

# Bulletin

of the Rutherford Appleton Laboratory

12 June 1984 No.9

## The AMPTE-UKS Prepares for Real-time Systems Tests at RAL

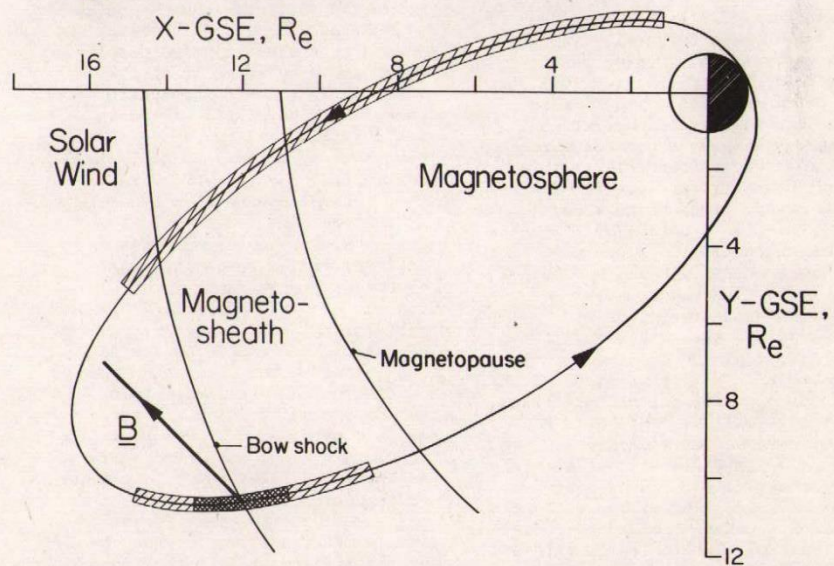
Early in May saw the first opportunity to integrate and test two very complex sub-systems: the AMPTE UK Spacecraft and the UK Operations Control Centre (UKOCC) at RAL. The Centre will be the focal point for all AMPTE-UK ground-support operations. The article below gives a background to these tests and provides an insight into future AMPTE operations.

### Introduction

On August 8th 1984 a German, an American and a UK Satellite will travel together on their way to a novel series of chemical release experiments in and around the Earth's magnetosphere. Launched from the Kennedy Space Flight Center, Florida, and known collectively as the Active Magnetospheric Particle Tracer Explorers (AMPTE), the German IRM (Ion Release Module), the American Charge Composition Explorer (CCE) and the UK Satellite (UKS) will study the release and subsequent dispersal of minute quantities of Barium and Lithium into the solar wind and magnetosphere, as well as contribute to studies of the micro- and macroscopic properties of the natural plasmas. (see Bulletin No. 18 1983). About six releases are planned, two in the solar wind soon after the August launch, one in the magnetosheath - the comet release - in December 1984, and several in the geomagnetic tail around Spring 1985.

The UK Spacecraft, constructed jointly by RAL and MSSL, is built around the conical adaptor that joins the IRM and CCE in launch configuration. Its instrumentation matches closely that of the IRM and includes: a magnetometer capable of 1nT resolution (1nT is approximately 1/50,000 of the surface geomagnetic field), positive ion and electron detectors, a particle correlator and a plasma wave experiment.

The focal point for all UKS ground support during the operational phase of the mission will be the AMPTE UKOCC, located in the former IRAS  
(cont'd over)



The UKS predicted orbit 7 projected into the ecliptic plane (close to the orbit plane of the satellite). On the inbound pass the UKS moves from the solar wind across the bowshock into the magnetosheath. The lightly shaded areas indicate satellite visibility from the UKOCC and superimposed darker area a 4-hour "data-taking" period spanning the bowshock.



Anxious faces study the main console waiting for the r.f. telemetry at the start of the second real-time test.

84RC 2548

## AMPTE - UKS (cont'd from p1)

control centre at RAL. Extensive use is being made of the existing IRAS equipment, including the 12.5m Chilton dish to be used for spacecraft commanding, the dual PDP11/34 computers for satellite control and experiment data processing and the telemetry receivers. New command transmitters have had to be bought producing an output power of 100 watts because of the much greater distance of the UKS which is 118,000km at the furthest part of the orbit. One other notable addition will be the use of the 25m Chilbolton dish for data reception with the data finally arriving at Chilton via GPO lines.

