

CSAR Service
Consolidated Management Report
1st Quarter 2001

Management Summary

The system continues to be the flagship HPC facility for UK Academia and Industry, enabling World-Class research and development.

The number of users has grown to a total of 509 to date.

The Cray T3E (Turing) system continued to run almost to full capacity again this quarter.

The Origin 2000 128 (Fermat) continues to run almost to full capacity.

CfS remains active in the UK Grid Forum.

The first Origin 3000 128 (Green) is due to be commissioned in April.

A 128 CPU upgrade to Green is due to arrive at the end of April. This will enable CfS to provide a service with the single largest memory system in the country at 256 Gb.

Good progress is being made in a number of e-Science and Science application support areas.

Introduction

This Management Report includes a section for each of the main service functions:

1. Service Quality
2. HPC Services
3. Science Applications Support Services
4. Training & Education Services
5. User Registration & New User Services
6. Value-Added Services

Each section includes a status report for the period, including notable achievements and problems, also noteworthy items for the next period.

1. Service Quality

This section covers overall Customer Performance Assessment Ratings (CPARS), HPC System availability and usage, Service Quality Tokens and other information concerning issues, progress and plans for the CSAR Service.

1.1 CPARS

Table 1 gives the measure by which the quality of the CSAR Service is judged. It identifies the metrics and performance targets, with colour coding so that different levels of achievement against targets can be readily identified. Unsatisfactory actual performance will trigger corrective action.

CSAR Service - Service Quality Report - Performance Targets

Service Quality Measure	Performance Targets					
	White	Blue	Green	Yellow	Orange	Red
HPC Services Availability						
Availability in Core Time (% of time)	> 99.9%	> 99.5%	> 99.2%	> 98.5%	> 95%	95% or less
Availability out of Core Time (% of time)	> 99.8%	> 99.5%	> 99.2%	> 98.5%	> 95%	95% or less
Number of Failures in month	0	1	2 to 3	4	5	> 5
Mean Time between failures in 52 week rolling period (hours)	>750	>500	>300	>200	>150	otherwise
Fujitsu Service Availability						
Availability in Core Time (% of time)	> 99.9%	> 99.5%	> 99.2%	> 98.5%	> 95%	95% or less
Availability out of Core Time (% of time)	> 99.8%	> 99.5%	> 99.2%	> 98.5%	> 95%	95% or less
Help Desk						
Non In-depth Queries - Max Time to resolve 50% of all queries	< 1/4	< 1/2	< 1	< 2	< 4	4 or more
Non In-depth Queries - Max Time to resolve 95% of all queries	< 1/2	< 1	< 2	< 3	< 5	5 or more
Administrative Queries - Max Time to resolve 95% of all queries	< 1/2	< 1	< 2	< 3	< 5	5 or more
Help Desk Telephone - % of calls answered within 2 minutes	>98%	> 95%	> 90%	> 85%	> 80%	80% or less
Others						
Normal Media Exchange Requests - average response time	< 1/2	< 1	< 2	< 3	< 5	5 or more
New User Registration Time (working days)	< 1/2	< 1	< 2	< 3	< 4	otherwise
Management Report Delivery Times (working days)	< 1	< 5	< 10	< 12	< 15	otherwise
System Maintenance - no. of sessions taken per system in the month	0	1	2	3	4	otherwise

Table 1

Table 2 gives actual performance information for the period. Overall, the CPARS Performance Achievement over the 1st Quarter 2001 was satisfactory (see Table 3), i.e. Green measured against the CPARS performance targets.

CSAR Service - Service Quality Report - Actual Performance Achievement

Service Quality Measure	2000/1											
	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March
HPC Services Availability												
Availability in Core Time (% of time)	100%	100%	99.70%	100%	100%	100%	100%	100%	94.90%	99.70%	99.70%	100%
Availability out of Core Time (% of time)	99.5%	99.40	99.40	100%	100%	100%	100%	99.40	98.49%	99.50%	99.40	99.40
Number of Failures in month	1	1	2	0	0	0	0	2	4	1	1	1
Mean Time between failures in 52 week rolling period (hours)	437	515	461	461	626	730	1095	673	584	584	626	674
Fujitsu Service Availability												
Availability in Core Time (% of time)	100%	100%	100%	100%	98.4%	100%	100%	100%	100%	100%	100%	100%
Availability out of Core Time (% of time)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Help Desk												
Non In-depth Queries - Max Time to resolve 50% of all queries	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Non In-depth Queries - Max Time to resolve 95% of all queries	<1	<2	<1	<2	<2	<2	<1	<3	<3	<5	<5	<3
Administrative Queries - Max Time to resolve 95% of all queries	<1	<2	<0.5	<0.5	<2	<2	<0.5	<0.5	<5	<2	<2	<3
Help Desk Telephone - % of calls answered within 2 minutes	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Others												
Normal Media Exchange Requests - average response time	0	0	0	0	0	<0.5	0	<0.5	<0.5	<0.5	<0.5	0
New User Registration Time (working days)	0	0	0	0	0	0	0	0	0	0	0	0
Management Report Delivery Times (working days)	10	10	10	10	10	10	10	10	10	10	10	10
System Maintenance - no. of sessions taken per system in the month	1	1	2	2	2	2	1	2	1	0	2	1

Table 2

Notes:

- HPC Services Availability has been calculated using the following formulae, based on the relative NPB performance of Turing and Fermat at installation: [Turing availability x 122 / (122 + 3.5)] + [Fermat availability x 3.5 / (122 + 3.5)]
- Mean Time Between Failures for Service Credits is formally calculated from Go-Live Date.

Table 3 gives Service Credit values for each month to date. These are accounted on a quarterly basis, formally from the Go-Live Date. The values are calculated according to agreed Service Credit Ratings and Weightings.

