



APPLETON LABORATORY

NEWSLETTER

Nos. 194/195/196

September/October/November 1977

ARIEL-V'S FOURTH YEAR OF OPERATION

The extremely successful X-ray astronomy satellite Ariel-V is to be kept in operation for another year. Launched in October 1974, Ariel-V is the fifth scientific satellite in the UK/US collaborative space research programme but the first in this series to be devoted to cosmic X-ray astronomy.

The experiments and spacecraft systems are still in excellent condition. Though the gas used for attitude control has now been exhausted it is still possible to maintain such control, subject to certain limits, by using the magnetorquer system. Although rapid changes of target are not possible, the spacecraft should be able to scan between one-third and a half of the sky, enabling more good science to be carried out at minimal operational cost.

The programme during the coming year will include extended observations of selected sources, both galactic and extragalactic, to study time variations more systematically and also to exploit the data in the Leicester University's high-latitude catalogue. The operation of Ariel-V for a further year will complement the observational programme of NASA's OSO-8 (Orbiting Solar Observatory) and NASA's HEAO-A (High Energy Astrophysical Observatory), launched in August.

In its third year of operation, Ariel-V continued to produce many new results. Two discoveries in previous years were the existence of a class of X-ray source known as "slow rotators", from the slowly-rotating neutron star which they contain, and of an emission line of the element iron in the X-ray spectrum of certain galaxy clusters. During the year, work at the Mullard Space Science Laboratory (University College London) has revealed a number of new examples of each of these classes of object. The Imperial College, London, group (following initial work by a German group) have confirmed the existence of a newly-observed feature in the high energy spectrum of the X-ray source Hercules X-1 which offers the possibility of determining the magnetic field (expected to be extraordinarily strong - of the order of 10^{12} Gauss) in X-ray emitting neutron stars. Analysis at the University of Birmingham has been

successfully directed at determining the positions of a number of X-ray sources in our own galaxy with good precision with the objective of seeing whether they can be correlated with objects observed by telescopes working at visible and radio astronomy wavelengths. This work is being actively pursued in collaboration with groups of optical astronomers and radio astronomers. Experimenters at the University of Leicester have, since the launch, been using Ariel-V to survey the sky and build up a complete catalogue of X-ray sources. This catalogue is now available for those regions of the sky where X-ray sources are expected to exist in other galaxies. Here again, there has been collaboration with astronomers using optical telescopes to identify counterpart galaxies radiating at both visible and X-ray wavelengths. This programme has led to the discovery of two, previously unknown, 'active' galaxies (in which very large amounts of energy are being released from the nucleus of the galaxy).

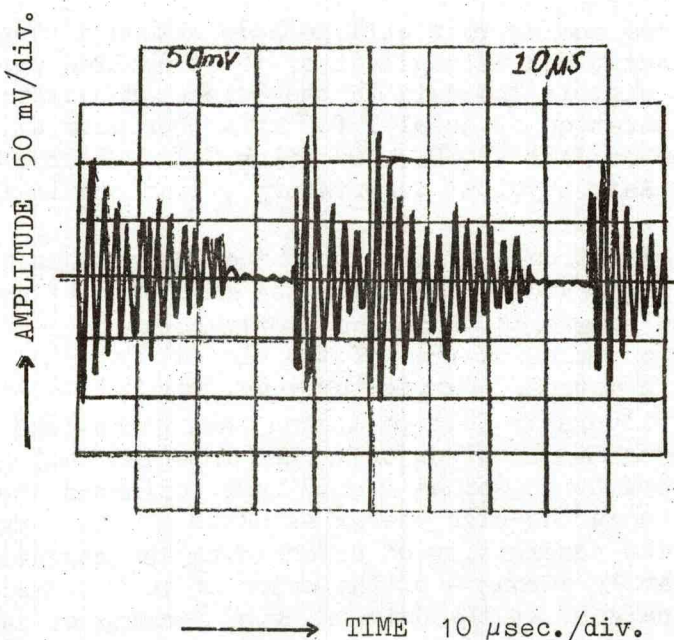
The Ariel-V control centre will continue to direct and receive data from the satellite for the fourth year of operations. At the same time, preparations will continue towards the launch of UK-6.

