

SCIENCE AND ENGINEERING RESEARCH COUNCIL
RUTHERFORD APPLETON LABORATORY

COMPUTING DIVISION

D I S T R I B U T E D C O M P U T I N G N O T E 6 2 8

PANEL MEETINGS

issued by
Miss G P Jones

Notes on a Panel Meeting held o 29 April 1982
at the Linnean Society

21 May 1982

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 DCS Meetings/Notes file

PRESENT: Prof R Needham (Chairman) B Brinkman
 Prof R L Grimsdale K Dixon
 Dr I Wand M Wright (DoI) am only
 R Milner J Monniot (Secretary)
 R Newey T Hinde
 B Holloway Mrs C Porter
 Dr D A Duce (Academic Co-ordinator)
 F Chambers (Industrial Co-ordinator)
 Miss G P Jones (Technical Secretary)

1. ATTENDANCE

An apology was received from Mr Portman.

2. MINUTES

The minutes were accepted as a correct record subject to the following amendment: Minute 5 section viii should read case not made that PERQ wanted for anything....

3. MATTERS ARISING

The Secretary informed the Panel of the outcome of some of the grants tabled at the last meeting for comment.

Professor Hoare's application to the Co-operative Grants Committee to use Pascal-plus in the design simulation of distributed systems for process control, was given an alpha plus recommendation.

Professor Healey's application to the Co-operative Grants Committee to design and construct a propotype for a new LAN using optical fibres was rejected.

Professor Grimsdale's application to the Co-operative Grants Committee to investigate the design and properties of high performance broad band local area networks was awarded to the value of £104K.

The application from Mr Hutchinson and Mr Shepherd to produce low-cost X25 ring interfaces was awarded 10K by the Co-operative Grants Committee.

4. CHAIRMAN'S REPORT

The Chairman reported that the visit to Dr Darlington had taken place and a favourable report was given to the Computing and Communications Sub-Committee at their last meeting. Consequently it was funded except for the proposal to get custom chips manufactured. A small deduction was made due to the fact that the cost of RAM chips had dropped since the application was made.

One grant from the last meeting was deferred because of lack of funds. This was the application from Professor Randell for an RA to survey German sites of relevance to the DCS Programme. It was rated alpha 2 and required funding of approximately 1.5K. The application would be reconsidered at this meeting. The Chairman recommended the Panel to support it as the monies involved were small.

5. ACADEMIC CO-ORDINATOR'S REPORT

Dr Duce invited the Panel to send a letter of congratulations to Professor Hoare on his recent election to Fellowship of Royal Society, this was agreed by all.

The Logica Ring equipment allocated by the Panel has now been installed and is operational.

The Academic Co-ordinator then reported that the Workshop on Logic Programming held at Imperial College in February had been very successful. A meeting was held in Loughborough, in April, of the Closely Coupled Systems Interest Group. The programme for this meeting has three themes:

- (a) numerical algorithms for parallel architectures
- (b) programming languages/methodology for distributed systems
- (c) reliability of distributed systems.

It was reported that there was a strong feeling that groups other than those traditionally interested in closely coupled systems could be profitably involved in discussion of topics and so the Academic Co-ordinator was asked to consider this view when drafting the 1982/83 Workshop programme. There will be a paper on the subject for the Panel's policy meeting in July.

Dr Duce informed the Panel that Professor Paker, from the Polytechnic of Central London, is organising an International Seminar on Control and Synchronisation in Distributed Computing Systems, to be held at PCL in September. The seminar would be run as a joint PCL-INRIA activity. The INRIA side of the seminar has been arranged. Professor Paker has submitted a visiting Fellowship Application to the Panel to

fund an eminent USA Computer Scientist to lecture at the Seminar. In addition Professor Paker would like the Panel to contribute £500 towards the running of the Seminar. Dr Duce invited the Panel to consider the requests.

The Secretary stated that there would be enough money in the DCS budget to fund the request. The Panel thought the fees for the Seminar to be high at approximately £250 a head. The Chairman thought that the general feeling was that the Panel would like to help, but with the facts put before them there really was nothing they could do. An idea was perhaps to give more than the £500 and have free places for DCS members. The visiting Fellowship/Application would be tabled as a research grant.