CSAR Service - Service Quality Report - Service Credits

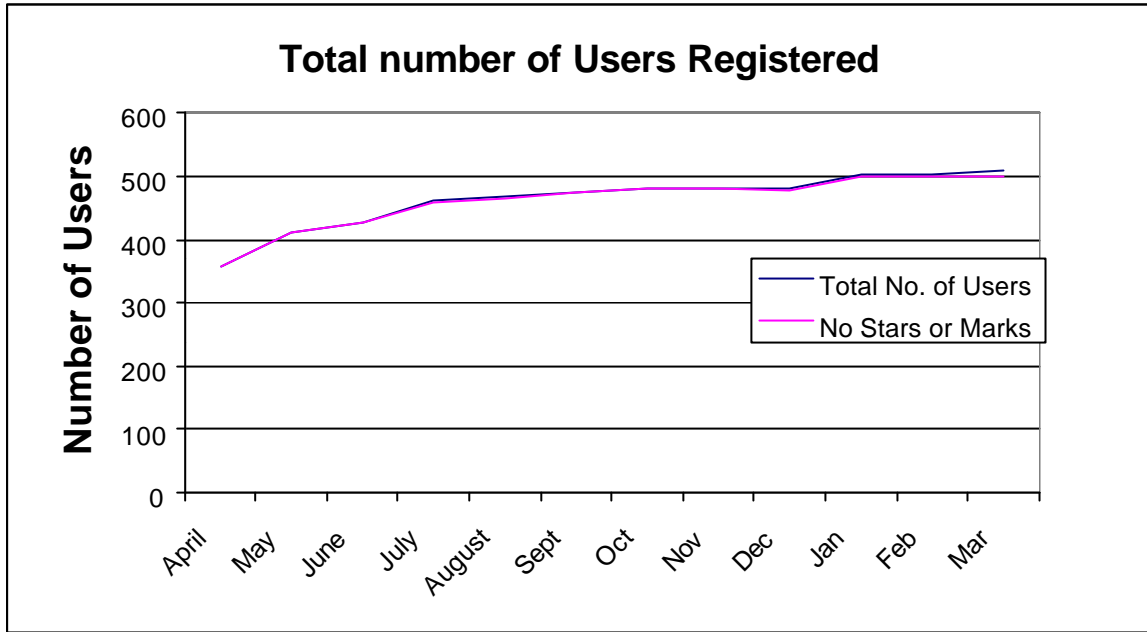
Service Quality Measure	2000/1											
	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March
HPC Services Availability												
Availability in Core Time (% of time)	-0.058	-0.058	-0.039	-0.058	-0.058	-0.058	-0.058	-0.058	0.195	-0.039	-0.039	-0.058
Availability out of Core Time (% of time)	-0.039	0	0	-0.047	-0.047	-0.047	-0.047	0	0	-0.039	0.000	0
Number of Failures in month	-0.008	-0.008	0	-0.009	-0.009	-0.009	-0.009	0	0	-0.008	-0.008	-0.008
Mean Time between failures in 52 week rolling period (hours)	0	-0.008	0	0	-0.008	-0.008	-0.009	-0.008	-0.008	-0.008	-0.008	-0.008
Help Desk												
Non In-depth Queries - Max Time to resolve 50% of all queries	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019
Non In-depth Queries - Max Time to resolve 95% of all queries	-0.016	0	-0.016	0	0	0	-0.016	0.016	0.016	0.031	0.031	0.016
Administrative Queries - Max Time to resolve 95% of all queries	-0.016	0	-0.019	-0.019	0	0	-0.019	-0.019	0.046	0	0	0.016
Help Desk Telephone - % of calls answered within 2 minutes	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
Others												
Normal Media Exchange Requests - average response time	0	0	0	0	0	-0.002	0	-0.002	-0.002	-0.002	-0.002	0
New User Registration Time (working days)	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019
Management Report Delivery Times (working days)	0	0	0	0	0	0	0	0	0	0	0	0
System Maintenance - no. of sessions taken per system in the month	-0.003	-0.003	0	0	0	0	-0.003	0	-0.003	-0.004	0	-0.003
Monthly Total & overall Service Quality Rating for each period:	-0.09	-0.06	-0.06	-0.09	-0.08	-0.08	-0.10	-0.06	0.11	-0.05	-0.03	-0.04
Quarterly Service Credits:	-0.21			-0.25			-0.05			-0.14		

Table 3

1.2 No. Of Registered Users

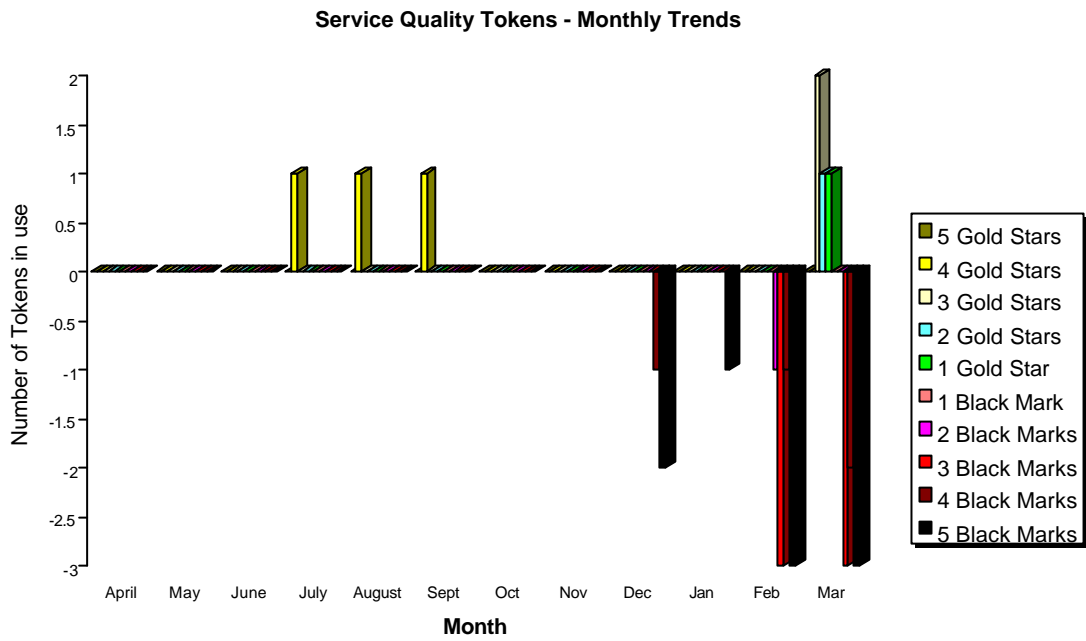
The current position at the end of the quarter is that there are 509 registered users of the CSAR Service.

It can be seen from the chart below that the number of users continues to grow steadily.



1.3 Service Quality Tokens

The graph below illustrates the monthly usage trend of Service Quality Tokens:



Over the course of the quarter the position is that as a management tool the Service Quality Tokens have been available to enable the users to provide qualitative feedback about all aspects of the service. This feedback is used as a mechanism to initiate change in the service where appropriate.

There are, at the end of the quarter, marks and stars allocated to the service as per the chart below.

