THE UNIVERSITY OF QUEENSLAND

Specification for High Performance Computing Equipment, Associated Visualisation Equipment, Software and Services

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1. Specification Summary

1.01 This specification is for the supply, delivery and installation of high performance computing equipment, associated software and workstations. The proposed equipment will replace a Cray YMP2D and Maspar MP1204 and provide immediate enhancement of capacity which can be expanded to meet requirements over the next five years.

1.02 It will complement the IBM SP2 recently installed for the Queensland Parallel Supercomputer Facility (QPSF) at Griffith University. The details of this facility are provided in Attachment A. The University of Queensland is entitled to approximately a 30% share of the capacity of this facility and intends to concentrate its developments in massively parallel supercomputing in cooperation with QPSF on this system.

1.03 The University intends to decommission the MasPar 1204 on 31 December 1994. In the context of this specification, the University would be pleased to receive proposals for trade-in or purchase of this equipment which is listed in Attachment C.

1.04 Attachment B provides information, including major applications, on the Cray YMP2D currently operated by the University. Use is made also of external supercomputer facilities. The University wishes to extend knowledge and skill in High Performance Computing to the undergraduate and postgraduate curriculum. It also wishes to continue its close collaboration with government and industry in the development of advanced applications and in the promotion of technology transfer.

1.05 The specification outlines the minimum and desirable capacity requirements. These suggest an initial configuration far in excess of the capability of the existing Cray YMP configuration. A Unix-based operating system is required as well as a wide range of applications packages. Existing applications should continue with a minimum of disruption.

1.06 Central to this development is the installation of an HPC Applications and Visualisation training facility. In addition to the equipment required for this facility, the University wishes to consider the advantages of entering into a period contract to cover a range of compatible workstations to meet departmental requirements over the next three years.

1.07 The University welcomes a cooperative arrangement with the successful tenderer which not only enhances the University's teaching and research programs but extends the external use of its HPC and Visualisation facilities to other universities, government and industry. The University will also consider naming rights over the life of the equipment and representation on a proposed advisory board to encourage industry participation.

2. Regional Environment

2.01 South East Queensland is the fastest growing region in Australia. In the five years between 1986 and 1991 the population of south East Queensland grew by over a quarter of a million people — primarily as a result of migration from interstate, overseas and intrastate. By 2011 it is forecast that there will be another one million people living in the region — increasing the total population to over three million. Six areas of South East Queensland experienced population growth rates of more than 4.9% or double the average recorded for the State as a whole in 1991/1992.

2.02 The contemporary issues of population growth, industrialization, climate change/variation and competitive environment means that it is imperative that the technical infrastructure of supercomputing and visualisation be in place to properly deal with these complex community issues. The University of Queensland through this specification demonstrates its commitment to contribute to these challenges in a significant way.

2.03 The emergence of the Asia Pacific Economic Co-operation (APEC) region of 15 Pacific rim countries promises to focus long term attention on economic growth and trading within the region. The University of Queensland through its supercomputing/visualisation centre will be well positioned to become a key contributor in a vibrant network of technological regions across APEC.

3. The University of Queensland

3.01 General Profile

The University of Queensland is one of the largest academic institutions in Australia, having some 25,000 students. It is known internationally for its teaching and research strengths. Founded in 1910, it has 63 departments covering all aspects of undergraduate and postgraduate training. The University is Queensland's leading research institute, ranking fourth nationally in Australian Research Council funding and third in National Health and Medical Research Council grants. These totalled over $14 million during 1993-1994. As well, the University has attracted some $10 million in industry sponsored research during 1993-1994. The University is also heavily involved in nine Co-operative Research Centres (CRC), with three new CRCs being initiated in 1994. The University has 1861 PhD students enrolled with approximately 250 graduating in 1993.

3.02 High Performance Computing Research Groups at The University of Queensland

In addition to applications undertaken by the Departments of the University listed in Attachment (B) there are a number of specific research groups which include the development of algorithms and research tools for High Performance Computing as one of their major goals, eg:
- Centre for Integrated Resource Management (Biological Sciences).
- Centre for Industrial and Applied Mathematics and Parallel Computing (Mathematics).
- Computer Aided Process Engineering Centre (Chemical Engineering).
- High Performance Computing Unit (Mathematics and Prentice Centre).
- Aerodynamics and Propulsion of Hypervelocity Spacecraft (Mechanical Engineering).
- Neural Networks and Advanced Computing Techniques (Electrical and Computer Systems Engineering).
- Queensland University Advanced Centre for Earthquake Studies (Earth Sciences).
- Non-linear Dynamics Studies (Civil Engineering).

Under the Centre for Integrated Resource Management (CIRM) The University of Queensland in collaboration with the Queensland Department of Primary Industries will undertake a project on nutrient run off in the Murray Darling river system. This will involve high performance computing, modelling and visualisation.

The University is well advanced in the establishment of a collaboration with Japanese space agencies and the University's Hypersonics Unit, Department of Mechanical Engineering. This project will make substantial use of high performance computing.

4. Outline of Capacity Requirements

4.01 The essential requirement is for a scalable supercomputer(s). It must have a high capacity disk system. It must provide a range of high speed communications and I/O interfaces (such as Ethernet, FDDI, HIPPI, Fibre Channel, ATM) to interface into existing and developing networks.