The software being used to operate the UKOCC is the result of a tremendous effort by software experts from RAL, Sussex University and the UKS experimenters. During routine operations UKS experimenters will be able to command the on-board instruments into the desired operational modes, and display the results from these instruments hopefully within seconds, and at least within minutes, of the observations being made. These real-time displays will enable the experimenters to adjust the instrument modes, albeit in a carefully controlled manner, to the changing plasma conditions encountered by the satellite, and allow different modes to be selected, for example on different sides of the naturally-occurring plasma boundaries. Although it will probably only be used in this way as a back-up in the event of a IRM failure, the UKS real-time magnetometer display could become an essential ingredient of the release experiments, where the magnetic field in the vicinity of the spacecraft will dictate the decision to release.

## The UKS Orbit

The highly eccentric UKS orbit will take the spacecraft from 500 km altitude at perigee to 18.5  $R_e$  geocentric distance (1  $R_e = 6380$  km) at apogee with a period of 43.8 hrs. Following the injection into final orbit perigee will be on the night-side and apogee on the dayside at approximately 14.20 hrs local time. Due to the beating between the orbit period and the diurnal rotation of the earth, the UKS will be visible to the UK ground station about twice per orbit, with the segment of the orbit sampled slipping forwards around the orbit by about 2.1 hours each day. The top figure shows one of the predicted UKS orbits (No 7) projected into the plane of the ecliptic, which is close to the orbit plane of the satellite, and also happens to be the X-Y plane of the Geocentric Solar Ecliptic (GSE) coordinate system used to present the real-time magnetometer results (X is directed towards the Sun). The lightly shaded areas indicate the extent of the UKS visibility from the UK which amounts to about 12 hours along each segment. The more-heavily shaded area on the inbound section

indicates a 4-hour data-taking period (constrained by the available satellite power) during which the satellite moves from the solar wind into the magnetosheath across the bow shock, the shock wave produced as the solar wind impacts on the obstacle of the magnetosphere. The bold arrow shows the assumed direction of the solar-wind magnetic field.

## The Real-time Simulation

By the beginning of May both spacecraft and UKOCC software had been brought to a stage where full-scale tests of the complete system could be realistically carried out. To make the tests effective all the instruments including the magnetometer and attitude sensors had to be stimulated externally to verify the accuracy of the real-time displays. Furthermore by stimulating the instruments it would be possible to check that the display software was sufficiently well optimised to keep pace with real-time. Finally to ensure that the tests were realistic they were performed to a schedule as if the spacecraft were actually moving along the inbound pass of orbit 7; ie the spacecraft was powered on for a short interval at the start of the visibility period to perform engineering checks, powered off until the science period to charge the battery, and then powered on again with a full experiment complement until the end of the science period. Two real-time simulation tests have been performed to date, the first using a hardline to communicate with the spacecraft and the second the full RF link. Initial indications are that the system performs well both from the point of view of commanding and producing real-time displays that are correct and keeping up with real time. Further tests are planned to check out operation at different bit rates. These tests should be completed ideally within the next two weeks before the UKS leaves RAL for Florida on the penultimate stage of its journey out into the magnetosphere and beyond.

*Further details of this project are available in the form of the AMPTE newsheet (Julia Gilling, R25), or from the Secretary, Chunky Lepine.*

## Found

Hewlett Packard calculator. Found in R1. Loser please contact Robin Marshall Ext.6256

## IRAS Continues to Surprise

Particles of solid material orbiting many dwarf stars may indicate that these stars are the centres of emerging planetary systems.

Data from the IRAS mission analysed last year show that the stars Alpha Lynae (Vega) and Alpha Piscis Austrini (Fomalhaut) are each orbited by these grains. The new discovery of forty other nearby stars sharing infrared characteristics similar to Vega suggests that this phenomenon may be commonplace throughout the galaxy. However, no actual planets have been detected.

