "If they don't like it, b-------- 'em".

We had Perchance to Dream first, followed by the Rose Adagio without music. Then we had Memo, The Wonder Memory Man, and a gentleman who did somersaults while playing "Czardas" on the violin. A man sang "The Yeomen of England" and "English Rose" followed by Sid Creeper, Your Cheerful Comic. Then we had Perchance to Dream and the Rose Adagio without music .....

"Right", said the organiser, "you're off. Beauty contest in five minutes". We covered the two hundred yards at a creditable pace. "Lot of 'em", said Harry, "take all of an hour, if not more". There seemed to be a struggle going on between the organiser and a young man with black hair. "Dissension in the camp", said Harry, "put another ten minutes on it". "It would be cooler down by the river", I said. "Right!" said Harry. "Let's take a few bottles down". We did, and it was.

I woke up with the moon in my eyes. I was alone. I stumbled back to the tent, but it was all over. Harry was in the bar with a pint. "You blighter", I said, "why didn't you wake me up?". "Couldn't!" said Harry, "I told 'em you'd had enough and gone home". "Thank you - mate", I said, "what on earth did they say?". "Nothin' to what they'd 've said if they'd seen you", said Harry, "Didn't matter. Young fellah with black hair was a real good piano-player". "Suppose you're right then", I said.

When you come to think of it, at least one lot won't ask me again.

F. V. Bale

## STATION NEWS

### Visits by Space Research Experimenters

With the object of bringing some of the space research activities of RSRS into closer association with those in the universities, representatives from most university groups visited the Station on November 25th. From the discussion which followed the tour of the Station, it was evident that the visitors were glad to have had this opportunity to see the relevant parts of our work.

On December 6th we had a visit by the Panel which has been set up to advise the SPGC on what forms of centralised support will be needed in the future for the UK space research programme. The previous visit of the experimenters had served to clarify their views, which were presented to the Panel.

Both parties of visitors expressed their appreciation of the way in which the staff had explained their work and answered questions.

### Staff News

Congratulations to:

Mrs. E. P. Paterson, now Audio Typist I

Welcome to:

| | |
|---|---|
| Mrs. J. M. Nassé | C.A. |
| J. K. Wilkie | A.E.O. |
| A. D. Stevens | E.O. |

Resignations:

| | |
|---|---|
| G. R. Dowling | S.O. |

Other Changes

| | |
|---|---|
| K. Feldmesser | E.O. changed from Div. 2 to Div. 1 |
| S. K. Bhattacharyya | E.O. Returned to duty at RSRS from Singapore |
| R. J. Powell | E.O. Left U.K. for 2-year tour of duty in U.S.A. |
| J. D. Ewart | A.E.O. Left U.K. for 2-year tour of duty in U.S.A. |
| C. Murphy | Tech.3 Returned to duty at RSRS from Singapore |

E.S.R.O.

| | |
|---|---|
| T. P. W. Winteringham | A.E.O. transferred from RSRS to ESRO<br>Arrived Falkland Islands |
| K. L. Seal | A.E.O. transferred from ESRO to RSRS |

## MAGIC SQUARES

1. Make a magic square 3 x 3
   (a magic square is a square array of numbers from 1 through $N^2$ such that the sums of the numbers in each row, column and major diagonal are equal, the sum being

$$\sum_{i=1}^{N^2} i \,/N = N(N^2 + 1)/2 = 15 \text{ for } 3 \times 3$$

2. How many ways can you re-arrange it, (keeping it magic)
3. Make a magic square 9 x 9
4. How many ways can you re-arrange it.
5. If a computer tried at random filling 9 x 9 squares once per microsecond, how much computer time would be needed before it hit on a magic square.
6. Can you make a magic square 4 x 4?

