

SCIENCE AND ENGINEERING RESEARCH COUNCIL  
RUTHERFORD APPLETON LABORATORY

INFORMATICS DIVISION

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Software Engineering Group Report  
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## 1. INTRODUCTION

The RAL/CD Software Engineering Group came into existence on 1st August 1983 when Dr Witty was appointed to a new post, that of Head of Software Engineering.

The appointment arose from the Lab's growing role in Information Technology research and R&D Management and in particular the Alvey Programme.

The rate of change in the technology of IT is mirrored by the rate of change in the organisations serving the R&D community. Therefore it is felt to be useful to begin the report by reviewing some of these changes.

## 2. HISTORY

The origins of the Software Engineering Group stem from 1977 when CD was asked to coordinate the DCS Programme. FRAH, RWW and DAD have provided the DCS Coordination and RWW and DAD have run a small associated support team which has served to help the university based researchers and introduce such things as the Cambridge Ring, UNIX and the PERQ into the CD.

The DCS Programme is charged with transferring technology into UK industry and became the nucleus for the collaborative project with ICL on PERQ/UNIX. The DCS Section became the Distributed Interactive Computing Section.

In 1981 RWW handed coordination of DCS to DAD and helped launch a new IT programme, the Software Technology Initiative. This stemmed from the Roberts Report.

The STI programme invented an infrastructure policy called the 'Common Base'; this grew from the DCS common equipment policy. The Common Base Policy was centred around PERQ/UNIX and proved sufficiently attractive to scientists generally that it became a council wide policy. The associated project team grew too and in November 1982 devolved from DIC section to become the Common Base Programme, under Dr Robinson, with group status.

In January 1982 RWW became involved in the embryonic phase of what we now call the Alvey Programme. RWW was seconded to the Alvey Committee during the summer of 1982 to help prepare the Alvey Report. Simultaneously the SERC's CCSC was preparing to launch a new SPP in the IKBS area. WPS became involved in the preparatory work. The SERC IKBS initiative was merged with Alvey during 1982. Again in parallel the need to coordinate SERC's MMI activities led to IDB becoming part time MMI Coordinator for SERC and a member of the Alvey Committee's MMI working party. To reflect this growing breadth of interest the DIC section became the Informatics Coordination Group.

The Alvey Committee submitted its report to the Government in the autumn of 1982. Around Easter 1983 the Government announced its support for the Alvey Programme, albeit with the 100% funding capability reduced to 50% for industrial work.

Brian Oakley was appointed Alvey Director on 1st June 1983. On 15th August David Thomas was appointed SERC Information Technology Director, the SERC representative on the Alvey Board and the Alvey IKBS Director. DBT's appointment signalled the change from IT being funded in the universities via the traditional SERC committee hierarchy to a new Directorate structure.

The RAL role in the new SERC IT Directorate and the Alvey Directorate is, in general, still in the process of being defined. In the Software Engineering area the current situation is that from 1st August 1983 a new group, headed by RWW, came into being. Its remit is to

- a. support the SERC and Alvey SE programmes
- b. carry out SE research.

The remit is reflected by RWW's split of working 50% for the Alvey Directorate and 50% for the RAL/ID research group.

The DCS Programme will continue towards its close in September 1984 much as it always has done; it will continue to be run by the DCS Panel reporting ultimately to the Information Engineering Committee. The RAL based DCS Coordination and support activity will remain under DAD in the SE Group.

## 2.1 Genealogy of the SE Group

1. DCS
2. DCS, PERQ
3. DCS, PERQ, STI
4. DCS, PERQ becomes CBP, STI
5. DCS, STI, MMI, IKBS
6. DCS, STI becomes Alvey, MMI becomes defunct, IKBS
7. DCS, Alvey SE, SE R&D, IKBS.
8. DCS, Alvey SE, SE R&D, IKBS moves to CO and Systems Development.
9. CD splits into CCD and ID; SEG goes into ID.

## 3. STAFF

### 3.1 Changes

1. The IKBS team of Tony Cox and Bill Sharpe left SEG to form the nucleus of ID's IKBS group.
2. Dr Mike Russell joined SEG on 1 July 1984 to head the Alvey SE Coordination section.