Dust and debris-type materials are detected relatively easily by IRAS. Planets around stars are much more difficult to find having smaller surface areas than a shell or a disc of particles. (Saturn's moons are visually less apparent than its rings). The infrared emission around Vega and Fomalhaut has been interpreted as protoplanetary material - an accretion of solids and gas left over from star formation - and the cool infrared excess observed in the 40 stars under discussion (many of which are of the same type as the Sun) may have a similar origin.

Studies of Vega and the stars which share these same characteristics, will help scientists to understand how planetary systems form, and to determine which stars are likely to possess planetary systems in advanced stages of evolution.

In coming months each star identified as being "Vegalike" will be individually studied to characterise its physical properties over a wide range of wavelengths, and to determine if the infrared excess is consistent with that which would be emitted from cold, solid material round the star.

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## Trade Exhibition

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STC Electronic Services is Europe's largest franchised distributor, offering a comprehensive range of electronic components. They will be exhibiting a selection of catalogue items in Harwell Exhibition Centre, Building 173 on Tuesday, 12 June from 10.00 to 16.00hrs.

There will be a one-day exhibition by ANCOM Ltd on Wednesday, 20 June in R12 Conference Room from 10.00 to 16.00hrs. On display will be equipment designed and manufactured by ANCOM, such as analogue components and temperature and humidity equipment.

## Chilbolton Brownies

Tea and cakes were an added attraction at the Chilbolton Observatory on a recent sunny afternoon, courtesy of the 1st Test Valley Brownies. The weather was so pleasant that it soon became an open air event. Even the wind, which rarely ceases on this ex-aerodrome site, condescended to be kind.

The Brownies had been set the task of making tea in an unusual place in order to celebrate National Tea making fortnight. For the Chilbolton staff it was a break in the routine and a welcome relief from the usual afternoon break task of tea making, not to mention the washing up afterwards.

In the photograph Craig Lewis, a member of the observatory staff and Test Valley Councillor, gets his cuppa from one of the Chilbolton Brownies.

N C LEWIS



Midweek Advertiser

## Audrey's Painting for Twin

A painting by RAL artist Audrey Foster has been chosen as Wantage's gift to its twin-town, Seesen, West Germany.

The water colour, a scene of the Berkshire Downs, was taken to Seesen by a party of Wantage Councillors led by the Mayor, Mrs Anne Chynoweth, on Friday 25 May.

Audrey (personal assistant to Deputy Director, Paul Williams) is well known in the Oxford area, exhibiting regularly at local shows.

At the Wantage Town Mayor's Art Exhibition at the Civic Hall from 14-15 July, Audrey will be showing a selection of framed pictures and a portfolio of local scenes.

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## Library Notice

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NUOVO CIMENTO-D

Please contact the Library, R61 if you wish to receive a copy of the contents pages of this periodical.  
(The list of users has been mislaid).

The following book has disappeared from display in the Library.

'Active Filter Design. Coherent Communications Systems' by A B Williams

We should be grateful for its return as soon as possible.

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## Film Badge Notice

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It is period 6. Colour strip YELLOW  
Please check that your film badge is current, and return all old ones.

Next Film Issue - Monday 18 June.

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## Missing

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A Lyons voltage regulator type CVR-360 Serial No 541371, Inventory No 11053, is missing from Chilbolton Observatory. Mr J A McGivney of Chilbolton asks that anyone with information as to the whereabouts of this unit, please contact him at Chilbolton, Tel:026-474-391, short code 005.

Peter MacNeice, R25 Ext 6405 wishes to recover his Sharp Scientific Calculator Type EL-515, Serial No: 36000736 which was removed from his office between 4-8 May. Would the borrower please return.

If you receive any recall notices AFTER you have returned an item, please come and enquire at the desk so that we can sort the problem out.

IF YOU HAVE ANY ENQUIRIES AT ALL, PLEASE DON'T HESITATE TO ASK US.

## Special Library Notice

For all of you who find our loans/recall system incomprehensible -

HERE'S HOW TO DO IT!!

We now keep a record of all loans (excluding periodicals\*) on a computer system, and to keep this system functioning properly we need your help.

- (1) By filling out loan cards correctly.
- (2) By returning borrowed items on time.
- (3) By responding to recall notices.