P. H. Dickinson

The March of Civilization

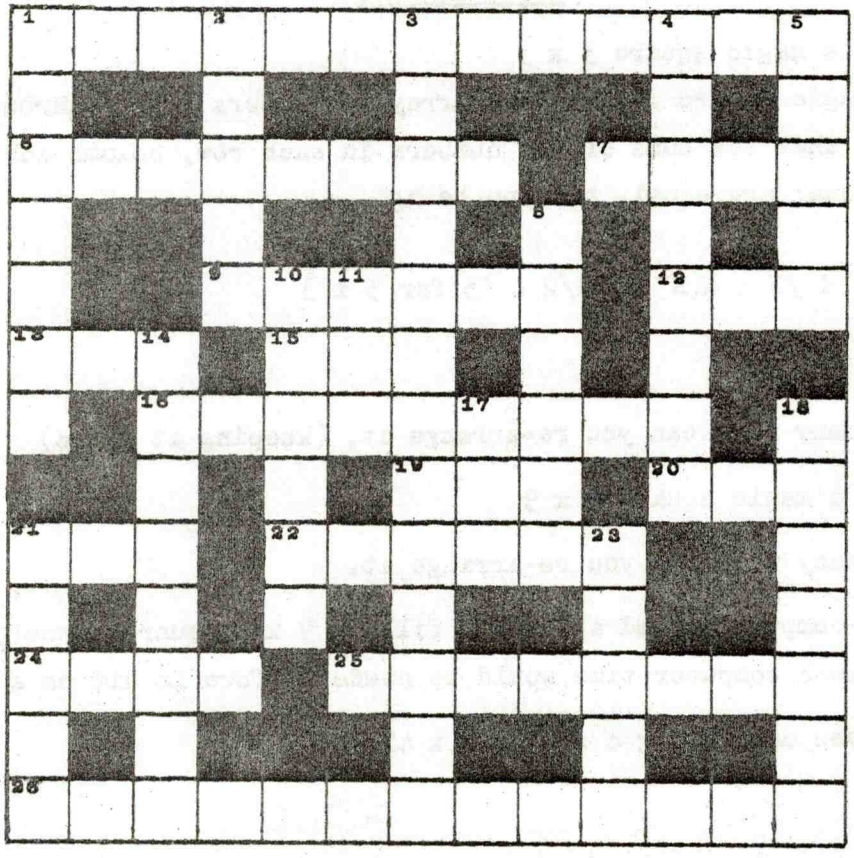
The toilets have been further improved this year; it is hoped that there will soon be some improvement in the condition of the car park. - IPCS report

Mileage for Official Trips?

U.K.A.E.A. - LSD Manual - seen in the Library

From the Reviews

"Almost immediately after recordings stopped the aerial system was 'crashed' to the ground ..... the operation was completed smoothly and quickly. Nothing was salvaged"



Across

1: Beyond 2 fifties, a Spanish article with no weight gives this shape (13)
6: Confused corps pet seeking gold (8)
7: I study the statue (4)
9: Powder from fatal cumulus (6)
12: Creed is a large number (3)
13: Employ America to a point (3)
16: No ritual after giving out a fire-ball (9)
19: Equal but sounds fishy (3)
20: Point as about retrospective ocean (3)
21: Backward flyers at a distance (3)
22: Name inside the Spanish coating (6)
24: Cut back in good order (4)
25: Muddled CID, dated and were hooked (8)
26: Horned he caned (anag): (with 11 faces) (13)

Down

1: Paper that dad mixed with syrup? (7)
2: An advantage is like a group (5)
3: A cycle mixed with one paid, but everything is in the book (13)
4: Serve ice broken and gets it (8)
5: Two way note (5)
8: A quiet anger below the print size, for the territories (6)
10: National Trust initially associated with an earl found at a stag party? (6)
11: Fifty that is a falsehood (3)
14: Comes into sight from ones mire (8)
17: A mixed arm sheep (3)
18: A french knight friend on a noise (7)
23: Kentish town up contains many threaded (5)

## Sports and Social Club News

### Table Tennis

The "A" team still meets with mixed success. One of the division's leading teams turned up with only 2 out of 3 players, justifiably thinking this would be enough to defeat R.S.R.S. So they did, winning 6 out of 7 games played, with an overall result of 6-4. They did the same thing again having been drawn against us in the Dilger knock-out Cup. This time, however, they suffered a 5-4 defeat, (no doubles are played in the Cup). The "A" team were also recently beaten 0-10 by Calor Gas. Calor Gas, perhaps having heard of our Cup win decided to turn out their strongest team, including a Bucks. County Ladies representative. The result was a foregone conclusion. The team's record is now Played 8, won 3, drawn 1, lost 4, by no means the worst in the division.