At the end of the report Dr Wand stated that York recently had problems with the installation of ring boards. Logica was not prepared to install them as it was not in the contract. Eventually York installed them but they were worried about the implications if something went wrong. Dr Duce stressed that he tried long and hard to get Logica to install ring equipment but failed to do so. The Chairman thought project responsibility should lie with the SERC and added he thought it would be a point to note for the future.

6. INDUSTRIAL CO-ORDINATOR'S REPORT

Mr Chambers reported that he now feels confident about explaining DCS projects to people. He said that the Applications Conference was taking shape and due to take place on 18 & 19 November 1982. Funding can come from the DCS budget, it would cost approximately £2K. The Panel approved this amount. Mr Chambers then added that due to the recommendations of the NCC the fee for the conference would be higher than discussed at the last Panel meeting, perhaps £40-£50. The programme probably would be 12 papers over 2 days but he stated that nothing was finalised yet. Professor Grimsdale suggested a review of the DCS Programme also. The Chairman thought it a good idea but time to fit such a review in was short but the idea should be considered. The Industrial Co-ordinator then went on to talk briefly about industrial exploitation in the DCS Programme. He stated that arrangements have been made to distribute Pascal-Plus. Ideas implemented by Keele have been taken up by others. The Manchester Dataflow group have been approached by one or two industrial parties. It was stated that the Panel would like to see approaches from UK industries.

7. RESEARCH PROPOSALS

Mr Monniot advised the Panel that recommendations should be classified as follows:

- alpha 1 - funding essential
- alpha 2 - funding highly desirable
- alpha 3 - funding desirable

and then ranked in priority order.

Dr D A Turner

The purpose of this application is to implement by custom microprogramming a 32 bit CPU, a combinator reduction machine performing 100,000 reductions per second and to build on this a complete operating system written entirely in an application language.

Mr Milner the spokesman for the application reported to the Panel he thought that within a year this machine could be very fast. Dr Turner's expertise should not be doubted, this project would be valuable to the DCS Programme.

Doubts were expressed about the distributed aspects of the application. Mr Milner pointed out that the application was best done on a distributed machine but not in a distributed way. Dr Wand felt that the proposal involved an awful lot of work to be done within a year. The Chairman felt that by funding the application we would be buying knowledge of such a design and therefore he suggested a rating of alpha 1, the Panel agreed.

Dr K A Bennett

The main research objective of this proposal is to study, design, and implement on enhanced, distributed, Unix-based filestore for heterogeneous networks, addressing in particular the problems of data reliability and availability, performance and transparency. Using results from current work to investigate the homogeneous case first using PERQ/UNIX workstations, subsequently incorporating systems of differing filestore architecture.

Mr Newey thought the reserach would be similar to that being done at Newcastle and QMC. He felt the case for support did not make clear what the group intended to do. On the other hand Dr Wand thought it well written and carefully thought out. On more careful reading he thought the work overlapped with York in the filestore design aspects. Dr Wand commented that the work seemed to concentrate on the UNIX end of the filestore and in one or two cases facilities already exist. The Chairman thought the case for support lacked references. Dr Duce added that the Keele group had no real UNIX guru but the application was in sympathy with the common base policy. Professor Needham advised the Panel that the consequences on the group would not be good if this application was rejected. He suggested a reduced 'survival' award of funding staff for one year and a request to the applicant to resubmit the application. The 'survival' award was rated alpha 1.

Prof G D Cain and R C Morling

The aim of this project is to incorporate rings and buses into MININET and the study of Network Level protocols. The choices of Architecture for a very high speed packet switching mode would be examined and prototype hardware produced. Network management functions, high-level service specifications and aspects of internetworking would also be explored.

Mr Holloway commented on the proposal, he suggested that they would be covering a lot of work in two years and wondered what the benefits for the project would be. He doubted the existing staff's ability to carry out the work. The Chairman, as a spokesman, thought that the group were trying to find the means of archieving special architectures and aiming for something different. He thought the group could incorporate a ring or Ethernet in the design. He added, the group were hardware orientated, they were practical people and he was in favour of the projects. Mr Chambers agreed with the Chairman that the group were hardware orientated and added that the proposal looked as if it would have an industrial application, and he would like to see the Control and Instrumentation (C&I) Panel informed of the project. Dr Duce informed the Panel that the robotics community has shown an interest in the project and they have been introduced to the applicants. Professor Grimsdale also commented that it would be desirable for HEP people to be informed. Before the next Computing and Communications Sub-Committee comments will be sought on the project from the Co-ordinator of the C&I SPP, and Professor Cain will be asked to comment on discussions with potential MININET users. Rated alpha 2.