### 1a) REPORTS

The Report number is the one underlined in RED on the front cover, ALWAYS put this on the loan card when borrowing a report.

### b) BOOKS

The majority of the books in the library now have an ISBN number on a fluorescent label just inside the front cover on the first or second page, if you are unsure or you cannot find the label mentioned above please ask at the desk. WE DO NOT BITE!! This number is vital - without it we cannot record the loan on the computer, so please ALWAYS put this number on the loan card.

### c) PERIODICALS

Periodicals may still be borrowed as before. Please remember to put volume number, issue number and date, as well as the title.

- 2) If a return date is specified on a book which we have sent to you, this means that there is a waiting list for the book, so please return books promptly so that other readers are not kept waiting. If you wish to go back on the end of the waiting list to see the book again, then just put a little note inside.
- 3) A recall is automatically produced after an item has been on loan for approx. 3 months. If you receive a recall notice saying an item you have is overdue, and you wish to keep the item in your possession, just tick the box provided and return the recall notice. (Returning the item itself is not necessary). If the recall notice says the item is required by someone else, please return the item straight away because somebody else has requested to see it.

## Moving On



84RB 2620

Peter Dewar has always been happy working at the forefront of technology we were told by Bill Trowbridge at a recent farewell presentation to mark Peter's departure from RAL.

Somewhat fortuitous, as throughout his career, at the 'sharp end' is where Peter has always been. As applied mathematician, electronics engineer and mathematical modeller his distinguished career has had many facets. He has taught at an RAF Radio School, worked on guidance systems, designed the first portable industrial x-ray equipment with self-contained power supplies, researched in plasma physics at Culham, established an "applications" content in the developing Open University Mathematics faculty and become a Staff tutor.

He joined SERC when it began its "Engineering Initiative, and at RAL's Atlas Centre began to develop the Computer Aided Design system, as a lone voice putting together a micro-electronics team and setting up a community and in-house group which developed as a model of interactive Computing Facilities. His influence was also important in the formation of Special Interest Groups in electronic circuit designs.

When this work was integrated into Technology Divisions "Computing Aid for Engineers" programme Peter decided he wanted to do something outstanding and with his "Histogram Chip" containing 30,000 'gates' now virtually finished he has achieved this ambition.

After being presented with a cheque to enable him to indulge his hobby of orchid growing, Peter thanked everyone for the gift. "I am sorry to go, he said. "So far I have managed to produce a very checkered c.v., so I must keep it up. I have

enjoyed myself here and shall leave a large part of myself embedded in the Lab, but I feel now is the time for a little management experience. When I get my orchids I shall, in some way, name them after RAL. Thank you."

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## Cricket

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The RAL Cricket Club plays its matches on Weekday evenings. We play in the local "Downs League" and many "FRIENDLIES".

We also run an evening 6-a-side competition, "The Dave Craddock Cup",

Any person interested, is invited to turn up at our "net" (Ha! Ha!) practice on Tuesday evening at 17.30, out on the sportsfield. The "Downs League" is a good standard but for the "friendlies" just good old British spirit is all that is required. We will be hoping to regain the cup on sportsday this year as well.

All enquiries to R Newman Ext 5538  
N Myer Ext 5115

P.S. Both Hon. Secretary and Captain retire this year - any volunteers?

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## Football

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The Football Club runs a league and cup competition during the lunch time (7-a-side). You may have read in previous *Bulletins* some light hearted banter showing how seriously everything is taken. Players of all standards are welcome but you must join the RecSoc. or else you won't be able to use the cold showers with loose fittings.

We are always short of spectators despite free admission and we generally enter five or six teams on Sportsday (now that we've stopped playing on postage stamps).

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## Thanks

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Harry Paterson would like to thank all his friends and colleagues for their generous gifts and says 'cheerio' to all the friends he was unable to see personally before he retired.

## Outdoor Sportsday

The 1984 SERC Outdoor Sportsday will take place on Friday 6 July at the Civil Service Ground Birmingham. Please enter names for events with the appropriate organiser listed below.