3. An advert for SO/HSO Coordination and Support staff resulted in 8 offers being made. No replies have been received yet.
4. Jeremy Dick has been awarded the St Cross Atlas Research Fellowship. He will be associated with SEG from 1 October 1984. Jeremy is a 'verification' expert.
5. Although not SERC staff the following people have been seconded to the Alvey SE Management team in Millbank Tower:
  - a. Dr Howard Nicholls (RSRE)
  - b. Mr Tony Dignan (Ferranti)
  - c. Mr Dan Simpson (Sheffield Poly - from 1.9.84)

### 3.2 Other Items

1. SEG's secretarial position was reviewed as part of the Administration Staff Review. This resulted in a recommendation that our effort be increased to one PS post plus one part-time S/T. Mrs Valentine was promoted to fill the PS post.
2. Mr Gibson and Mr Kinroy attended the SERC Summer School on 'Good Practices in the Production and Testing of Software'. This was successful.
3. Mr Gibson attended an Induction Course at RGO in January 1984.
4. Mr Gibson attended the course on Cambridge Ring technology at Kent University in March 1984.

### 4. ALVEY SOFTWARE ENGINEERING PROGRAMME MANAGEMENT

RWW has been working almost full time for Alvey. The major tasks have been

1. Helping the new Alvey SE Director, David Talbot, get up to speed.
2. Preparing and implementing a national SE strategy.
3. Visiting industrial, GRE and University people.
4. Liaising with SERC IT Directorate.

David Talbot is now up to speed as Alvey SE Director and is providing energetic and skillful leadership in this high profile, national role.

Alvey SE Strategy Overview and detailed SE Strategy documents have been produced, published, and circulated widely. They have been formally reviewed by various committees and informally judged by the community. Both the committees and the community have received the strategy with warmth and enthusiasm.

Two advisory panels have been set up; they are the Formal Methods AP and the Reliability and Metrics AP. Both have produced Overview and Detailed

Strategies which have been published for review. These strategies are refinements of the Overall SE Strategy. The Advisory Panels form the nuclei of Alvey Clubs.

A major activity for D E Talbot and RWW has been travelling around explaining the strategy to the community and receiving feedback which will be incorporated into the next iteration of the strategy (4Q84).

The continuous travelling and meetings have been aimed at

- (a) explaining the strategy and receiving feedback
- (b) learning what is going on in industry and academe
- (c) helping to form consortia to bid for Alvey projects
- (d) refining Alvey proposals with consortia
- (e) judging, rejecting and awarding Alvey contracts.

The biggest Alvey SE Contract to date is called the Aspect project. Aspect is lead by SDL with ICL, GEC, MARI, York University and Newcastle University. Aspect will attempt to build a distributed host, distributed target IPSE (Integrated Project Support Environment) using the Newcastle Connection, UNIX, VAX, PERQ and GEC Series 63. Aspect will cost over £3M.

Other countries have been launching IT programmes recently. DET and RWW have, between them, had liaison meetings with DARPA (USA), DoD (USA), ADI (France) and Esprit (EEC, Brussels). The relationship with Esprit is special in that Alvey acts as the UK agent for Esprit; the Esprit and Alvey programmes are attempting to act in a complementary mode.

Esprit's IES (a European network) and Alveynet are being connected; indeed Alveynet will be the UK part of IES. On a smaller scale the Alvey SE Infrastructure policy has been drafted; its first tangible results can be seen in the IKBS/SE joint action to provide VAX and Series 63 MUMs to the academic parts of the respective communities. This work has been subcontracted by Alvey to RAL/ID and recently been consolidated into the Alvey Infrastructure section of ID under Eric Thomas.

Some highlights from RWW's diary are:

- Nov 83: public launch of Alvey SE side of academic MUM infrastructure.
- Dec 83: IBM Vice President, John Jackson, briefs Alvey Director on IBM's formal methods education programme.
- Jan 84: RWW gives major talk at Ada UK conference
- Feb 84: RWW chairs session at Software Processes conference.
- Mar 84: RWW gives major public presentation on Alvey at 7th ICSE, Florida.
- Apr 84: Alvey SE Workshop on Toolpack project, held at RAL, in association with NAG.

May 84: DET and RWW visit French opposite numbers.

June 84: Major Alvey presentation in Scotland.

: Visit to Esprit opposite numbers.

: Harlan Mills, IBM, gives workshop on IBM formal methods programme.

## 5. DCS

During this period coordination of the DCS Programme has continued. The programme terminates in September 1984 and organisation of the final conference is the major activity. Two books are being published to mark the end of the programme - a set of five tutorials on the major themes in the programme (Academic Press) and the conference proceedings themselves (Peter Peregrinus Ltd). David Duce and Gill Jones are editors of both. The AP book was actually typeset by us - an activity which consumed the whole of April; Alan Kinroy, Duncan Gibson and Elizabeth Fielding produced the 97 diagrams in the book with the UNIX pic software.

