

Bulletin

of the Rutherford Appleton Laboratory

28 July 1986 No.7

Mobile Satellite Services

RAL's Role in Developing Future

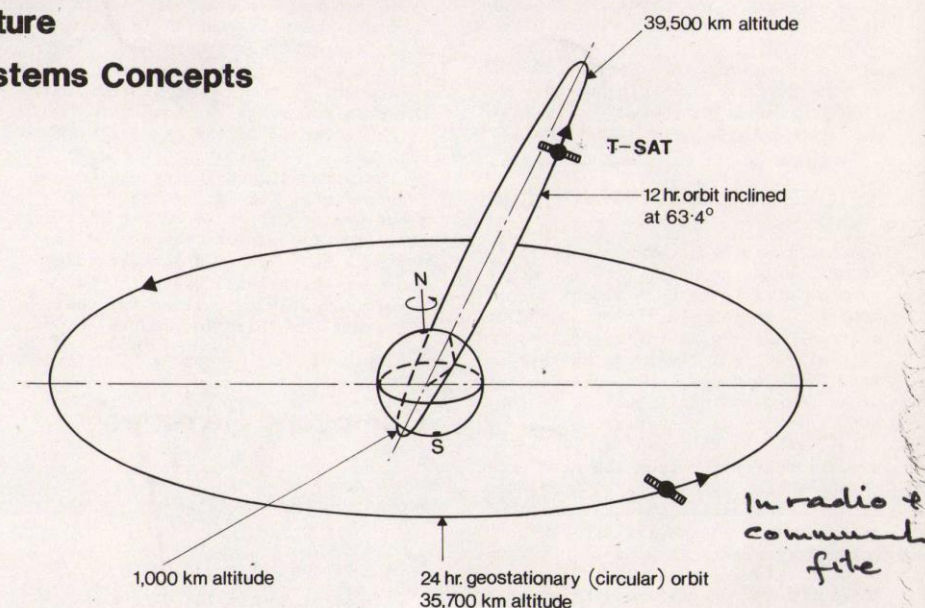
Satellite Communication Systems Concepts

Over the last 20 years satellite communications have revolutionised international communications. It seems difficult to believe that the first transatlantic transmission of a television picture occurred in 1962 as a 4 minute experiment and that worldwide toll quality international telephone connection via satellite is less than 20 years old. Now more than 100 satellites occupy geostationary orbit slots and provide services such as telephone connection, data transmission and television programme distribution to numerous earth stations.

Although early development in satellite systems concentrated on services to fixed earth stations, development in the 1980s has been concerned with mobile systems. INMARSAT now provides satellite communication services to 4000 ocean going ships. More recently the commercial interest in land mobile communications through satellites has stimulated no less than twelve commercial ventures to propose operating such a service for North America. A growing interest in satellite mobile services has occurred both in Japan and Europe where projects concerning land, maritime and aeronautical services are in progress. Truck fleet operators, business travellers, safety and security services, small aircraft and shipping activities, oil companies, etc, have all expressed a strong interest in such services.

Choice of Orbit for Mobile Services

The common feature of all these proposals is that of satellites operating in a geostationary orbit, where the satellite appears to stay stationary with respect to the Earth. This orbit is by far the most suitable for satellite communication to fixed earth stations. The earth station antenna can be accurately aligned to the satellite, both to increase the signal power and also to avoid interference from other satellites. However, when land mobile satellite services are considered, the use of the geostationary orbit is a poor compromise. As the elevation angle from Europe to a geostationary



satellite is characteristically less than 30 degrees, any two storey building to the south of the mobile will cause signal blockage. As the mobile takes up a random orientation, omnidirectional low gain antennas are proposed rather than expensive tracking systems. Thus considerably more power is required from the satellite to sustain a sufficient signal. Other problems arise from multiple reflections from buildings and signal absorption by tree foliage. To provide a commercial coverage service, the satellite needs an excess of expensive Radio Frequency (RF) power.

For some years RAL has coordinated a research programme, together with seven Universities (Manchester, Bradford, Loughborough, Surrey, Kings College, QMC London and Portsmouth Polytechnic) on novel aspects of future satellite systems. The Molniya orbit, used by the USSR for fixed services, provides a possible alternative for mobile services. Figure 1 shows it, in relationship to the geostationary orbit. Because the world is an oblate spheroid, inclined orbits precess around the line of apsides. However, at 63.2 degrees the various gravitational effects cancel to provide a stable orbit. A 12 hour orbit thus provides a configuration in which the apogees of the orbits are always positioned

Fig. 1. Relationship between Molniya and geostationary orbits.