SUMMARY OF SERVICE QUALITY TOKEN USAGE

No of Stars or Marks	Consortia	Date Allocated	Reason Given
3 Gold Stars	CSN003	12/03/01	Service greatly improved
3 Gold Stars	CSN006	15/03/01	Now achieving good throughout
2 Gold Stars	CSN003	12/03/01	Improved turnaround times on Queues
1 Gold Star	CSN003	16/02/01	Problems resolved
3 Black Marks	CSN006	16/02/01	Excessive Queue times
3 Black Marks	CSN001	21/02/01	Excessive Queue times
3 Black Marks	CSN006	16/02/01	Excessive Queue times
4 Black Marks	CSE006	08/03/01	Excessive Queue times
4 Black Marks	CSE002	16/02/01	Excessive Queue times
5 Black Marks	CSE006	08/03/01	Excessive Queue times
5 Black Marks	CSE002	16/02/01	Excessive Queue times
5 Black Marks	CSE006	09/03/01	Excessive Queue times

2. HPC Services Usage

Usage information is given in tabular form, and in graphical format. The system usage information covers:

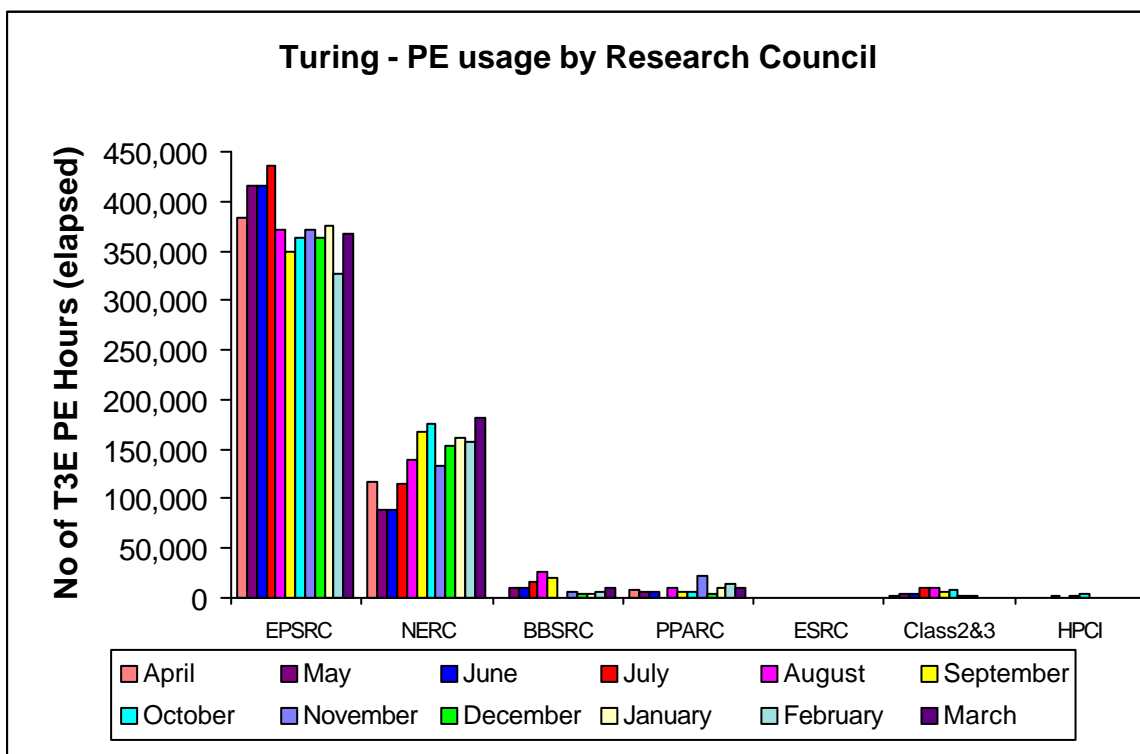
- CPU usage
- User Disk allocation
- HSM/tape usage

This is illustrated in a number of graphs including;

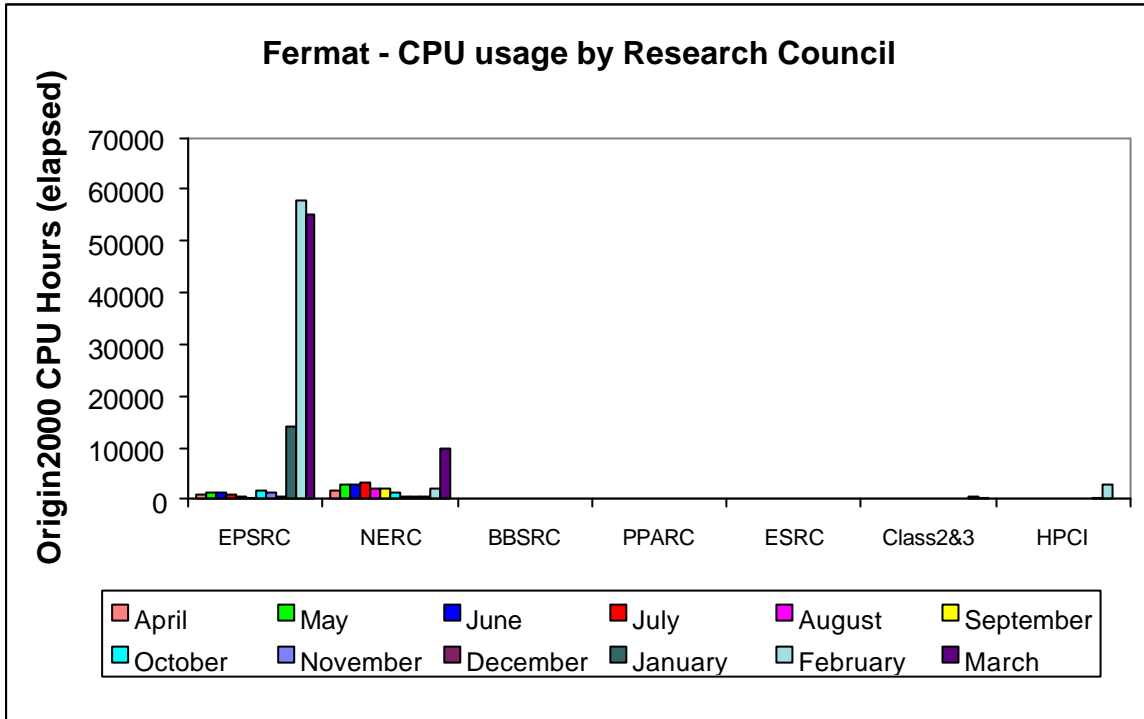
- MPP (T3E) Usage by month, showing usage each month of CPU (T3E PE Elapsed Hours), split by Research Council and giving the equivalent GFLOP-Years as per NPB. The Baseline Capacity is shown by an overlaid horizontal line.
- SMP (Origin) Usage by month, showing usage each month in CPU Hours, split by Research Council and giving the equivalent GFLOP-Years as per NPB. The Baseline Capacity is shown by an overlaid horizontal line.
- High Performance Disk (T3E) allocated for User Data by month, showing the allocated space each month in GBytes, split by Research Council. The Baseline Capacity (1 Terabyte) is shown by an overlaid horizontal line.
- Medium Performance Disk (Origin) allocated for User Data by month, showing the allocated space each month in GBytes, split by Research Council. The Baseline Capacity (1.5 Terabytes) is shown by an overlaid horizontal line.
- HSM/Tape Usage (T3E) by month, showing the volumes held each in GBytes, split by Research Council. The Baseline Capacity (16 Terabytes) available will be shown by an overlaid horizontal line.