Angling (Teams of 4)	P. Craske Ext 6273
Bowls (Triples / pairs)	Mrs M Shepherd Ext 5635
Cricket (six-a-side)	N Johnson Ext 6363
Croquet (pairs)	R Platon Ext 5161
Football (six-a-side)	R Newman Ext 5538/6352
Rounders (Team of 10, 3 male 7 female)	H Dorsett Ext 5580
100 Metres 3,000 Metres	N Whitehead Ext 6521
Tug of War (Team of 8 4 male, 4 female)	A Forster Ext 6363
Tennis (Men's double) (Mixed doubles)	B Maddison Ext 5427

Coaches leave RAL from the Main Gate at 8.45 a.m. Spectators are very welcome - please contact Ian Forster for coach bookings.

## Games Room Booking

The Games Room in R58 has a new Booking Secretary. Any requests for Bookings should go to Brian Maddison, Ext 5427.

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## Sales to Employees

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The sale of scrap metal and plastics will take place (subject to the usual conditions) on 8 and 22 June in the R40 scrap compound from 12 - 12.30hrs.

# Bulletin

Editor: Jean Banford  
Building R1  
Rutherford Appleton Laboratory  
Chilton, Didcot, Oxon OX11 0QX  
Abingdon (0235) 21900 ext 5484

Deadline for insertions:

# Bulletin Supplement

12 June 1984

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## INTERNAL Events

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HEP SEMINARS  
R61 CONF ROOM - 1100 hrs

13 June C Fraser/Oxford  
"A Skirmish with Baryon  
Number"

20 June HERA meeting

27 June J W F Valle/RAL  
"Supersymmetry with R Parity  
Breaking"

COMPUTING SEMINARS  
ATLAS CENTRE - 1515 hrs

12 June Nigel Bevan/NPL  
'Man-Machine Interface'

CONDENSED MATTER SEMINARS  
R3 CONF RM - 1330 hrs

19 June J B Goodenough/Oxford  
'Surprises in NiO  
Chemistry

M Ashford/Bristol  
'Laser Studies of Molecular  
Dissociation Dynamics

### Computing Seminar

These lectures will take place in  
the Atlas Centre Colloquium at  
3.15pm on Tuesday 12 June

"MICROTEXT and the Design  
of User Interfaces"

and

The Social Psychology of  
Computer Conversations"

by

Dianne Murray and Nigel Bevan  
National Physical Laboratory

The National Physical Laboratory has  
over a number of years developed a  
new computer language called  
MICROTEXT. MICROTEXT is an easy-to-  
use but powerful "Authorising System"  
designed on the basis that "SIMPLE  
THINGS SHOULD BE EASY TO DO". It  
enables people without programming  
experience to set up computer based  
interviews and instructional material,  
which can be integrated with external  
devices such as touch screens and  
video disc players.

Experience with MICROTEXT has been  
the basis for current research on  
user models of interaction with the  
computer. One approach is to base  
these on human conversations.  
Computer systems are conventionally  
designed purely on the basis of  
functional efficiency and overlook  
the social relationship between user  
and computer. Such a relationship  
can be crucial in establishing  
successful interaction. Cultural  
differences between human and  
computer conversations will be  
discussed and suggestions will be  
made on how to incorporate appropriate  
social conversational elements into  
a computer interface.

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## EXTERNAL Events

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PLASMA SCIENCE SEMINARS  
DEPT ENG SCI - OXFORD - 1615 hrs

14 June Prof B Coppi/MIT  
"Successes of Academic  
Experiments and Thinking in  
Fusion Research"

21 June Mr A A Howling/Oxford  
"Experiments in the Edge  
Region of a Tokamak (TOSCA)"

ELEM PART THEO SEMINARS  
NPD - OXFORD - 1430 hrs

15 June Dr N McDougall  
"Chiral Symmetry Breaking and  
the U(1) Problem"

THEO PHYS SEMINARS  
TPD - HARWELL - 1400 hrs

19 June Dr N Cowern/JET  
"Pre-equilibrium Effects in  
Heavy Ion Stopping"

26 June Prof John Vail/Manitoba  
"The Ion-size Effect in  
Colour Centre Calculations"