(S.R.C. Press Release)

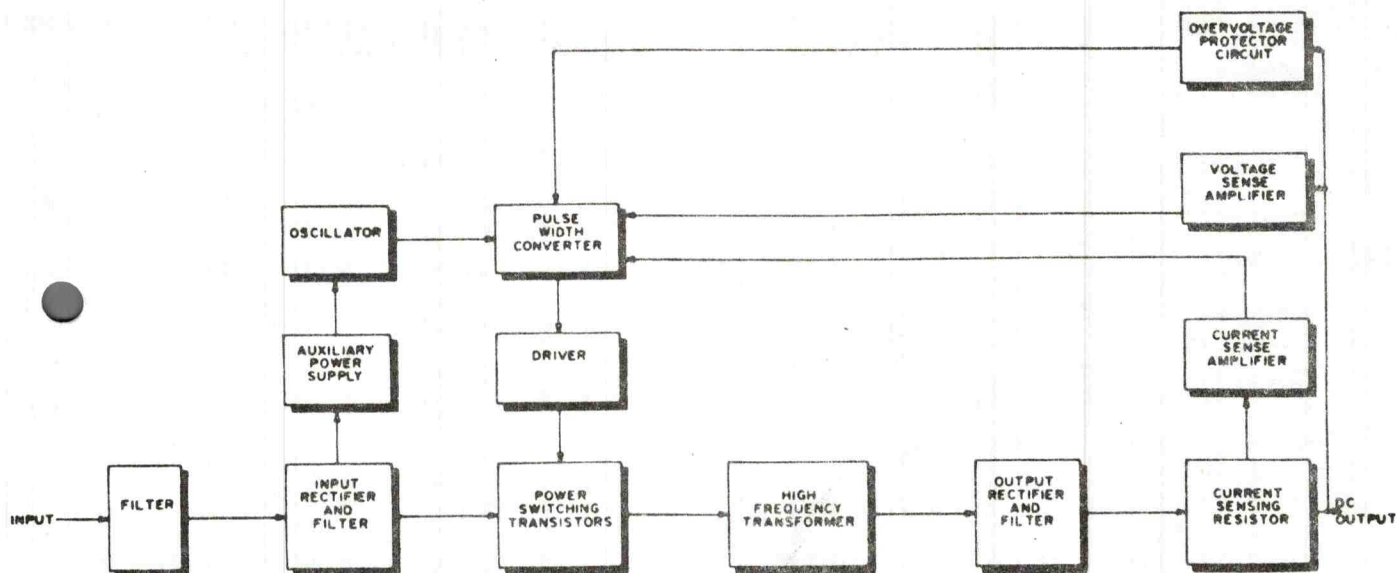
MEASUREMENTS LABORATORY NOTES

A Switched Mode Power Supply Problem

While testing a new d.c. power supply, the waveform shown in the diagram was observed across the load resistance, superimposed on the 24 d.c. supply, with a peak-to-peak amplitude of 250 milli-volts.



The supply was of the type in which the 240-volts mains is first rectified and smoothed, and then used to supply switching transistors in a high frequency transformer circuit as shown in the block diagram. The system is generally known as a switched-mode power supply.



Typical Block Diagram.

In our unit the switching frequency is about 25 kHz, the ringing frequency 500 kHz and the load current 5 amps. The effective r.f. power is a few milliwatts and the radiation can be detected with a receiver and aerial system up to a hundred feet away.

Apart from causing r.f. interference, any modulation of the d.c. level will degrade the performance of voltage-sensitive loads such as voltage-controlled oscillators, Impatt devices, etc. The only advantage in this type of supply is that it is smaller and lighter for a given output power, but this is generally unimportant in a laboratory bench supply.