2.1 Service Usage Charts

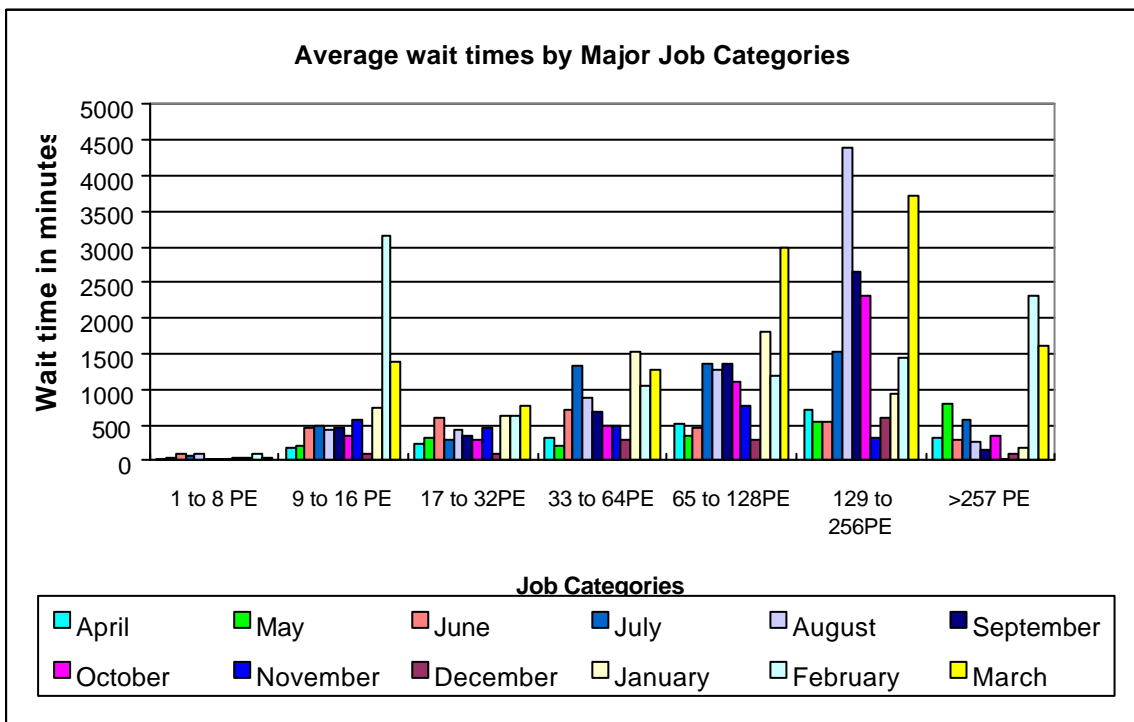
The graphs below show recent monthly CPU, PE, disk and HSM allocations and usage.



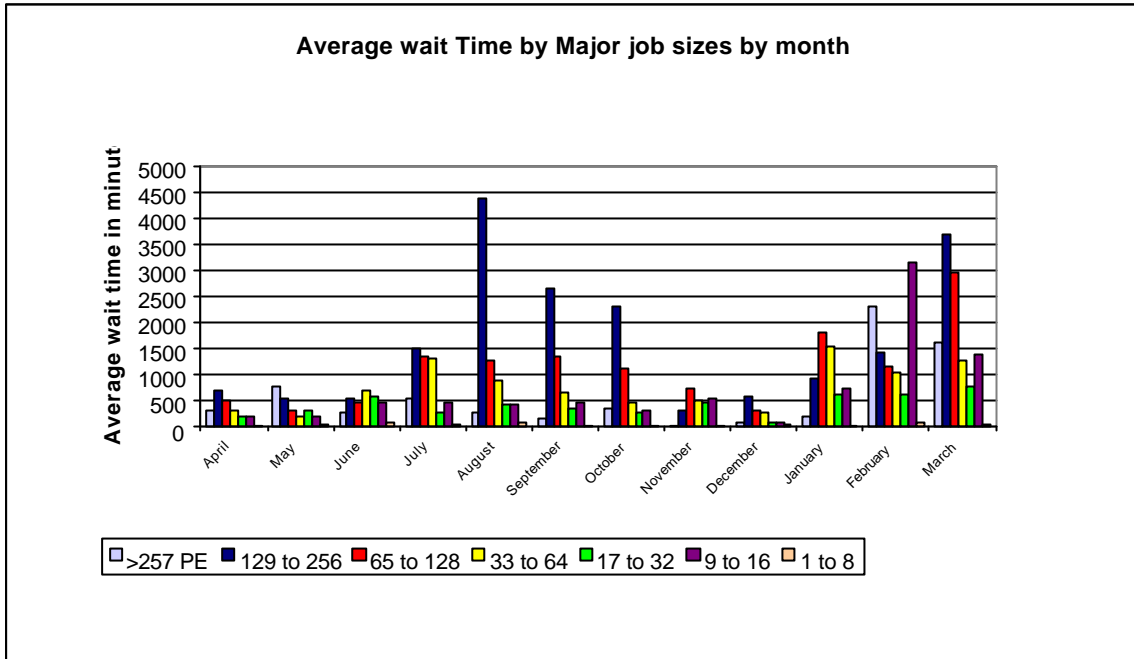
Turing PE usage is shown by Research Council during the last 12 months of service is shown in the above chart.



Origin2000 CPU usage is shown by Research Council during the last 12 months of service is shown in the above chart.