Dr Ibett et al

The objectives of this proposed research are to design, construct, and evaluate a high performance local area Modula computer network capable of expansion from a single node to a campus-wide configuration.

Mr Holloway, spokesman for the project, did not see the benefits to the DCS community. Mr Dixon commented that the proposal seemed to want to implement the group's own campus requirements. The Chairman thought there was almost nothing on high level systems and the proposal rather outdated. The Panel decided to reject the application.

Dr M Sloman & Dr J Kramer

This proposal is for funds to provide an integrated set of techniques and tools for constructing and managing a large Distributed Control System. Consisting of a network architecture, a software methodology, a distributed operating system, a communications system and a management system.

As a spokesman, Dr Wand reported that he was not over impressed with the previous grant, however, this seemed more impressive. He explained to the Panel that this was a Co-operative grant with the National Coal Board. He commented that the applicants had an ambitious programme before them, the equipment would be expensive. The worrying aspect was that they proposed to invent another language instead of using existing DCS compilers such as Pascal Plus.

The second spokesman, Mr Newey, was concerned with the size of the projects as were other members of the Panel. Dr Duce informed the Panel that Imperial College had had a contract from the Coal Board for the past three years. Dr Kramer has a grant with Mr Cunningham doing related work, this project seemed to be a coming together of talents.

Questions were asked by the Panel about the CONIC language that the investigators intend to use, plus the number of RA's required. The Chairman thought the situation should be clearer. More questions arose about who should fund the project (DCS or the Co-operative Grants Committee) and the amount of money requested. The Industrial Co-ordinator suggested that the application would have been rejected by the Co-operative Grants Committee on three counts:

1. Specification and validation aspects brought out but nature of industrial application undefined.
2. Low quantity of technical output.
3. Lack of evidence in the advance of the 'State of the Art'.

It was decided in view of these questions, the Academic Co-ordinator plus representatives from the Panel should visit the project before the next C&CCSC meeting to clarify the unanswered questions and to give the project an alpha rating (or decide to reject).

Prof P T Kirstein

The grant would provide the basic infrastructure to support the central facilities used in the Computer Network research activity at UCL allowing other research projects to make use of facilities on two UNIX PDP11 computers.

Dr Wand pointed out that the project applications by Martin, Higginson and Wally (see below) would use the facilities of this Grant Application. Mr Holloway added that he would have preferred a shorter timespan for the project than the proposed 4 years. The Panel as a whole thought the grant application 'too thick' with not enough superstructure. The application does not say anything. The feeling of the Panel was to reject the application and 'top up' any of the other UCL grant applications where necessary if successful.

N Martin

The proposal of this project is for a two year grant to continue research in the area of linking using the Cambridge Ring, aiming to provide a user-transparent method to interconnect UNIX or UNIX-like systems using a high-speed communications network.

Dr Wand a spokesman for the application said Mr Martin was a competent man, but he objected to the 'UNIX hacking' of the project. Dr Wand added that results that would be obtained from the project already exist and the approach was low-level.

The second spokesman, Mr Newey, reported that the work would overlap with work already being done and nothing would be achieved by the project.

On these grounds the application was rejected.

Mr P L Higginson

The proposed application would study the protocols required for the New Digital Network Services (ISDN) for mail exchange and for multi-media data transfer (text, graphics, facsimile and voice). Experiments would also be carried out on interfaces to Teletex, the Cambridge Ring, and a long term file store. Protocol studies would be based on the ISO/OSI model and on CCITT Teletex recommendations.

The Chairman, as spokesman for the project was in two minds:

- (a) That the proposal was not very advanced.
- (b) A proposal that UCL are very experienced at
on reconsidering he thought the proposal worth supporting.

Mr Holloway, the second spokesman for the proposal, thought it not innovative or pure research, but a useful and needed project. Dr Wand added that he would support the proposal as Mr Higginson is very knowledgeable in this field. The Panel decided to rate the proposal alpha 1.

Dr D Walley

This project would involve the analysis of the Cambridge Ring operating with various configurations and protocols in order to produce a simulation package for a full network.