At the beginning of the period the DCS Annual Report was typeset, reproduced by Swindon and dispatched to some 500 members of the community throughout the world.

The DCS and SE finance papers have been updated, which is not an easy task as the system is such that it is almost impossible to trace items with no requisition numbers. Production of these papers has been enhanced by a macro written by Chris Webb which does all the addition in the paper (a time-consuming job that used to be done by 'hand'). Finance papers are typeset using troff.

A portfolio of DCS grants is updated regularly, with the grants being categorised into one of eight different headings. An account of spend to date is kept on all 'live' grants. The paper is tabled at all DCS panel meetings.

A first draft of the Software Technology Final Report was compiled but has not been published.

The latter part of the period was spent compiling, editing and typesetting a book of Tutorial notes for the forthcoming DCS Tutorial/Conference in September, the book is being published by Academic Press. A book of Conference Notes will also be published in September by Peter Peregrinus.

During the period of this report G Jones has also taken over the task of adding users to the DCS GEC mail machine. This is being augmented by the Alvey 'industrial' mail machine sited at NPL.

During February/March the Alvey Directorate established a steering group for computer architecture. For those two months David Duce was secretary of the Steering Group and the two subgroups subsequently formed. This also was a major time consuming activity. This has now lapsed due to pressure of other commitments.

David Duce has been Vice Chairman of the Eurographics Association since January 1984. This also involves considerable work in connection with the Eurographics conferences. He was secretary of the UK Chapter of EG until April 1984, when again pressure of other activities necessitated resignation. He continues to be co-chief editor of the EG journal, and has produced two issues during this period.

Also during this period a research grant application was made to the Alvey Directorate with Elizabeth Fielding for a research project on Formal Specification of Graphics Software (GKS). Informal notification of an award has been received, though the formal announcement letter is still awaited (6 months later!). It has been possible to do some preparatory work on the project culminating in a joint paper presented at the ISO TCG7/SC5/WG2 (Computer Graphics) meeting in France in June 1984.

David Duce has also continued as secretary of the BSI Computer Graphics Panel - a non-onerous task - only one set of minutes per month!

## 6. RESEARCH AND DEVELOPMENT

From November to February Liz Fielding and Duncan Gibson were involved in organising demonstrations for Tony Hoare's Royal Society Discussion Meeting on 'Mathematical Logic and Programming Languages'. The preparations took a large amount of effort and also required support from Telecomms Section and OA/UNIX group. These efforts were rewarded by everything going smoothly during the meeting in mid-February.

By November t.i.troff had been installed on the 11/70 (by Liz Fielding) and on the VAX 750 (by Alan Kinroy). From this stage to June members of the group were occupied individually as detailed below.

Chris Wadsworth has continued and is now winding up the development of Cambridge Ring software for the PERQ, for the Common Base Project. He has also been involved in an initiative to produce a BSI (and eventual ISO) standard for Cambridge Ring and has acted as expert advisor for miscellaneous ring activities, problems and enquiries.

### Liz Fielding

Once the Royal Society Meeting was over at the end of February apart from management, involvement in the following:

- (1) A paper on 'Implications for troff of the FR80 Replacements' was produced with David Duce after a meeting of everyone concerned with troff.
- (2) A t.i.troff driver for the IBM 4250 has been written and 'hand-checked'. It needs to be tested properly once font width tables are constructed. Further talks on providing this on UTS are going on with Chris Osland and Francis Yeung. There are also outstanding problems on missing characters in the DCF font library etc.

- (3) In February, approval was given for an Alvey-funded project on 'Formal Specification and GKS' to be jointly undertaken by David Duce and Liz Fielding. This work has involved several trips to Manchester University where Professor C Jones, who is a consultant to the project, also has a student interested in the area. Work has progressed to the point where a draft joint paper was presented by Dave Duce at the ISO TC97/SC5/WG2 Specification and Certification subgroup meeting in Benodet in June.