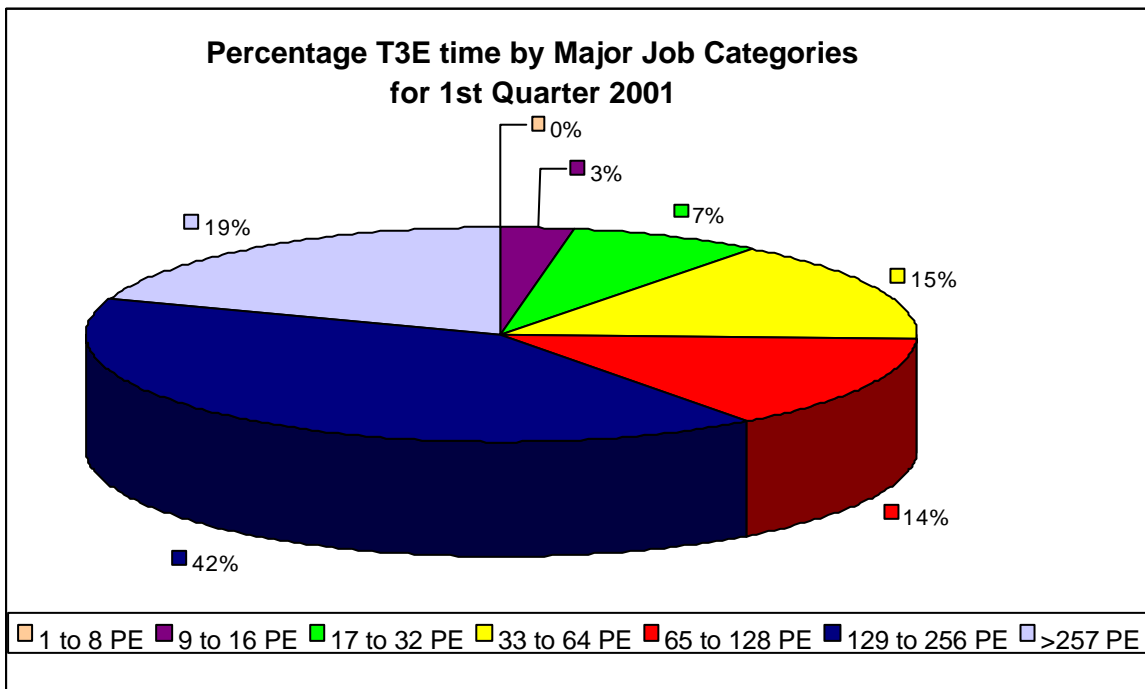


The above chart shows the wait time trend on the Turing system by job size. The trend is towards rising wait times. This is an unfortunate side effect of an over-full machine. The situation should however be alleviated as the new machines come on stream starting with Green which will come into service in April as a 128 processor system, rising to 256 processors in May.



CfS needs to ensure sufficient head room exists in the systems to reduce wait times to more satisfactory levels. It is intended that the provision of the planned SGI Origin 3000 systems (Green & Napier) will assist in better meeting the growth in user demands.

The next chart shows the percentage PE time utilisation by the major job categories on the Turing system for the year end 2000.



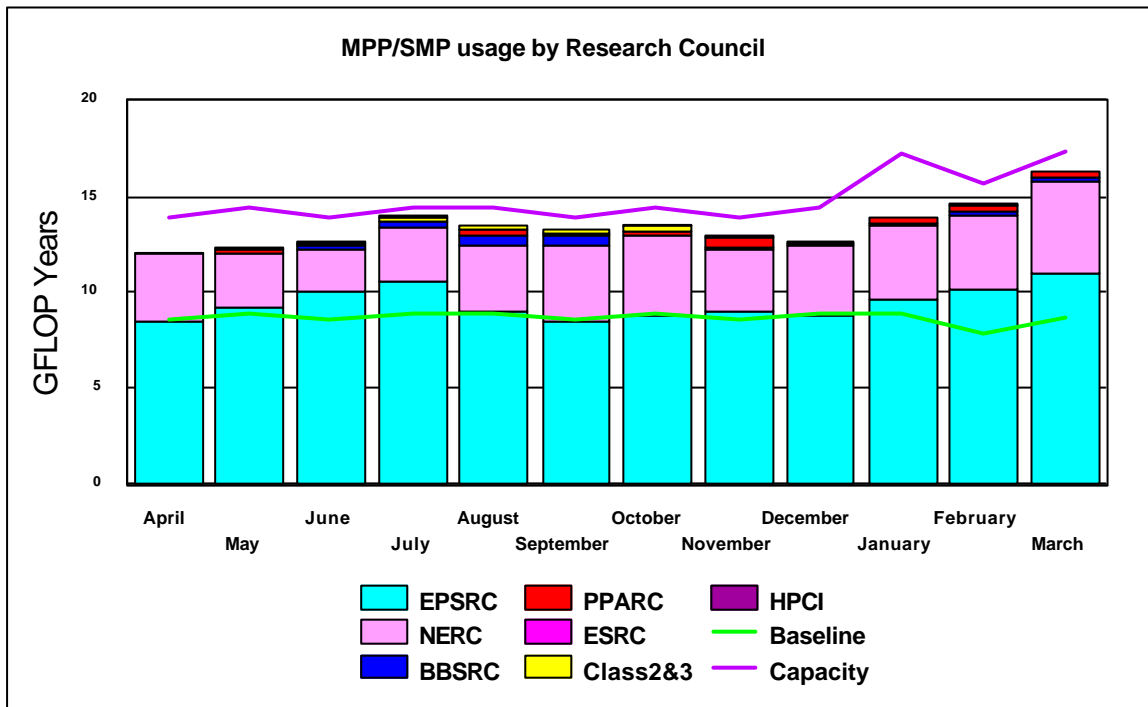
The trend on job size has shifted and now the predominant job size is towards the capability jobs.