4.02 The important factors to be considered in assessment of the supercomputer tendered will include its ability to support research and applications requiring the highest levels of performance. Relevant factors include processor speed, memory size and speed, inter-processor communications latency and bandwidth, I/O bandwidth, quality of compilers, quality of development and debugging tools, and hardware reliability. Sustainable performance on the largest of problems is a major criteria for selection.

4.03 The initial configuration of the supercomputer should be capable of significant progressive expansion which must be achieved without fundamental changes to system software, or user programs or application packages.

4.04 The technology must be considered over the lifetime of the equipment. It is expected that the technology will be state-of-the-art and consistent with high performance and reliability, moderate physical requirements, low maintenance and minimum operating costs. The University will not consider superseded equipment. Tenderers should outline the central technology and architecture of their proposed system including a brief statement of the recent historical and developmental background. Tenderers must indicate their willingness to disclose detailed technical information requested by the University during the life of the equipment.

4.05 The mix of work will vary over a broad spectrum of job types and sizes. However, high sustained floating point performance and high communications speeds are critical.

4.06 The following provides indicative hardware requirements for minimum and desirable performance to be attained by the tendered system:

Minimum requirements:

- Sustained performance over a set of typical problems (eg. Attachment D) not less than 400 Mflops at 64 bit precision.
- At least 1 GB fast RAM.
- At least 50 GB disk storage.
- Reasonable communication links to the existing University local area network.
- At least a 32 bit word length.
- A disk server mechanism.
- Performance must scale with the number of processor nodes with the minimum of effort.

Desirable requirements:

- Preferably the machine should have a sustained performance of 1 Gflop or more at 64 bit precision.
- 100 GB disk storage or above.
- 4 GB fast RAM.
- a 64 bit word length.
- It is desirable that the cpu performance is not hindered by the disk I/O transfer.

Information is required on all aspects of the hardware tendered.

4.07   Equipment for the backup of disk storage and the procedures for archival and migration of files to and from the backup medium must be included in the proposal.

4.08   It is expected that any necessary front-ending machine(s) will be included in the tendered equipment. However, separate details of the hardware, software and interface mechanisms must be given. Any performance limitations that the tendered front-end machine(s) may impose must be detailed.

4.09   Architectural and other features which are effective in achieving high performance should be highlighted. Benchmark tests are not at this stage specified. The University reserves the right at its complete discretion to request short listed tenderers to develop codes in accordance with the University's specifications to demonstrate satisfactory performance on a range of typical problems, example of which are provided in Attachment D. Nevertheless, tenderers in response to this specification may wish to provide an indication of comparative performance at 64 bit precision such as Perfect Club (13 application codes), LINPACK (small and large), and NAS Parallel Benchmarks.

Furthermore, the vendor must supply detailed performance figures of the tendered machine for a range of problems of their own choice. Preferably, in this set of performance figures, the vendor would include some comparisons with other competitive architectures.

4.10   Tenders should emphasise features which contribute to improved reliability, availability and maintainability as well as to lower costs of operation.

4.11   Tenderers should provide reference to sites where the tendered configuration is working in a similar operating environment. Where this is not possible, the names of sites which represent closest comparisons and which can provide a reference to increase confidence in the tenderer's proposal must be provided.

5.   Operating System

5.01   A UNIX or UNIX-based operating system (OS) is required which complies with a current international standard (e.g. UNIX 5 or BSD 4.3). The OS should support:

(a) A network environment including high performance transparent access of files on other systems.

(b) Automatic scheduling according to job resource requirements as well as facilities for overall operator supervision and control.

(c) A disk-based hierarchical file system with comprehensive and effective file naming and controls over file access and security of users files. Any upper limits on file size should be stated.

(d) Automatic generation of a machine-readable systems log to permit evaluation of all aspects of systems performance. Operator displays and control functions should be sufficient to allow effective and efficient operational management.

(e) Account management facilities to enable the monitoring, recording and analysis of the usage of the various system resources.

(f) Availability of all systems facilities to workstation users over the network, including interactive control of a running program.

5.02   Tenderers should provide information on the history of the development of the Operating System proposed. The amount of memory required for the Operating System should be stated including any assumptions made in the calculation of such memory requirement. Full details are required of system calls, features for the optimisation (eg. vectorisation, parallelisation) of code, as well as documentation which will allow an understanding of the functioning of the Operating System.

5.03   The following information must be given about the operating (OS) tendered:

(a) The ORIGINAL developer of the OS.

(b) The version of the OS to be supplied.

(c) The cost (if any) for the licence of the OS.

(d) The party responsible for maintenance of the OS (i.e. correction of problems, supply of new versions, etc.) and the charge for such maintenance.

(e) The commitment of the tenderer to the OS in terms of the number of staff working full-time on that variation of the OS in:

    i.   Brisbane;

    ii.   Australia (other than Brisbane);

    iii.   Overseas.

5.04   The availability of sources of the Operating System together with language and/or other processors necessary to produce a running Operating System is considered desirable. Tenderers should give costs and conditions of availability of these, together with copies of all licence agreements required.

6.   Software — General

6.01   Supercomputing requirements within the University exhibit a number of characteristics which may not be evident in other computing environments. At the applications level are researchers, typically scientists, engineers, and industry partners, who develop specific applications to produce particular research and applications results. These people typically need much more computing power than other users.