Alan Kinroy

- (1) Alan modified the 'DISPLAY' program used for previewing V7 troff output on the PERQ under PNX so that it would also accept t.i.troff output. He made similar modifications to 'FR', the program which generates FR80 orders from troff output. In addition to generating a more general form of ASCII output rather than binary output targetted to the CAT phototypesetter, t.i.troff has extensions which allow for the typesetting of graphical objects. Some time was spent on implementing graphical algorithms to draw objects such as circles, arcs etc using line segments, for incorporation into both FR and DISPLAY. A study of the performance of DISPLAY on the PERQ is currently being completed and some changes are being made to this program to help speed it up.
- (2) He spent some time fixing bugs in the 'ideal' documentation.
- (3) Alan has installed on the VAX a version of TREE META that has been worked on by Chris Crampton of Common Base Group. This involved discussions with Tony Williams and Chris Crampton and some iterations as further changes were made by both Chris and Alan for better adherence to the PASCAL standard. Alan is currently looking at some possible extensions to the resulting version of TREE META, as well as bringing the documentation up to date.
- (4) Alan has been investigating the feasibility of obtaining or writing a software emulator for the IBM 3270 protocol (to support PROFS) to run on a portable microcomputer. A software supplier of an existing package is being looked at as a promising solution.

Duncan Gibson

- (1) Duncan added final modifications to the 'dcat' driver. This is a filter which converts t.i.troff output to the form of V7 troff output. The version supplied with the t.i.troff release did not work. Having done this he was able to test the newly-installed t.i.troff by generating output from user documentation and previewing it with utilities developed for V7 troff.
- (2) Duncan made a good job of typesetting all the handout material for the demonstrations at the Royal Society meeting on the FR80 and also typeset a paper for David Duce early in 1984.
- (3) Duncan has installed a version of GKS in 'C' on the VAX. This was obtained from Amsterdam and is more complete than a Sandia version with which he began. It is not however complete, and has only been installed for interest and evaluation. He spent some time trying it out and altering test programs for the Tektronix.



- (4) In March Duncan started work on an interpreter to convert GKS metafile output into t.i.troff pre-processor input. PIC was chosen as the target pre-processor and this work is progressing well.
- (5) Duncan attended an Induction Course at RGO Herstmonceux in January and a conference on Cambridge Ring technology at the University of Kent, in March. The latter was for background information for when he will have to mount the Newcastle Connection on development machines for evaluation.

Both Duncan and Alan put an enormous amount of good effort into typesetting the great majority of the 90-odd diagrams to appear in the DCS tutorial book. The DISPLAY program proved itself to be indispensable for this work.

Alan and Duncan both attended the SERC Summer School at Cosener's House, entitled 'Good Practices in the Production and Testing of Software' and found it a worthwhile experience.

#### Chris Wadsworth

- (1) An implementation of the Cambridge Ring Basic Block Protocol for the PERQ has been completed and a pre-release is now being distributed to selected sites for assessment and evaluation. Continuing difficulties have been experienced in accessing the ring via its IEEE 488 interface on the PERQ, caused by remaining bugs and deficiencies in ICL's firmware and software. These have been fully documented and discussed with ICL, but ICL's loss of expertise in the relevant areas (following the move of PERQ system development from Dalkeith to Kidsgrove) had hindered their ability to resolve the problems in the short term. Once the problems are resolved by ICL, upgrading ring software entails only minor one-line changes, but until then the pre-release is capable of being used only in a restricted fashion.
- (2) Chris has provided technical advice to BSI Working Group 1 of OIS/6 for their work to align Cambridge Ring standards with those now emerging internationally for other local network technologies (Ethernet, token ring, token bus). He acted as co-editor for the final draft of the proposed BSI standard for ring protocols. A talk on these standards developments was given to a Cambridge Ring Workshop at the University of Kent in April.
- (3) Maintenance and distribution of PDP11 UNIX ring software to DCS and other SERC investigators has also continued.
- (4) Chris is now preparing for the transition from involvement with Cambridge Rings to software engineering R&D and will be going to Japan shortly to investigate the IOTA program specification and verification system for the UK academic community.

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# A P P E N D I X

## KEY TO ABBREVIATIONS

RWW	-	Dr R W Witty
DAD	-	Dr D A Duce
FRAH	-	Professor F R A Hopgood
DBT	-	Dr D B Thomas
DET	-	Mr D E Talbot
IT	-	Information Technology
DCS	-	Distributed Computing Systems Programme
STI	-	Software Technology Initiative
CCSC	-	Computing & Communications Subcommittee
SPP	-	Specially Promoted Programme
IKBS	-	Intelligent Knowledge Based Systems
MMI	-	Man Machine Interface
SE	-	Software Engineering
GRE	-	Government Research Establishment
CD	-	RAL Computing Division
ID	-	RAL Informatics Division
CCD	-	RAL Central Computing Division
SEG	-	RAL/ID Software Engineering Group