Mr Holloway, as a spokesman, thought the proposal well presented. Mr Brinkman wondered why the proposal involved simulation when there was a system already there. But he added that the paper was well put together. The Chairman added that although he did not believe in simulation he thought there was a case for it here.

Dr Wand asked how it compared with the Mitrani project at Newcastle University. Dr Duce replied that although work at UCL was valuable because of their experience in the field, UCL should be aware of work in Newcastle. The Chairman added that the Mitrani project was aimed at a lower-level than the proposal from Mr Walley. The Panel rated the application alpha 2.

Dr D G Smith

The proposal of this project is to investigate methods of controlling the behaviour of processor based systems under overload. An algorithm will be studied which observes the system and controls the degradation of service as the loading increases.

Mr Holloway commented that the majority of the money requested was used as a salary for Dr Smith plus a small amount for travel. The Chairman proposed funding at a rate of alpha 1, the Panel agreed.

Dr D G Smith

This second application by Dr Smith proposed a study of recent significant developments in the theory of networks of queues and their extension to the solution to some problems in communication networks and systems. The spokesman for the project, Mr Holloway, reported that work in the field had already been done and recognised. Techniques were already implemented and could not be improved upon.

The Chairman said that Mr Mitrani, the referee for the project, had reported the same as Mr Holloway. The Panel's view was to reject.

Prof Y Paker (VF)

This application by Professor Paker is for Dr M Bozygit, Middle East Technical University, Turkey, to visit PCL for a period of three months to assist with a project on Computer Aided Design of office information handling. This grant has not yet been awarded and is tabled at this meeting. A decision on this application cannot be made until a decision has been reached on the Computer Aided Design project (see below).

Prof Y Paker

The objective of this project is to develop interactive computer aided design methods for modelling and simulation of distributed computer systems, in particular, office automation applications.

Professor Grimsdale reported that since the last meeting (at which this application was tabled and rejected) he has been in contact with Professor Paker, who has been in touch with many people in this field. Professor Grimsdale then reported that he still had reservations about the project. The same arguments arose as at the last meeting. (The underestimated complexity of the application, the time scale of the project, the irrelevance of some results, Professor Paker's background not in this type of work). The Panel rejected both this application and the Visiting Fellowship application.

Prof Y Paker (VF)

This application is for Professor E Jensen of Carnegie Mellon University to visit PCL for one week to lecture at the Seminar on Control and Synchronisation in Distributed Computing Systems to be held at PCL in September. The Panel was in full agreement with this application and rated it an alpha 1.

Mr Winter et al

The aim of this project is to design and construct a high-level language compiler for multi-processing element computers having a dataflow execution mechanism.

Mr Milner reported that the construction would take about 12 months. The application was not well put together. Dr Duce read a report from the referee, Dr Gurd, who thought the applicants were not familiar with what was going on in the field at the moment. Mr Milner thought the onus was on the applicants to familiarise themselves with the current situation. On these grounds the Panel rejected the application.

Mr Milner et al

The proposed research of this project is to design and construct a host-connected special processing unit featuring an interconnected array of micro-processor controlled processing elements.

Professor Grimsdale reported that he thought there was a 'sniff' of an interesting idea in the proposal. Many questions needed to be answered, eg. how units will be connected together. He was however uneasy about turning down the proposal.

Dr Duce informed the Panel that he had spoken to the applicants and advised them that more information was needed in the application. He stated that he had invited them to contact him before the meeting. This they had not done. It was decided that Professor Grimsdale and the Co-ordinator should visit the group to find out more details.

Prof M Healey

This grant would provide funds to investigate the use of Teletex protocols in Local Area Networks. Teletex uses a layered protocol and this project would study the distribution of these modules in different hardware configurations in a Local Area Network.

Mr Holloway reporting on the proposal informed the Panel that this was a re-application. Professor Healey had contacted Mr Holloway with a rather hurried revised proposal. This application did not have much 'meat' to it and although much work is being done in this field Mr Holloway commented that he did not rate it highly. The Chairman thought the application contained little research content. The Panel rejected the application.

Dr D Bustard

This application is for funds to continue the work started by the grant titled, 'The Design, Implementation and Applications of Languages for Distributed Computing'. This work includes:

- i. enhance the existing Pascal-Plus systems; and
- ii. prepare a kit to ease the construction of high quality compilers.