2.2 System Usage Graphs

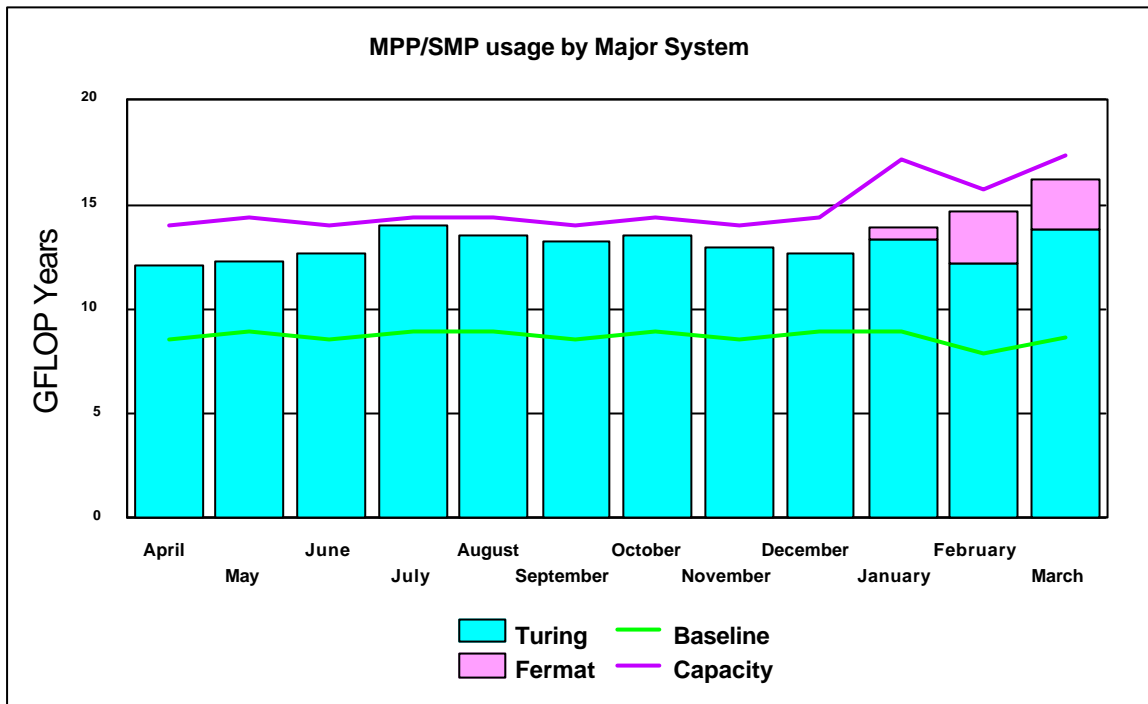
In all the Usage Charts, the baseline varies dependant on the number of days in each month, within a 365-day year.

2.2.1 Baseline System

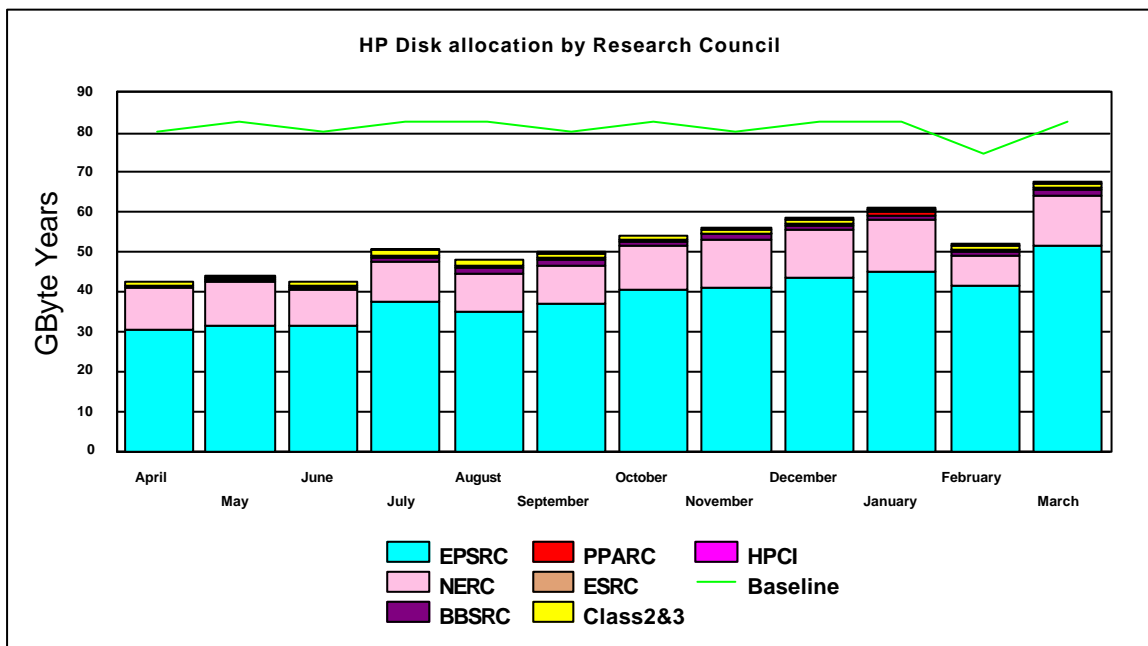
The graph below shows the GFLOP years utilisation on Turing by Research Council for the past year.



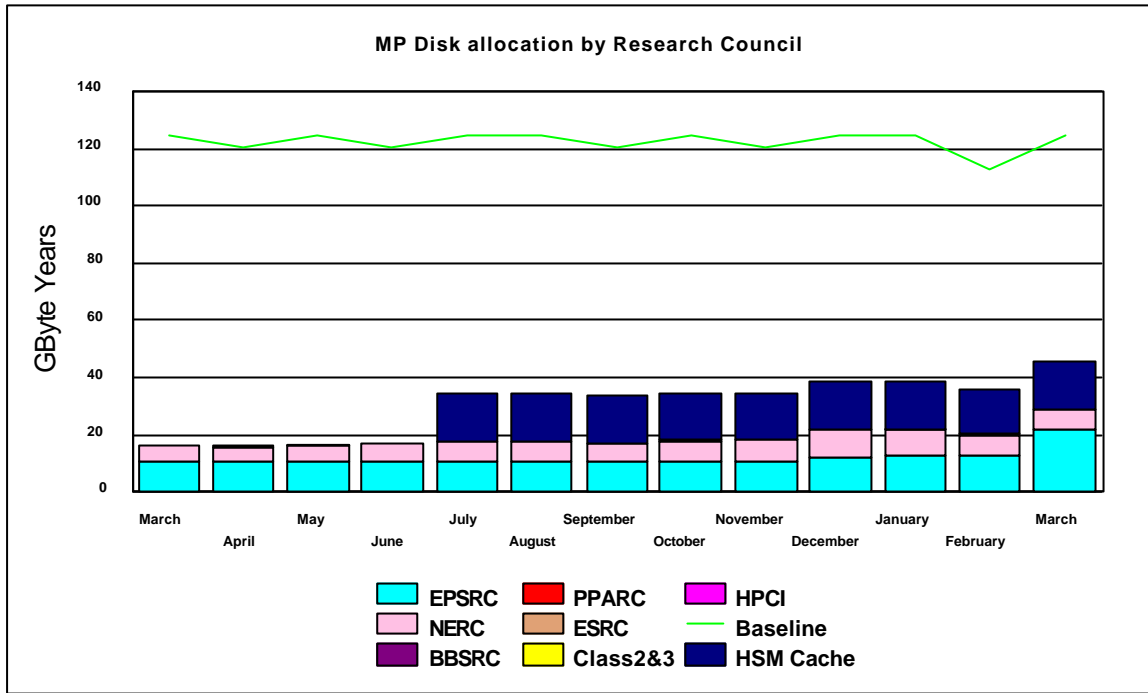
The graph below shows the historic GFLOP years usage on the major systems (Turing & Fermat) by Research Council for the past year. Usage demands continue to grow and the SGI Origin Sustems are meeting an increasing proportion of the total workload.