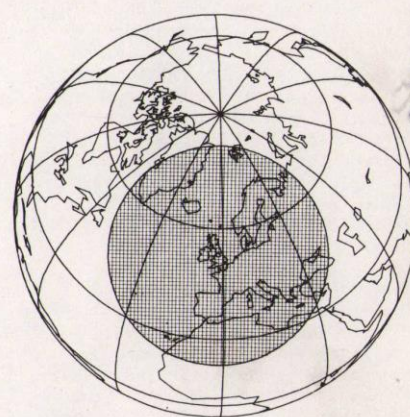


Fig. 2. Apogee view of the Earth from a 12-hour Molniya orbit. The shaded circle represents the proposed footprint from the satellite.

over the same two points of the Earth. Figure 2, which shows the view of the Earth from the apogee of this orbit, clearly demonstrates the coverage potential for moderate and polar latitudes. The satellite appears to

Mobile Satellite Systems

(cont'd from p1)

almost hover in this quasi overhead position for 8 of the 12 hours of the orbit. Three satellites in a constellation provide a 24 hour coverage for two regions of the Earth at moderate or polar latitudes, where at least one satellite would appear to be almost directly overhead all the time.

This unique feature of the Molniya orbit is the basis for the study of mobile applications. Not only does the use of this orbit provide a much better communication channel because of the excellent propagation characteristics and thus much lower power levels on the satellite, but it also allows the use of a zenith pointing, high gain, antenna on the mobile. Communications protocols such as Time Division Multiple Access (TDMA), similar to those used by fixed satellite systems, are also possible.

Innovative Technology

Another feature of current satellite communication technology, which might seem surprising in this era of the computer, is the almost total lack of any on-board processing associated with all present civil communication satellites and even those planned to be in operation until the end of the century. The architecture of current satellites has followed an evolutionary trend from the earlier communication system of the sixties, where the satellite channel resembled a linear analogue amplifier. The current satellite studies also include a serious investigation into the application of full demodulation of the signals to base band and on-board processing. The advantages of on-board processing can be realised, if novel approaches to the overall design of the communication system are adopted. Thus the up and down links of the system can be treated independently with a switching and re-formatting function performed at the satellite. The "telephone exchange in space" concept could thus be realised. Placing the complex parts of the system in the satellite also allows a less expensive earth station and potentially a better service at a reduction in the overall cost.

Monolithic microwave integrated circuits (MMIC) are also considered as a key technology for future satellites. All the present generation of satellites have their microwave sections assembled from subsystems, each of which has to be tested to rigorous qualification standards. The advantages of trying to design the RF receiver and transmitter sections on one chip are obvious. Success with the implementation of this approach could lead to a re-thinking on the RF architecture of future satellites. Even the largest current communication satellites have, perhaps 24-48 wide band channels and use relatively high power travelling wave tube amplifiers.

Overall mass and expense in testing prohibits any large increase in these numbers. However with an MMIC approach, the number of channels would not be constrained by these considerations as narrower bandwidth and thus lower power channels could be realised in much greater numbers. Thus a trend to multiple narrow bandwidth systems, incorporating perhaps hundreds of channels can be envisaged. The main benefit of this approach might be in simplification of the testing procedures and relaxation of the qualification standards. Systems constructed on these principles would have both graceful degradation qualities and considerable redundancy.

These novel concepts form the basis of the mobile payload associated with the T-SAT project - a complementary project in space technology which is again being coordinated through RAL. The current studies have involved refinement of the system design, and the construction at a breadboard level of key elements of the payload by the University participants. Although not yet an approved and funded project, it is hoped that the British National Space Centre will take up the challenge to allow UK engineers the chance to demonstrate and evaluate these novel concepts which could place the UK in a very favourable position for their commercial exploitation in the future.

J R Norbury

Computing Seminars

CODAS - The Control and Data Acquisition System of JET.

by

Dr Henri van der Baken

Colloquium, Atlas Centre

Tuesday 2 September

3.15 pm.

CODAS is based on a network of minicomputers (NORD-100s, NORD-500s) interfaced to the experiment and the operation team through CAMAC.

The hardware and software structure of the system will be presented together with some of the packages developed at JET. The role of the computers during operation will be described and some aspects of the software management will be addressed.