Our recommendation is that requisitions for purchase of d.c. power supplies should not be for the switched-mode type. If they have to be used, then care must be taken with the connections. The leads should be a twisted pair, or screened, with attention to the earthing arrangements, and possibly using additional decoupling capacitors. Using these precautions the amplitude of the ring was reduced to 50 millivolts peak-to-peak. This still compares unfavourably with conventional bench supplies, which have a typical figure of 1 or 2 millivolts.

N.B. We have also observed appreciable r.f. interference generated by an oscilloscope having internal switched mode power supplies (it radiated from its mains lead). The interference covered a frequency range from 100 to 500 kHz at harmonically related frequencies.

STAFF NEWS

Congratulations to:

Richard and Janet Browning on the birth of their daughter Charlotte Esther on 2nd October.

Dick and Wendy Holdaway on the birth of their son Graham on 18th October.

Brian and Angela Stewart on the birth of their daughter, Hannah Lucy on 13th October.

John Smith now Licentiate of the Institute of Incorporated Photographers.

Welcome to:

Mrs. E. G. Robson	CO
J. K. Woodward	SCS (Culham)
A. Hall	SCS
K. J. M. Phillips	HSO (Culham)
M. G. Easterbrook	SO
J. M. Devine	Craftsman I
S. Phillipps	SO
D. M. Webster	SO
D. J. Bailey	Craftsman I
Mrs. J. Juggins	Typist (Culham)
(On Secondment from UKAEA)	

Resignations:

L. C. McClure	Craftsman I
A. E. Dilly	S/S Labourer
J. E. Allnutt	P.S.O.
M. P. Brincat	Ex. 0
Mrs. P. Rhind	Personal Secretary. Returned to U.K.A.E.A.
Mrs. J. Sandal	C.O.

Transfers etc.

R. S. Guy	Ex.0	to State House
G. W. Eastwood	P.S.O.	" " "
G. W. Ackland	P.T.O. I	to A.L. Culham

GOLDEN RAIN

At 7 p.m. on the evening of 5 November last, a collection of staff and visitors could be found huddled under massed umbrellas in a rainstorm of monsoon proportions. All were awaiting the commencement of the annual fireworks display.

Right on time the "dry" Guy was carried ceremoniously forth and placed atop the bonfire.

Then amid the dampened cheers from the onlookers the fire was lit and soon became a welcome source of heat and cheer. When it was really ablaze the Guy decided to jump from his chair but whether this was to avoid rain or flame we shall never know for he was quickly cremated in the flames of the sacrificial sump oil.

On to the fireworks and despite any doubts to the contrary, out there in the encircling gloom and slush there were some intrepid arsonists who somehow managed to keep their powder dry. Up went the Roman Candles and Rockets and down came showers of multicoloured sparks to the delight of young and old alike. Some fireworks gave such a realistic imitation of wartime anti-aircraft fire that many of the older onlookers had a reminiscent glaze in their eyes as if they expected to see a passing Jumbo Jet come spiralling out of the sky as a credit to the ability of our Appleton "gunners"! The only effect the rain appeared to have was to cause the rocket trajectory to end over the main building (or have we a militant "Move to Rutherford" faction in our midst?!)

Finally another scene reminiscent of wartime - the retreat from Stalingrad when our soaked and bedraggled "refugees" lined up at the "soup kitchen" for very welcome and warming refreshments.

Despite the terrible weather conditions the organisers had finished another successful and entertaining event. Grateful thanks to you all. (Did I hear someone say "Come back Fawkes - all is forgiven!")

L. Mitchell

DIVISIONAL MATTERS

Solution to problem in Newsletter No. 90.

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R. J. Pratt

RETIREMENTS

Mr. L. C. McClure

With the retirement from the Laboratory of Mr. Les McClure on 12th August this year we lose the services of a member of Staff who ably coped with the engineering problems of experimental apparatus.