At the algorithms level are Computing Science and Mathematics researchers who develop usually general-purpose algorithms. The skills needed for this are more complex and often rely on considerable computing and mathematical abilities.

Both the applications and algorithms level users rely on the programming and monitoring environments developed and maintained by systems level support personnel.

6.02 The range of software necessary produces a large documentation problem. User documentation is needed at various levels. For example, student use requires large quantities of simplified documentation at a low price. The University will therefore require, as part of any contract:

i. a waive on copyright so that the University can edit, copy and reproduce in whole or in part any portion of the supplied documentation for sale to their users;

ii. a right to purchase manuals for resale to the users of the system.

6.03 The availability of human and machine-readable sources of software, including the Operating System, is considered highly desirable. In a research environment, where much of the research is into new and advanced applications, the research may be limited without the ability to modify aspects of the operating system and other software modules.

6.04 (a) The University considers the following software essential:

- FORTRAN 77 with advanced extensions similar to those to be found in FORTRAN 90 and with appropriate libraries.
- ANSI C and appropriate libraries.
- graphically based development/debug tools integrated with FORTRAN and C languages.
- TCP/IP networking.
- Support for an X11 based graphical environment.

(b) In addition, a range of software is desirable including:

- C++.
- Modula 3.
- Pascal.
- Ada.
- Database software (including spatial databases).
- visualisation packages.

6.05 (a) A comprehensive list of libraries including application packages, and mathematical, statistical and graphical algorithms and tools should be given.

(b) Tenderers should state which of the software packages listed in attachment (E) are available. Packages not available should be explicitly stated. The tenderer should include the price of the package and the name of a 3rd party supplier if they cannot supply the package themselves. Descriptions must include a version number and a description of the minimum desirable configuration for each package.

(c) Tenderers should specify the hardware and software packages and maintenance products for supporting database management systems and associated fourth generation language tools and associated facilities for supporting a large terabyte filestore with automated tape robot.

6.06 Tenderers must specify which languages and applications are available under the operating system tendered and for every language and application offered as part of this tender the following should be provided:

(a) One copy of the manual giving details of the language or application.

(b) The name and address of the original supplier of the language or application system (if different to tenderer).

(c) Supplier of maintenance for the language or application system (if different from tenderer).

(d) Additional cost (if any) of machine readable sources and source language processor used.

(e) Annual maintenance charge (if any) and maintenance service provided.

(f) The licensor of the language or application (if any).

(g) Licence fee for language or application (if any).

(h) Copy of licence agreement (if different to the corresponding OS license).

(i) Copy of language or application maintenance agreement (if different to the corresponding OS maintenance agreement).

6.07 Tenderers should indicate whether the software packages efficiently exploit the hardware features of the system tendered.

6.08 The price for the supply of manuals for all software should be supplied together with discounts applicable to large orders.

7. Visualisation Facilities

7.01 A powerful supercomputer is but one element in a high performance computer centre. Visualisation facilities of appropriate matching performance are required to complement the computing powerhouse embodied in the supercomputer.

The integration of supercomputing and visualisation practice and expertise is a world wide trend. The University of Queensland and various partners in a number of projects have already made international contributions based on this methodology. The Centre for Industrial and Applied Mathematics and Parallel Computing (CIAMP) and QDPI won the Government Technology Productivity Gold award for their work on the development of the package ADVISE a visualisation tool designed to enable transparent connection of Visualisation work stations and high performance networks.

7.02 The effective use of the next generation of supercomputers will need to be supported by workstations offering a variety of graphics facilities from simple 2d contouring and surface portrayal to advanced 3-d model development tools. While the workstations will be the core elements in such configurations essential elements in these laboratories will be the variety of peripheral devices which allow the images resident on the work station to be lifted from the machines and presented by means of hard copy, video and film, etc.. Post processing and manipulation of this visual data will also need to be an option.

Already several departments offer courses in supercomputing and this will inevitably increase as the university expands its high performance computing capacity. In accordance with the teaching and research goals set out in the UQ strategic plan first and higher degree graduates should have computing expertise of a standard expected in the highest levels in their professional and academic areas of specialisation. It follows from this that visualisation will be addressed as a key issue in the complete spectrum of activities from undergraduate teaching to advanced research. It thus follows that the successful response to this specification document will contain a full range of options for visualisation.

7.03   A visualisation laboratory is required as a teaching facility for staff advancement, for later year undergraduate and post graduate courses and as a facility for use by government and industry. The University also wishes to investigate the possibility of entering into a period contract for the supply of a range of graphics equipment for all departments and centres at the University and for university wide site licences for software.

Regarding graphics workstations and software, certain requirements are essential:
- Open GL capability
- A long term commitment to the graphics subsystem
- demonstratable technical and customer support
- compatibility with other hardware such as video-mastering hardware, projectors, colour printers, video capture devices such as slide producers
- software support

Initially the requirements for a teaching laboratory will include most of the following:

Entry level machines:

Hardware:	64 Mb RAM
	1 Gb Hard Disk
	24 bit colour graphics (quote also for 8 bit plus upgrade)
	CD Rom
	File Server
	Tape back up and read facilities (e.g. DAT drives)
Software:	Unix operating system with X windows and TCP/IP software
	Mathematica
	Matlab
	Maple
	Fortran, C, plus program development environments
	Data Explorer
	IMSL and NAG Graphics libraries

7.04   There is also expected to be a number of top of the range workstations for research facilities, as an enhancement to the teaching laboratory and as part of an envisaged advanced computing and modelling centre. Software similar to the list for the teaching laboratory, with enhancements and expansions which are appropriate to the high performance of the machines should be specified by the tenderer.