The "B" team still has a 100% un-beaten record, although a recent 6-4 win over Andfoil "B" was achieved only after a struggle in the last set.

P. Muzlish (Hon. Sec.)

### THE CHRISTMAS DANCE 1971

This year the Dance was held on Saturday 11th December and was, as usual, in the Station Main Assembly Hall. Dancing was to music provided by the Clubmen.

The Committee were sorry that Dr. and Mrs. Saxton were unable to attend. Dr. Saxton was detained in the United States by the delayed UK-4 launch. Dr. Smith-Rose also sent his apologies for having to miss the function this year. We were, however, delighted to welcome Dr. and Mrs. Horner and Mr. and Mrs. Wilkins as our guests.

Despite a slightly lower attendance this year - quite possibly due to the number of staff involved with UK-4 - the evening proved a huge success and all of the comments I have received from people both during the evening itself and since have been praiseworthy.

The evening's events were traditional, with dance music being provided to cater for everyone's tastes.

The Smith-Rose Cup, for sporting events on the Station, was presented by Doctor Horner who was able, in his short speech, to announce the 'successful lift-off of UK-4, to the added interest of the assembled company. Yvonne Dias received the Cup on behalf of the winning team - the South.

This year, as an innovation, and to make use of our newly acquired tape-cassette system, the Sports Club provided taped music for Scottish Country Dancing. The Band, having agreed that this was a little "out of their scene" were glad of an extra 20 minute break. Some of the novelty prizes in the Raffle provided a little amusement and I think that there will be some surreptitious visits to Personnel Office to view the two prizes that were won there!!

After a rather successful Musical Chairs game, in which some dastardly and ungentlemanly acts were perpetrated to obtain ladies' favours, the evening continued with such shenanegins as the Conga, Hokey-Cokey and Knees-up. Before the evening got too out of hand it was brought to an end at Midnight by ruthless application of the Licensing Laws.

I should like to take the opportunity of thanking all the committee and their helpers for making the evening the success that it was and in particular Elaine Wright for her excellent effort put into the wall decorations for the Hall.

May I also wish all Club Members a Very Merry Christmas and a Happy New Year.

John Cathrew
Chairman

## LETTER TO THE OUTSTATIONS

Dear Colleagues,

So far as can be seen, little recent reference has been made here to the latest addition to the row of huts at the rear of the main building. It is in fact an anechoic chamber; at first sight it seems to possess overtones of a Chinese puzzle or of those little Russian dolls that stack one within the other. The visitor on entering one hut finds another within.

Proceeding further, however, events take a more sinister turn, for within the inner hut what have we; a third hut? the heart of things? No, the visitor finds - nothing; a sink; a void; a black hole; a wasting box; a cymophage - the very nullity at the centre of the onion. Too long a stay within makes one too wise.

Still everything has its use and this is no exception. As a good absorber of radiation it will free workers from the nuisance of unwanted R.F. spattered back from all and sundry in the lab, and since it works quite well acoustically it might in very short spells serve to quiet the mind. Perhaps it could restore serenity after celebrations of that Merry Christmas and Happy new Year which is the wish of us all including,

Yours sincerely

The Editor

DECEMBER 1971

## List of Reprints

| | |
|---|---|
| G. A. Clarke and R. H. Slater | Experimental laser system for monitoring deformations in large radio reflectors<br>Proc. I.E.E. 1971 Vol. 118, 1562-1568 |
| L. Thomas M. D. Harrison and S. Horowitz | Reflection of radio waves by the lower ionosphere at night.<br>Proc I.E.E. 1971 Vol. 118, 1553-1561 |
| D. L. Croom and R. J. Powell | 19 GHz (1.58 cm). Solar radio bursts in the period July 1967 to December 1969.<br>Solar Physics 1971 Vol. 20, 136-146 |

## Internal Memoranda

NIL