The next series of graphs illustrates the usage of the disk and HSM resources of the system.

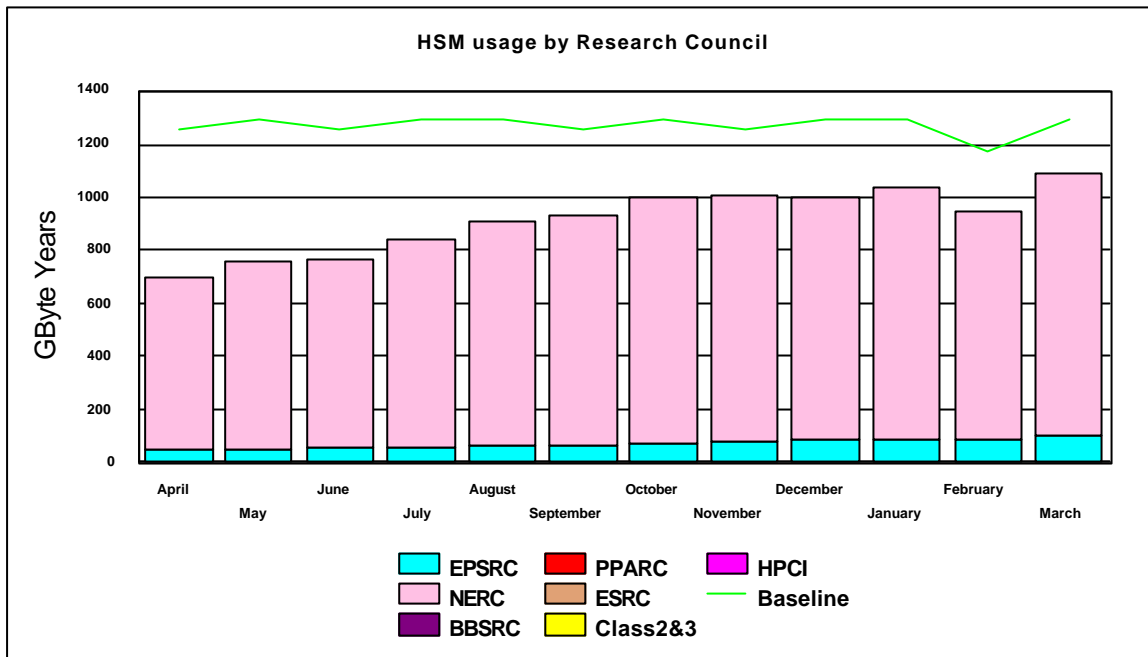


The preceding graph illustrates the historic allocation of the High Performance Disk on Turing. There is growth towards the Baseline.

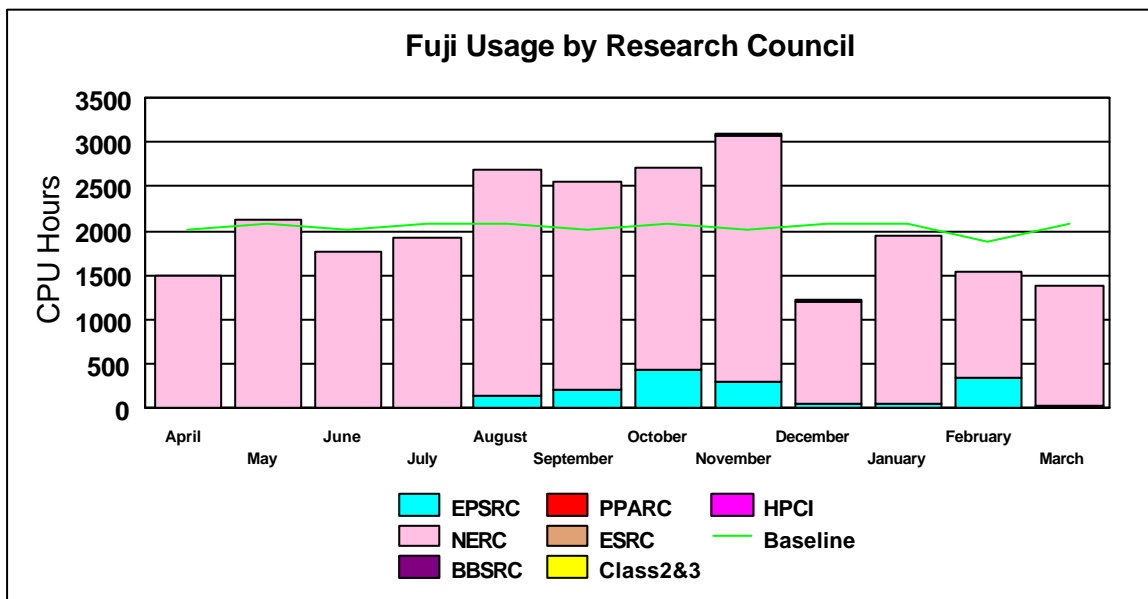


The graph above illustrates the historic allocation of the Medium Performance Disk on Fermat. From July 2000, 200 Gbytes has been used as a data cache for the enhanced HSM system.

The graph below shows the historic HSM usage by Research Council funded projects. The primary usage is for NERC, with steady growth in data volumes.



2.2.2 Fujitsu System Usage Graph



The above graph shows the current CPU usage on the Fujitsu VPP 300 NERC system based at the University of Manchester. The Fujitsu usage was below the baseline for the quarter, with variable demands.

2.2.3 Guest System Usage Graphs

A Compaq ES40 cluster is now situated at Manchester. A NEC SX4 vector system is available through CSC's Maidstone Data Centre. Usage is negligible at present.

2.3 Service Status, Issues and Plans

Status

Overall the service continues to be heavily used.

The upgraded Origin 2000 is now in full production and has been well used this Quarter.

The new Origin 3000 (Green) is to go into production soon as a 128 processor batch engine, with an additional 128 processors arriving before the end of April.

Issues

Wait times on Turing can still be excessive at times due to the time demands on the machine, however these are being carefully managed where at all possible.

Plans

Green, the new Origin 3000 system, is to be brought into service as a purely batch service and will provide the largest single memory machine in the UK available to the CSAR users with 256 Gb of usable memory.