7.05   The final number of systems required will depend on available funds and price. Tender prices should be based on 20 entry level machines and four advanced workstations.

8.   University of Queensland Networking Environment

8.01   The University of Queensland data network (UQnet) is based on Wellfleet routers which support IP, DECNET, and Appletalk services. In the wide area, the routers are interconnected with routers both within the University of Queensland and in other institutions via the Australian Academic and Research Network (AARNet) using synchronous links ranging in capacity from 64 kbps to 2 Mbps. It is planned that some of these links will, in the next three years, be upgraded to ATM links running at 34 Mbps and higher speeds. On the St. Lucia campus, the routers are interconnected via 155 Mbps ATM connections.

8.02   Data services are distributed to departments via optical-fibre Ethernet links, and Ethernet is distributed to the desktop, in most cases, via category 5 UTP connections. It is expected that within 12 months there will be some ATM services to desktop workstations where high-bandwidth applications such as visualisation are required.

8.03   It is envisioned that UQnet will continue to develop as a hybrid ATM/Ethernet network, with Ethernet being used as the connection of choice where 10 Mbps access is sufficient, with ATM being used to interconnect routers, Switched Ethernet hubs, high-throughput hosts such as numerically-intensive computing facilities, large filestores, and video servers. It is expected that integration of Ethernet and ATM will be achieved by a mixture of RFC1483-encapsulated VCs between routers and routers/hosts, RFC1577 LISs, NHRP services, and ATM Forum LAN Emulation services. ATM is also likely to be used to provide a virtual switched Ethernet.

8.04   Tenderers should give information as to how they intend to make use of the current and likely future UQnet environment. In particular, they should state:
   (a) What native ATM interfaces they can provide, and planned rollout of ATM interface products.
   (b) The ATM signalling protocols currently supported (e.g. ITU-T Q.2931, ATM Forum UNI 3.0, 3.1, etc.) and their timetable for development of signalling protocols.
   (c) Other methods of integrating their equipment with ATM networks.
   (d) What methods they currently support for the transport of IP over ATM networks, and timetables for future developments in this area. (e.g. RFC1577, NHRP, RFC1483, etc.)
   (e) Timetable for the provision of a LAN Emulation Client for their equipment.
   (f) Other network interfaces supported (Ethernet, 100 Mbps Ethernet, FDDI, HIPPI, etc.)

8.05   Provision of a native mode ATM interface with appropriate software to allow the equipment to participate in an IP-over-ATM network in 1995 is highly desirable.

9. Accouting and Security Requirements

9.01 As there is a diversity of job types in the University environment, charging (both notional and real) may be based on the use of each system resource (e.g., processor time, file I/O, memory use, etc.).

9.02 With large numbers of users and restricted budgets, the ability to set limits on an individual job and on an individual user is essential. As well as the job and user limits, it is also desirable to limit a particular resource within a given job (e.g., processor time), or for a given user (e.g., disk file storage space).

9.03 There must be adequate mechanisms to ensure the absolute control of access to accounting and audit files to ensure security of accounting and audit information and to prevent unauthorised use of the system.

9.04 The system must meter and record details of all resource usage with associated parameters (e.g., interactive/batch, priority used, login/logout time, etc.), and should provide routines for analysis of this information for management control.

9.05 Tenders must specify for the equipment tendered, the mechanisms used for user authentication, resource access control, and auditing.

9.06 Passwords must not be stored in plain text anywhere in the system and must not be stored in a world readable file. Password shadowing capability is a mandatory requirement of this specification.

9.07 Tenders must clearly describe any system management tools or programs specific to the tendered equipment which have a mandatory requirement of ".rhosts" or "/etc/hosts.equiv" files.

9.08 Tenders should include technical information regarding additional system security and access control facilities provided as "standard" equipment by the tenderer. These facilities may include, but are not limited to, one-time passwords, data integrity verification tools, system security scanners, per host connection access control, and RFC931 compliant services.

10. Software Maintenance

10.01 The tenderer should state the method used for product control and testing prior to release of software and, for difficulties encountered by the user, the procedure for reporting and the locations where difficulties are evaluated and amendments made to software where warranted. The average turnaround time for remedying (a) temporarily and (b) permanently faults in the main software system should be stated. This should be able to be supported by reference to customers or difficulty report control statistics.

10.02 The method of updating software documentation should be stated.

10.03 All prices attached to the support of software for the initial system, and supply of periodic revisions and new version must be supplied.

11. Operational Management

11.01 Tenderers should outline the facilities (including programs) available to assist operational management. It would be expected that, as a minimum, facilities would be available for system-wide backup, for dynamic re-configuration and for program library, disk and backup media control. Sample documentation of the major systems provided to aid operations should be supplied.

11.02 It is desirable from the outset to have available performance monitoring aids to manage and plan the development of the installation. Tenderers should indicate the availability of such aids covering hardware, software and data communications performance, and any prices involved in the supply and maintenance of such facilities.

12. Training Requirements

12.01 Initial training will be required for current users, research and support staff. It would be expected that some initial training would be provided at no further cost and details should be stated. Charge rates for training beyond this should be supplied.