Dr Wand commented, to continue work on Pascal Plus seemed like an EMR agreement. If there were commercial aspects the British Technology Group should fund. Dr Duce disagreed with this and it was decided to send the application to the Software Technology Panel with the remarks that it looked like good work and other activities should be taken into account.

Prof D Evans

The proposed research of this application is the investigation of the relationship between algorithm structure and parallel architectures.

Professor Grimsdale thought the case for the application sent by the investigator was very brief but work at Loughborough in the past had been good. Mr Milner added that the current work was varied the group were moving away from mathematical algorithms, much rested on the past work at Loughborough.

The secretary suggested asking him to expand his case for support as the Panel could not judge the application on such a short description. It was decided that the investigator should be asked to send a more detailed case to the Chairman who would rate the application on receipt of the report.

Mr S Abramsky

This application is for funds to develop an applicative operating system for networks of powerful computers.

Mr Milner thought the case for support interesting reading, he reported that he had visited Mr Abramsky at QMC and was impressed. Mr Milner went on to say that the proposal seemed a valuable thing to do and he strongly favoured the project.

The Panel agreed and rated the proposal alpha 1.

Dr J Hunter and Dr C Mellish

The aim of this proposal is to develop a heterogeneous interactive environment in which a user can implement an intelligent knowledge based programme on a distributed system, by establishing a network of processes written in different languages, by running on different types of machine. Evaluation of the environment will be done by using it for a number of research projects.

The spokesman for the project, Dr Wand, thought that there would be many software alterations. The Chairman commented that:

- (a) the heterogeneous environment was a good one
- (b) but the specific application proposed by the investigators cloudy.

Dr Duce said that the applicants recognised the 'left overs' from their previous project (held up by late delivery of a Cambridge Ring). The Panel were generally in favour of the project but decided to refer it to the Computing and Communications Sub-Committee without grading but with favourable comment.

Mr T Goodwin et al

The objectives of this application are to develop a method for storing and transmitting high resolution colour images within a standard viewdata system. To design in accord with SERC common base policy, an image viewdata system having a high level of transportability; the system would be developed in Pascal on a PERQ which will act as a server to a Cambridge Ring local area network.

Mr Holloway commented that he would like to have seen a diagram in the request by the investigator, plus the cost of a PERQ should be added to the request. He went on to say that some contact with British Telecom had been established, he was doubtful about the details given in the request. The Chairman suggested that it could not be classed as distributed computing and advised sending it to the Computing & Communications Sub-Committee unrated with comments from Mr Holloway. The Panel agreed.

Mrs J Hughes and Mr M Powell

The aim of this project is to produce a cross development system to facilitate the production, testing, and maintenance of distributed computing systems designed using state of the art techniques.

Mr Brinkman reported that the application had some exceptionally good ideas, the cross compiling work involved DTL and Pascal, he would support the proposal.

The overall view of the Panel was that the group was good, the ideas in this application interesting, it was decided to rate the project alpha 1.

Dr D J Cook

Funds for this grant would produce a grammatical specification and analysis of parallel aspects of computer programs.

The Panel was sceptic about the application, they thought proposals not specific, they were not confident that it would produce any useful results and recommended rejection.

Mr H Dewar and Dr P McLellan

The objectives of this application is to develop and implement an operating system technology aimed at exploiting the capabilities of advanced single user computer systems on local area networks.

Mr Newey reported to the Panel that he was lukewarm about the application. Dr Wand thought it too ambitious, the software implications were alarming. The Chairman also thought it very ambitious and suggested to ask the investigators to do more planning of the application and resubmit it. He added they were good people however, and should be encouraged. The application was rejected.

Prof J Iliffe

The application from Professor Iliffe was for trial application programming and simulation studies leading to the specification of a new type of parallel processing system.

Professor Grimsdale reported that the application had potentially good ideas, it was difficult to understand why simulate the ideas, it seemed to take too much time. The Chairman asked why £10,000 consultancy fee for Computer Aided design. Mr Newey thought it sounded like the investigator wanted to produce a proven logic design. He added that any feelings about the application were on the past record of the investigator.

The Chairman asked Professor Grimsdale to clarify the unanswered questions and report to the Chairman his recommendations before the next Computing and Communications Sub-Committee.