Christian Fellowship

Meetings of the Fellowship are held in the R2 Conference Room (top floor) at 12.30 pm on Thursdays. Visitors are most welcome.

- Aug. 7 Bible Study - John Campbell
- 14 Prayer Meeting - Ray Powell
- 22 Music & Praise - Steve Walters (Note:- Friday) & AERE CF
- 28 Holiday Thanksgiving (shared lunch) - Open.

Enquiries please to Margaret Summers Ext, 5617.

Library Notice

The following book was received in the Library on 6.6.86 and has already 'walked'!

'Digital Fundamentals' 3rd Ed. T L Floyd. Publisher - Merrill 1986.

If anyone knows of its whereabouts, please could they return it. Thanks.

Some Library users are ignoring the recall notices which are sent to them for items with waiting lists. Whilst we appreciate that you may be on leave or travelling on Laboratory business, it does cause considerable inconvenience to borrowers further down the waiting list who have to wait longer than necessary to see the items they want.

Would everyone please make sure that books are returned promptly to the Library. Persistent failure to do so will result in you being moved to the bottom of all waiting lists. If you will be out of the Laboratory for any length of time, please could you ensure that your books have been renewed or returned if necessary. Thank you.

The Librarian

Missing

The following items are the subject of loss reports. Would anyone having information as to their whereabouts, please contact the enquirer.

Hewlett Packard Calculator.

Type H41C No. V 012796

D J Stickland Ext. 6523

Desk Fan Ser. No. 2220 14/2259

Inv. No. R008018

Neil Cunliff. Ext. 6631

Levers-Rich Bulk Eraser

Inv. No. R005634

Garry Williams Ext. 6104

Fluke 73 Multimeter

Zippered Toolcase

Various hand tools

Gas Soldering Iron and bits.

A H Kershaw, Ext. 6352

Pendix Dosimeter No. 453

L West R2 or

ISIS Health Physics.

Paint Spray Gun.

Ser. No. RF96477

D Baker, Ext. 5335

Film Badge Notice

It is period 8 Colour strip RED.

Fast Neutron Issue resumed on 19 July for regular users.

Please be sure you are wearing the correct dosimeters.

Enquiries to Jenny Coates, Ext. 5430

RAL on Korean TV

News of the excellence and wide diversity of research undertaken at RAL brought this South Korean Television Unit unexpectedly dashing to Chilton on 25 June.

Arranged at 48 hrs notice, the visit enabled them to cram into a tightly scheduled tour of European Research Institutes and Universities an extra two days filming for a documentary "People at Work in Research" featuring the work of Nobel Laureates in science.

They left RAL delighted with both their reception and with the quality of filming that had been possible.

Pictured with the team are Robin Marshall (the tall one) and Jean Mills who bore the brunt of the organisation for the visit.



86RC 3358.

Alvey Conference 1986

Some 400 plus delegates descended on the Falmer campus of the University of Sussex for the second Alvey Conference held from 1-4 July. The first was held in Edinburgh last year. There was a good representation from RAL, and the Laboratory was also very much involved in organising the six IKBS and architecture stands in the associated exhibition.

With some 187 projects now underway in the Alvey programme, the conference is a useful way of bringing together those taking part to mull over successes and problems and to renew old acquaintances. This latter objective was well achieved at the various social occasions scattered through the conference programme.

The opening day, Tuesday, included plenary speeches from Information Technology Minister Geoffrey Pattie and Alvey Director Brian Oakley - a former SERC Secretary. The guest speaker at the conference dinner in the evening was the Parliamentary Under Secretary of State for Education and Science George Walden.

Geoffrey Pattie, stressed the collaborative nature of Alvey. "Whether in domestic or in European programmes, collaboration between firms, between firms and higher educational institutions or between countries is increasingly going to be the name of the competitive game", he said. This remark was made the day after Mr Pattie had chaired a ministerial meeting on the major European Eureka initiative which involves major industrial collaboration across European frontiers. He also announced that ICL had delivered, on schedule, the experimental transputer-based ALICE parallel processor which is to be a major part of the biggest Alvey project 'Flagship'.



Geoffrey Pattie, well involved.

86RC 3488.

Brian Oakley covered the detail of the Alvey project. Nearly all the funds had been committed and some 187 projects were now set up. When the funds were fully committed there would be around 200 projects.