12.02 Tenderers should state prices and availability of course materials and training aids sufficient to enable the University to be self-sufficient in the training of new programming, operations and technical staff as well as users.

13. Equipment Not Supplied by the Tenderer

13.01 Within a contract negotiated as a result of this specification, the University would reserve the right to connect other equipment (of whatever manufacture) to any equipment installed. Tenderers should state their policy in this matter and clearly indicate if there would be any limitations to normal support as a consequence.

14. Hardware Maintenance

14.01 The following information should be supplied in the tender:
   (a) A copy of the tenderer's standard maintenance contract (or contracts if more than one level of service is available) with prices and statements of:
      i. guaranteed response times to service calls
         • during normal working hours;
         • outside of normal working hours during the week;
         • over weekends and public holidays.
      ii. the location of the nearest spares holding for each item of equipment proposed.

(b) A statement on the extent to which the support staff for the facility can practically participate in the preventive and remedial maintenance process (e.g. preventive maintenance, first-level diagnostics, module exchange, repair of mechanical devices such as printers and magnetic tapes, on-side work in association with tenderers remote diagnostic services, etc.) The statement should include an estimate of the number and capability of technical staff and the training required and cost and location of such training. In conjunction with this statement, the following information should be supplied:

i.   the initial cost of a recommended holding of on-site spares. The University may require some tenderers at a later stage to provide a detailed list and prices of an initial spares and parts complement and special tools or equipment required on-site and details of diagnostic programs and procedures.

ii.   a statement of the response times that may be expected from time of order until supply, for:

    • normal replenishment of usual on-site spares;

    • emergency requirement of components not normally held on-site.

iii.   a representative sample set of engineering documentation is required.

iv.   assistance that the tenderer could provide to support the facility together with associated costs, during an initial period following warranty.

Details of the location of repair/support facilities in Australia and overseas are required and the access the University could expect to such facilities should the University elect to perform part or all maintenance.

15.   Environmental Requirements

15.01   Tenderers should supply full details of environmental requirements. However, any special or unusual requirements should be brought to the attention of the University; for example, special cooling, conditioned power or space requirements.

16.   Acceptance Tests

16.01   Products supplied under a contract arising from this specification will be subject to acceptance tests which are intended to satisfy the University that:

(a) Hardware products as delivered and installed are in good working order and conform with the specifications provided by the supplier;

(b) Software products supplied operate as described in the appropriate manuals and other software documentation;

(c) The products in (a) and (b) operate in a reliable manner;

(d) The documentation supplied with the products is of the correct revision and describe the product adequately to allow use or maintenance of the product as required.

(e) Meets requirements as per 4.06, 4.09, and Attachment D.

(f) The system is secure. A security audit of the system will be required as part of the acceptance test.

16.02   Such acceptance tests will be negotiated to the satisfaction of the University prior to the finalisation of a contract as a result of this specification.

17.   Company Information

17.01   The response to this specification should also include such information that the tenderer would wish to provide to establish the viability of the company as a long-term supplier of high performance computing and associated equipment and software. As a minimum, such information would include the last two annual reports of the parent company and the Australian subsidiary and brief statistics, of which the following would be indicative for (a) the world and (b) Australia.

(a) Annual value of sales of high performance computing equipment over the past three years;

(b) Number of staff employed by the company associated with high performance computing equipment and associated software including a breakdown by such areas as research and development for hardware and software manufacturing, sales, and support for hardware and software, and;

(c) Indicators of research and development activity for high performance equipment over the past three years.

18.   Prices

18.01   All prices are to be quoted in Australian dollars. If prices are subject to adjustment in respect of variations in cost or exchange rates, the tenderer should indicate the basis on which such variation in prices should be determined. The University shall receive the benefit of any reductions in list price between the time of ordering and the delivery of equipment. The university is exempt from Sales Tax.

18.02   The prices sought are for outright purchase of equipment items. The prices are to be inclusive of all costs of manufacture, assembly, carriage, insurance, customs, duty, installation and acceptance and as far as is possible, such components of the price should be shown separately. Prices are to be supplied for each item of equipment. The prices for all other charges arising out of this specification are to be detailed and without limiting the requirement, the following schedules must be completed.

18.03   The University wishes to determine the total cost of ownership of each tenderer's proposal for an initial period of three (3) years. Therefore, ALL costs and charges associated with the acquisition, installation, maintenance, licensing, support, etc., necessary to determine this total cost must be provided in the attached schedules.

19. Payment

19.01 The conditions of payment will be the subject of the contract between the University an the successful tenderer but, in general, payment will be conditional upon satisfactory completion of acceptance tests of hardware, software and documentation and all other conditions relating to the performance of the contract being met. Whilst the initial assessment of tenders will be based on outright purchase, the University may wish later to consider proposals from short-listed tenderers on spreading payments over a period of more than one year.

20. Delivery and Installation

20.01 Tenderers should state the minimum period from the date of signing a purchase contract when delivery can be made. The University hopes that it would be possible to conclude a contract during January 1995 and the most suitable period for delivery and installation would be prior to 31 March 1995. Nevertheless, the University would not rule out of consideration a superior proposal purely because this delivery timetable could not be met.