Dr G Plotkin (VF)

The application is for Dr P D Mosses, a lecturer at Aarhus University, Denmark to visit Dr Plotkin at Edinburgh for 1 year starting January '83 to investigate general samantic algebras for concurrent programming languages. Dr Needham, spokesman for the project, reported that he asked the advice of Dr Gordon who was very much in favour of the application and strongly recommended it. Dr Duce suggested he hold a workshop while he was here and the Chairman added that we could pay for him to visit INRIA. The Panel being in favour of the application, it was rated alpha 1.

Dr A Burns

The proposed research of this project is to adopt a small stand alone UNIX system to give support for a number of decision makers within an organisation. Tools would be produced that will aid the co-operation and co-ordination of group activities that are interacting with the same information system whether that be built on a single mainframe of distributed environment.

Dr Wand reported that the work would be based on existing publications or things about to be published. The investigators intended to alter the UNIX kernel. The overall project would be complicated. The Panel decided to rate the proposal alpha 2 subject to comments by John Taylor.

Dr J Standeven et al

The proposed research is to investigate, design, and develop an architecture for a network of graphics workstations. Architectural features include an extensible system instruction set, a system wide virtual memory, and the ability for applications programs to utilise a variable number of system processors. Professor Grimsdale thought the proposal unclear and raised many question marks in his mind. The Chairman reported that the graphics people he had talked with about the project also thought the proposal unclear, and he thought the project overambitious. The Panel rejected the proposal and asked for the investigators to resubmit the application in a clearer manner.

THE FOLLOWING APPLICATIONS ARE FOR COMMENT ONLY

Dr R Periott

Consideration by the Software Technology Panel.

Dr Periotts project involves the implementation of the parallel programming language ACTUS on the PERQ. ACTUS is a Pascal based language which is suitable for both array and vector processors. If implemented on the PERQ ACTUS could provide programmers and researchers with a design, construction, and debugging tool before transmitting their programs to a large parallel processor.

Dr Wand said that we would recommend the project to the Software Technology Panel. The Chairman added that he thought it useful and he would be happy to recommend the project with the comment that it was not distributed computing.

Dr J Gordon

Consideration by Computing and Communications Sub-Committee.

The proposed research of this project is to investigate and evaluate methods for the secure transmission of digital data at megabit rates. Mr Holloway reported that most of the work relied on analysis and implementation, the work seemed useful, but he pointed out (and the Panel agreed) it was not in the area of distributed computing. The Chairman suggested to the Panel that we could not give a constructive report to the Computing and Communications Sub-Committee as it was outside our field.

Mr J Bailey

Consideration by Computing and Communications Sub-Committee.

This project proposes to develop software in a number of application areas using a novel class of language and to evaluate both the development process and the performance of the products on a variety of machine architectures. The Panel was not enthusiastic about this application. Mr Milner thought that the initial study should already have been done. Dr Wand said the application was short of detail.

The Chairman thought the comment should be that the Panel was unenthusiastic.

Mr Dyer and Dr Stringer

Consideration by Computing and Communications Sub-Committee.

This project would involve the design implementation and methodology of configuration of a parallel processor for decoupled control problems. The objectives would be to complete the processor and apply it to representative problems.

Mr Brinkman reported that no staff figures were given in the funding request, he could not see the justification for building their own equipment. Mr Dixon commented that the investigators were experienced in the field and he looked at it favourably. Mr Brinkman then added that he thought building twenty nodes was a big task, he wondered why that many would be necessary. The Chairman thought the hardware was overweighted.

The priority order of applications as follows (including Randells referred grant):

Alpha 1

1. Turner
2. Abramsky
3. Plotkin (VF)
4. Bennett
5. Evans (if recommended by Chairman)
6. Higginson
7. Smith
8. Hughes
9. Paker (VF)

Alpha 2

1. Randell
2. Cain
3. Walley

8. PROGRESS REPORTS

The following progress reports are those which were not received in time for consideration by the Panel at its meeting on 14 July 1981. It is intended to concentrate on outstandingly good or bad reports and decide on any follow-up action necessary.

Investigator - Mr R Bornat, Referee - Dr Wand

Dr Wand reported that progress has been made, there was, however, much work to do in the remaining 6 months, but this should not cause any problems to the investigator.

The progress report on Professor Colouris' project was deferred in the absence of Mr Portman.

A progress report for Mr Turner's project on denotational language for dataflow machines has still not been received.

The date of the next Panel meeting will be 14/15 July 1982.