In the present projects, Mr Oakley said, there were 53 Universities or university colleges taking part as well as some 11 polytechnics. Every university in the country was involved. There were academic partners involved in 85 per cent of the industrial projects and also 15 research establishments and non-profit making distributing bodies involved with Alvey. He paid particular tribute to RAL who along with the Royal Signals Research Establishment at Malvern, had provided much of the infrastructure support for the programme.

George Walden, DES minister responsible for the research councils, made a witty and provocative speech defending the present administration's education policy. This drew a certain amount of heckling from the academics present. He drew a parallel between the structure of the Alvey programme with its government-industrial-educational institute collaboration and the way the government saw education, especially higher education progressing.

Have You Seen This?

Stolen from RAL R25 bike shed on Tuesday 8 July (pm) - A red "mountain" bike. It is a very distinctive machine with 18 gear ratios, very wide handlebars, 2½" wide (fat) tyres. The manufacturers name "Overburys" appears on white on the down tube.

Any information gratefully received by Adrian O'Hea, Ext: 6530.

Classics for Pleasure 1986/1987 Season

These two series of concerts by the London Philharmonic Orchestra take place at the Royal Festival Hall. There are two separate series, each with the same programme performed on two separate Friday evenings one week apart. The concerts start in October and there is one programme per month (2 concerts) until April.

For clearer explanation, details of how to book, list of works to be performed soloists etc, please contact Julia Gilling, Ext: 6174.

RAL Golfers Win SERC Tournament

For the second year running the SERC golf day was held at the Burford Golf Club in the Cotswolds. It was RAL's turn to host the competition and all the arrangements for the day were organised by Roy Bell and Ken Louch. There was a splendid turn out with teams from all establishments. It was particularly pleasing to welcome RGO back after being absent for a few years.

In a truly lovely setting it was RAL 'A' team who won the day with a score of 295 points (being the best four scores out of six) with the runners up CO 'A' team with 258 points.

The individual prizes were won by Robin Walters (RAL 'A') who returned a gross score 5 shots over par to score 79 points for the two rounds. He won the best gross score trophy and Brian Rimmer (DL 'A') won the best nett score trophy. Best morning score Doug House, best afternoon score J Wall RGO.

Dr Geoff Manning, who presented the prizes, made an amusing speech with quips about why RAL kept winning and also cast aspersions on Doug House's character for winning the team prize, the morning prize and some money off him.

The Burford Club made us very welcome and the whole day was enjoyed by all who came to take part. Thanks are warmly given to all the organisers and helpers.

A splendid gesture was made by RGO to host next year's event, which received loud applause.

THE DON FALCONER TROPHY

Mrs Falconer asked the RAL Golf Section to use the money collected in memory of Don to provide a trophy to be presented to the person who makes the best contribution to RAL golf each year. The Committee decided to present it to the person who produced the best results at the SERC golf day. The first winner of this lovely trophy is Robin Walters, pictured above holding the Cup and receiving the congratulations of Geoff Manning.

Sunday Football

We have now registered a team from the Lab in the Upper Thames Valley League, playing on Sunday mornings.

Any players interested, please contact K Chapman or M Dew, Ext. 5505 or K Lewis, Ext. 6713.

Prompt replies would be appreciated, for registration.



86RC 3689

IBM and CRAY Get Their Chips

On Saturday 5 July a Rutherford Appleton angling team recorded their best ever win when, on the AERE lake at Sutton Courtenay, they won the FISSION CUP.

This was the first time the event had taken place and it will now be an annual event.

The competition was fished between teams from IBM COMPUTERS, CRAY RESEARCH, HARWELL and RAL. The angling took place from 7 until 12 o'clock in the morning with liquid refreshment supplied during the match by a band of secretaries from IBM and CRAY. After the match a social gathering with barbeque, by the side of the lake, provided the perfect end to a perfect day - especially for the RAL team.

RESULTS.

1st	RAL	41 lbs
2nd	CRAY	28 lbs
3rd	HARWELL	16½ lbs
4th	IBM	16 lbs

The RAL team was, Peter Craske, Dennis Day, Malcolm Davies, Mark Jefferies Phil Hibberd and Keith Sandlands.

There were also 2 other prizes for:-

BEST CATCH Mark Jefferies- 14 lbs.

BEST FISH Kim Rockall (CRAY)
4lb 1oz Tench.

P Craske



Well well, what have we here? The triumphant anglers show off their cup. Pictured from left to right: Malcolm Davies, Dennis Day, Phil Hibberd (with cup), Keith Sandlands, Peter Craske and Mark Jefferies.

86RC 3806

Bulletin

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