20.02 Where vendors are unable to supply their tendered equipment by 31 March 1995, they are to indicate what equipment can be supplied and delivered on an interim basis by this date, as well as the firm delivery date for the tendered equipment. (Details of interim equipment are to be provided with the tender).

20.03 Delivery will not be deemed to have been effected unless all items including hardware and software required for the acceptance test of any item or system have been delivered.

20.04 Installation of the equipment should follow immediately upon delivery. All costs associated with the installation and commissioning of the equipment are to be included in the tendered prices.

20.05 Without limiting the tenderer's responsibility for installation of the equipment, the University reserves the right to decide final placement of the equipment, subject to the technical recommendations of the tenderer. The new equipment must be installed with minimum disruption of services on the existing facilities. The University would prefer that their own engineers and technicians be involved with the installation.

20.06 Once a contract is finalised, the successful tenderer would be expected to have readily available to the University a senior representative who would assist in developing a detailed planning schedule and provide liaison to ensure the schedule is met. All information necessary to prepare the site for the installation of the equipment must be supplied in good time to the University. Any costs which would be charged to the University by the successful tenderer in order to meet such requirements should be stated.

21. Insurance

21.01 The successful tenderer shall be required to accept the cost of insurance against loss of or damage to the equipment up to and including the date of acceptance of the equipment.

22. Tendering and Contractual Matters

22.01 The final acceptable system or systems would be the subject of a contract or contracts between the University and the successful tenderer or tenderers. It should be noted that the ability of the successful tenderer to enter into a mutually agreed contract with the University is considered an important item in the assessment procedure. A tender will, therefore, not be deemed to be accepted until a contract of agreement has been concluded. The formal contractual agreement will cover such matters as supply, delivery, installation, acceptance, support, penalties for non-performance, training, etc.

22.02 The tenderer should supply a copy of each of the tenderer's standard purchase contract and maintenance contract for information purposes.

22.03 The University reserves the right to:
(a) Modify this specification at any time and to request further information from any tenderer, and;
(b) To accept and award a contract or contracts in respect of tenders which do not comply strictly with the specifications.

22.04 The University will not be bound to accept the lowest, or any, tender and the University reserves the right to accept any tender in whole or in part. The award of a contract will not imply sole rights of supply to the University of any item or class of item.

22.05 If there are any inhibitions or constraints which would limit the full and complete use of the tendered systems by students or clients of the University, tenderers should give details.

23. Lodging of Tenders

23.01 All tender documents are to be submitted in duplicate and lodged with the Secretary and Registrar, The University of Queensland, 4072 not later than 5:00 pm, Monday, 16 January 1995. Tenders should be clearly marked "HPC and Visualisation Facility".

23.02 Tender documents may take any form desired by the tenderer provided they supply the information requested herein in a clear manner and include the tender form and price schedules. Tenderers may propose alternative equipment and configuration but must give full information for each one.

24. Confidentiality

24.01 In providing response to this specification, the tenderer should state agreement that the tenderer shall not without the prior written agreement of the University make any public statement in relation to this specification or to the awarding of any subsequent contract or order for items the subject of this specification.

25. Concluding Remarks

25.01   Further information of an explanatory nature may be obtained only through Mr Alan Coulter, Director, Prentice Centre. At the University's complete discretion, tenderers may be given the opportunity for formal presentation of the merits of their proposals and may be required to provide further information.

25.02   All information in whatever form supplied or to be supplied by or on behalf of the University in relation to any matter relevant to this specification has been or will be prepared in good faith and from information available to the University at the time. Any such information was or will be furnished for the convenience of prospective tenderers only and the University does not warrant the accuracy of that information or of any part of it and will not be liable for any claim whatsoever based upon an allegation of insufficient or inaccurate information respecting any matter.

Attachment A: QPSF (Queensland Parallel Supercomputer Facility)

The Queensland Parallel Supercomputing Facility is a regional facility for parallel supercomputing for Queensland universities. QPSF is ARC funded through a Mechanism "C" grant. It is specifically aimed at scalable MIMD massively parallel processing (MPP). It is managed by a board with representation from all Queensland universities.

The computer is a 22 node IBM SP2. More specifically the system consists of eight "thin", and fourteen"wide" nodes. Wide nodes have more cache and twice the memory/cpu bandwidth. Each node has 128 Mbytes memory and 2 Gbytes disk. Peak floating point performance, 64 bit, for each node is around 260 Mflops. Aggregate 64 bit floating point capacity is over 5 Gflops. Two of the "wide" nodes are currently configured for interactive use and are configured with 6 Gbytes disk each. These two nodes also have high performance access to a 10 Gbyte RAID disk.

Attachment B: Cray Y-MP 2D at The University of Queensland

The Cray Y-MP 2D is a 2 CPU machine. It has 128 Mbytes of fast memory which is shared by both processors. The IO Subsystem contains a further 320 Mbytes of slower memory which is used at this site for disk caching and swapping. Each CPU has a peak 64 bit floating point performance of 330 Mflops. Aggregate 64 bit floating point capacity is 660 Mflops. 10 Gbytes of disk is directly connected to the Y-MP I/O sub-system, with a further 10 Gbytes NFS mounted on a dedicated communications front end.

This machine was installed in September 1993 to test the demand for HPC at The University of Queensland. The take up was particularly fast and its CPU, memory, and I/O capacities were quickly saturated. The level of demand for the machine continues to grow steadily.