A member of the pre-war R.A.F., his career after demobilisation in 1945 was spent in various skilled engineering posts, including a spell in Canada. All this contributed to an increasing store of experience from which we have been able to benefit. To the wide range of equipment needed here he has made valuable contributions.

Though retired from Government Service, Mr. McClure has taken up another appointment. His new firm is fortunate to have his abilities and we wish that his future may be an enjoyable and successful one.

Mr. A. E. Dilly

Mr. A. E. Dilly retired on 31st August, having joined the Laboratory in 1970. Arthur Dilly's duties here have made him a well-known and liked figure to a large number of the Staff. His cheery humour and impressive physical strength have been equal assets in what were sometimes trying circumstances.

The successful removal of quart-sized apparatus from pint-sized rooms; the transfer of cumbersome displays up the august marble staircases of the Royal Society; all this he tackled with aplomb and a spirit of enquiry as to the purpose behind the job.

Prior to coming here he spent many years with a Slough firm, the spell at Ditton Park being, as it were, a secondary career. May his retirement be both long and happy.

LETTER TO THE OUTSTATIONS

Dear Colleagues,

Those of you with a taste for literature may have been enjoying a false sense of security. It is some time since this offering came amongst you. This fact springs not so much from my well-known compassionate nature as from the interplay of those forces which muck up the best-laid plans of editors and such.

The outcome of this has meant that the Newsletter has not appeared for some time. Please do not blame your local cleft-stick runner, or even the Post Office for non-delivery. By the same token it may yet be a while before the illustrated issue comes out.

Meantime we're here again with apologies for delay from,

Yours sincerely,

The Editor

SEPTEMBER/OCTOBER/NOVEMBER 1977 REPRINT LIST

- A1236 A J Gibson, L Thomas & S K Bhattacharyya
'Some characteristics of Cirrus clouds deduced from laser-radar observations at different elevation angles',
JATP, 1977, Vol 39, 657-660.
- A1218 J E Allnut
'Prediction of microwave slant-path attenuation from point rainfall-rate measurements',
Electronics Letters, 1977, Vol. 13, 376-378.
- A1244 J E Allnut
'Variations of attenuation and space diversity with elevation 12 GHz satellite-to-ground radio path',
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- A1203 P H McPherson & W L Oliver
'F-region temperatures at Malvern and S. Santin',
JATP, 1977, Vol.39, 779-786.
- A1208 G E Bromage & B C Fawcett
'The $2p^2-2p3d$ transition array of Fe XXI and isoelectronic spectra',
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- A1217 G E Bromage & B C Fawcett
'The $2p^3-2p3d$ transition array in Fe XX and isoelectronic ions',
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- A1248 S K Bhattacharyya & A J Gibson
'A method for stabilising an air-spaced Fabry-Perot etalon',
Journal of Phys. E. Scientific Instruments, 1977, Vol. 10, 878-879.
- A1151 P H G Dickinson, N D Twiddy, R A Young
'Atomic oxygen concentrations in the lower ionosphere',
Space Research XVI Akademie Verlag, Berlin, 1976, 301-305.
- A1215 J E Allnut & J E Goodyer
'Design of receiving stations for satellite-to-ground propagation research at frequencies above 10 GHz',
IEE;Microwaves, Optics and Acoustics, 1977, Vol. 1, No. 5, 157-164.
- A1159 P H McPherson
'The UK multistatic incoherent scatter facility',
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- A1158 H Rishbeth
'Thermospheric structure and the F region',
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- A1255 P F Shutie, E C Mackenzie & J E Allnut
'Satellite-ground signal depolarization at millimetre wavelengths through thunderstorms',
Electronics Letters, 1977, Vol. 13, No. 19, 556-558.
- A1219 E C Mackenzie & J E Allnut
'Effect of squall-line direction on space-diversity improvement obtainable with millimetre-wave satellite radiocommunication systems',
Electronics Letters, 1977, Vol. 13, 571-573.

INTERNAL MEMORANDUM