Including all interactive and NQS job runs, we are achieving a sustained 64 bit floating point computation rate of between 55 and 90 Mflops per CPU.

Research topics undertaken on the system since its installation:

- Computational Fluid Dynamics
- Filtering techniques in Cross Validation Algorithms. Surface fitting by thin plate splines and local quintic bases.
- Quantified Risk, Modelling toxic fire plumes. Land use planning.
- Models of Processes, Large Scale Spectral Analysis.
- Molecular Structure, spectral analysis, Potential Energy surfaces.
- Hypervelocity aerodynamics
- Neural Net simulations
- Elasto-Plastic analysis of transmission towers under dynamic loading.
- Crystallography. X-ray data.
- Hydrologic and Climate models. Tracking rain cells.
- Biology and Information Transmission Problems.
- Quantum Mechanical stochastic simulations of a Maser. Nonlinear dynamics and chaos — solutions of a nonlinear Schrodinger Equation describing propagation in optical fibers.
- Nonlinear load-deflection of a beam-sheeting system
- Quantum field propagation problems
- Hypersonic flow over blunt cones with chemical dissociation
- Training and testing model for speech recognition
- Molecular orbital programs
- Two phase flow in an elutriator
- Molecular dynamics simulation of water. The CF1 model.
- Interpolation of Rainfall data.

Attachment C: MasPar 1204E at the University of Queensland

The MasPar was purchased in 1991 with funds received from an ARC Mechanism C grant. It is proposed to decommission it on December 31, 1994.

The MasPar 1204 consists of a frontend workstation and a DPU (Data Parallel Unit). The front end machine is a DECstation 5000 running ULTRIX. It is configured with 64 Mbytes memory and a 600 Mbyte disk (RZ56). Also attached is a CD ROM drive (RRD40). The DPU is a SIMD processor with 4096 processors. Each processor of the DPU has 64 Kbytes of main memory. Attached to the DPU is a 4 Gbyte RAID disk array.

Attachment D: Typical Problems and Applications at The University of Queensland

A. **Set of Typical Problems**

Problems are:

1. Finite-difference methods:
   - first order in time and space.
   - high order in time and space
   - pseudo-spectral.

2. Finite element methods.

3. Particle based methods:
   - molecular dynamics.
   - lattice solid/discrete elements.

4. Semi-microscopic methods:
   - lattice Boltzmann lattice gas.

B. **Set of Typical Application Codes**

1. Laplacian spline rainfall interpolation (Modification rules available on request).

2. Rangeland simulation of Australia, 5 km grid for 10 years, with and without I/O and visualisation (Modification rules available on request).

3. Ecological Dispersal Model with and without I/O and visualisation (Modification rules available on request).

Attachment E: Applications Software

Quantum & Molecular Simulations

    (a) GAUSSIAN 92,94 (Gaussian Inc., Pittsburgh, USA)

    (b) BIOSYM — INSIGHT 2, DISCOVER, DMOLE, TURBOMOLE and POLYMER modules (Biosym Tech., Sydney)

    (c) AMPAC 5 (SemiChem, Shawnee KS, USA)

    (d) GAMESS (Iowa State Univ., Dept Chemistry, IA, USA)

    (e) XPLOR (Molecular Simulations, MA, USA)

    (f) ACES II (Pharmaceutical Chemistry, Uni of Calif, San Francisco, CA, USA)

    (g) GROMOS (Physical Chemistry, Zurich, Switzerland)

Computational Fluid Dynamics

    (a) FIDAP (Compound, Sydney)

    (b) FLUENT (Fluent Inc, Lebanon, NH, USA)

Statistical Analysis

    (a) SAS

    (b) SPSS

Mathematical Analysis and Visualisation

    (a) IMSL Numerical & Visualisation Library (Visual Numerics, Houston, TX 77042, USA)

    (b) NAG Numerical and Graphics Libraries

    (c) MATLAB plus Toolboxes (CEANET, Sydney):
    SIMULINK
        Control System Design
        Mu-Analysis and Synthesis
        Optimisation
        Symbolic
        Robust Control
        Signal Processing
        System Identification
        Neural Nets

    (d) TECPLOT (Amtec Engineering, Melbourne)

    (e) MAPLE (SIR Pty. Ltd. 10-18 Cliff Street, Milsons Point)

Computer Aided Engineering

    (a) PATRAN (PDA Engineering, Costa Mesa, CA, USA)

    (b) MSC/NASTRAN Universal Analytics, Inc., Torrance, CA, USA)

    (c) ASPEN PLUS 9 (Aspen Tech, Cambridge, MA, USA)
        Model Manager

    (d) ABAQUS (Hibbitt, Karlsson & Sorensen, Inc., RI, USA)

    (e) ASKA (IKO Software Service GmbH, Stuttgart, Germany)

    (f) PERMAS (INTES, Stuttgart, Germany)

Seismology

    (a) DISCO (CogniSeis Development Inc, Houston, TX, USA)

APPENDIX

SPECIFICATION FOR
HIGH PERFORMANCE COMPUTING
EQUIPMENT AND VISUALISATION FACILITIES
FOR THE UNIVERSITY OF QUEENSLAND

THE UNIVERSITY
OF QUEENSLAND

Contents

THE UNIVERSITY
OF QUEENSLAND

Tender Form

To: Secretary and Registrar
        The University of Queensland   Qld 4072

We, the undersigned, do hereby tender to supply and install computing equipment and associated systems, facilities and components at the Prentice Centre, The University of Queensland, in accordance with the tender documents submitted herewith including the schedules and supporting material.

Full Name of Tenderer

Signature of Tenderer or Authorised Representative

Position of Representative

Address of Tenderer

Signature and Address of Witness

Date

HIGH PERFORMANCE COMPUTING EQUIPMENT AND VISUALISATION FACILITIES FOR THE UNIVERSITY OF QUEENSLAND

THE UNIVERSITY OF QUEENSLAND

Schedule HPC-01 — High Performance Computing System Price Summary

Name of Tenderer			Date

Item	Installed Price	Associated Annual Charges	Remarks
Hardware Price (Total HPC-02)			
Software Price (Total HPC-03)			
Other Charges and Prices (Total HPC-04)			
Adjustments not included in above (Cross-reference to paragraph numbers in tender document)			
Total Net Price			

Price Related Matters

(Tenderers may wish to summarise price related matters (if any) not included in above. Cross-references to paragraph numbers of the tender document should be shown.)

HIGH PERFORMANCE COMPUTING EQUIPMENT AND VISUALISATION FACILITIES FOR THE UNIVERSITY OF QUEENSLAND

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Schedule HPC-02 — Hardware Prices — High Performance Computing System

If prices are subject to variation state basis at foot of schedule. Prices must be given for individual items.

Name of Tenderer:

Date:

Item		Purchase			Additional Information
Item #	Identification #	Short Description	Price including installation and acceptance costs (excluding freight, customs & primage) ($A)	Freight, customs and primage ($A)	Total Price ($A)	Annual maintenance including parts and one-shift operation ($A pa)	(i) Name of prime manufacturer (ii) Date first installed (iii) Warranty period

HIGH PERFORMANCE COMPUTING EQUIPMENT AND VISUALISATION FACILITIES FOR THE UNIVERSITY OF QUEENSLAND

Schedule HPC-03 — Software Prices — High Performance Computing System

Prices must be given for individual items; the schedule must include communications software, operating system, languages and all other software essential for the viable operation of the system.

Name of Tenderer

Date

Software Item			Either Purchase/Licence		or Annual Rental	Other Charges Payable
Item Identification # and name	Version and Release Date	Prime Supplier	Initial Purchase/Licence Fee (inc sources) ($A)	Annual Maintenance Fee (inc supply of all new versions) ($A)	Annual Rental Price (inc sources, maintenance and all new versions) ($A)	

HIGH PERFORMANCE COMPUTING EQUIPMENT AND
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Schedule HPC-04 — Other Prices — High Performance Computing System

Prices must be given for individual items. Prices are required for all items arising out of the specification for the installation and effective operation of the system not included in Schedules HPC-02 and HPC-03.

Name of Tenderer

Date

Item			Either Purchase		
Item #	Identification #	Short Description	Specification Paragraph Reference #	Price Installed ($A)	Annual continuing charges ($A pa)	or Annual Rental Charge (where applicable) ($A)	Basis of charging (where applicable)
				Totals			

Schedule VIS-01 — Visualisation Facility – Price Summary

Name of Tenderer			Date
Item	Installed Price	Associated Annual Charges	Remarks
Hardware Price (Total VIS-02)			
Software Price (Total VIS-03)			
Other Charges and Prices (Total VIS-04)			
Adjustments not included in above (Cross-reference to paragraph numbers in tender document)			
Total Net Price			

Price Related Matters
(Tenderers may wish to summarise price related matters (if any) not included in above. Cross-references to paragraph numbers of the tender document should be shown.)

HIGH PERFORMANCE COMPUTING EQUIPMENT AND
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Schedule VIS-02 — Hardware Prices — Visualisation Facility

If prices are subject to variation state basis at foot of schedule. Prices must be given for individual items.

Name of Tenderer

Date

Item		Purchase			Additional Information
Item #	Identification #	Short Description	Price including installation and acceptance costs (excluding freight, customs & primage) ($A)	Freight, customs and primage ($A)	Total Price ($A)	Annual maintenance including parts and one-shift operation ($A pa)	(i) Name of prime manufacturer (ii) Date first installed (iii) Warranty period

Schedule VIS-03 — Software Prices — Visualisation Facility

Prices must be given for individual items; the schedule must include communications software, operating system, languages and all other software essential for the viable operation of the facility.

Name of Tenderer

Date

Software Item			Either Purchase/Licence		or Annual Rental	Other Charges Payable
Item Ident # and name	Version and Release Date	Prime Supplier	Initial Purchase/Licence Fee (inc sources) ($A)	Annual Maintenance Fee (inc supply of all new versions) ($A)	Annual Rental Price (inc sources, maintenance and all new versions) ($A)	

THE UNIVERSITY
OF QUEENSLAND

Schedule VIS-04 — Other Prices — Visualisation Facility

Prices must be given for individual items. Prices are required for all items arising out of the specification for the installation and effective operation of the facility not included in Schedules VIS-02 and VIS-03.

Name of Tenderer

Date

Item			Either Purchase		
Item #	Identification #	Short Description	Specification Paragraph Reference #	Price Installed ($A)	Annual continuing charges ($A pa)	or Annual Rental Charge (where applicable) ($A)	Basis of charging (where applicable)
			Totals				