3 Project Management, Documentation and User Feedback

This section covers aspects relating to the registration of projects and users, the management of projects and resources, topics associated with documentation and user feedback.

3.1 Project Management

Work was carried out to integrate the fuji /WORK area accounts into the registration system. ARS, the helpdesk call logging and tracking system, was further customised to provide automatic weekly emails to CfS staff. A new ARS schema, Change Management, was brought out of development into live service and will undergo a series of enhancements during the next quarter.

3.2 User Registration

Early users of fourier and kelvin were integrated into the registration system. Fourier registration is now enabled for the use of frontline staff via the registration system.

3.3 Annual Report

The CSAR Annual Report 1999-2000 has arrived from the publishers and has been circulated to all CSAR Principal Investigators.

3.4 User Survey

A summary report for the Second Annual User Survey has been produced and will be published on the CSAR webpages.

3.5 CSAR Audit

Professor M. J. Clark of Salford University is presently reviewing the CSAR and benchmark information provided.

3.6 CSAR User Liaison Forum/User Steering Group

As an essential part of the next High Performance Computing procurement, EPSRC held a series of regional seminars to maintain the full involvement of the academic community. Four meetings took place on the following dates:

Bristol	- @Bristol (Bristol Exploratory Centre) - 26 February 2001
London	- Royal Institution of Great Britain - 27 February 2001
Edinburgh	- Pollock Halls - 28 February 2001
Manchester	- Weston Building, Manchester Conference Centre - 1 March 2001

On each afternoon the CSAR Service held a User Liaison Forum including talks on the technology refresh and scientific presentations.

3.7 CSAR Focus

The 7th (Summer) edition of CSAR Focus is being produced. The 6th edition was distributed in January 2001.

3.9 Documentation

The CSAR website is being substantially updated to reflect the changes to the service associated with the Technology Refresh and includes information specific to all the new machines. Machine-specific sections have already been published for all seven machines.

A provisional website has been released for the two "HPC on Intel Itanium" Summer Schools (2nd - 6th July 2001 and also 8th - 12th October 2001). A new section entitled 'The CSAR Technology Refresh' has been published and a user questionnaire has been made available on the web in order to plan for the future of the CSAR Service more effectively, in light of user feedback. A section on IO porting has been developed and published.

The free code portability programme, to assist in providing information and support on the process of porting codes to run on the Technology Refresh system, was advertised on the web and in the CSAR bulletin.

CSAR published the HPC(X) questionnaire on the topic of HPC procurement on behalf of EPSRC/Idetica.

Additional information on the kelvin system and service, including an FAQ, was published on the web.

4 Science Application Support Services

Two new members of staff have been appointed: Jon Gibson and Mike Daw.

4.1 Consortia Support

Extensive single node optimisation for Turing has been carried out on behalf of one consortium.

Crystal properties has been installed on Fermat and a meeting was held regarding potential profiling of the Crystal MPP code.

Visualisation work has been performed on behalf of three groups. In one case this included the use of the new Virtual Reality Centre in Manchester Visualisation Centre.

More general support has been given to assist users in moving their codes to the upgraded fermat.

4.2 Training and Education

Courses given:

- Introduction to MPI
- Advanced MPI

- SGI Origin2000 Optimisation

Developments have been made to the following courses:

- IA-64 course (due to take place early May)
- Visualisation/Virtual Reality

4.3 Service Developments

4.3.1 Fermat

The default Fortran and C compilers on fermat were upgraded to version 7.3.1.2

Gaussian98 and amber 6.0 have been installed. Additional processors became available for batch use. Up to 64 of the 128 R12000 processors can be utilised in a single batch job.

4.3.2 Turing

Two new libraries were installed on Turing: pblasv2 and fxdr. The default version of the compilers was changed to 3.4.0.2

4.3.2 Green

Preparations are being made for the installation of the 128 processor MIPS R12000, 400MHz, 128GB memory total SGI Origin3000 system, Green. The machine was shipped in March 2001. All of the processors can be utilised in a single job.

4.3.4 Fourier

Preparations are being made to upgrade Fourier to a 32 processor system. 12 additional nodes for the prototype Itanium cluster arrived in March 2001. Conquest kernel has been ported.

4.3.5 Kelvin

- Users have been invited to make use of the new guest system
- The operating system will shortly be upgraded.
- Compaq will shortly be providing a course for CfS staff.

5 Collaboration and Conferences

5.1 UKHEC Reports

- The UKHEC case study on VIPAR has been submitted to EPCC for QA.
- The Terra consortium QA report has been received from EPCC and changes have been incorporated ready for publication.
- The VR/Visualisation Technology Watch Report has been completed and is being sent to Daresbury for QA.

5.2 UKHEC GRID Work

- Globus 1.1.3 has been installed on the Sun MDS server at MRCCS.
- MRCCS have visited Daresbury to see the HPC Portal and to discuss issues to do with restarting the UKHEC Grid.
- MRCCS has submitted an outline of a proposed Grid Report to Tony Hey, eScience director.

5.3 UKHEC Newsletter

MRCCS are editing the Spring issue. This is nearly complete.

5.4 MRCCS Projects

5.4.1 EuroGrid

A new member of staff, Dr Jon MacLaren, has been appointed and started work in March on the Eurogrid project. The MRCCS role in this project is to develop a GRID resource broker. Jon is currently completing an implementation of UNICORE on turing.

5.4.2 Global Supercomputer

- MRCCS has successfully bid to be the UK SCGlobal Constellation site. £ 30K has been awarded by EPSRC to establish an ACCESS Grid node at MC and the remaining £20K has been donated by Manchester Computing.
- MRCCS visited RAL to talk to the solar-terrestrial physics group resulting in the planning of a joint UK-US workshop for SCGlobal.
- John Brooke has applied for a Royal Society travel grant to visit Finland in June/July to work on solar-terrestrial physics via high performance visualization. Jo Leng has worked on visualization of sunspot data and will visit Finland to present this and prepare it for the collaborative STP work.
- MRCCS has been invited to present the global metacomputer at an international GRID workshop alongside Jack Dongarra of UKC and Ed Seidel of Max-Planck Institute. Preparative testing of the networks is already starting.

5.4.3 North West Centre for Advanced Virtual Prototyping

MRCCS is part of a consortium from the Universities of Manchester, Salford, Lancaster and UMIST, which has been awarded £1.7M from the OST North West Science Funds to set-up a Research Centre in Advanced Virtual Prototyping. This will result in the appointment of a new member of staff to work on the MRCCS component of the project - an advertisement is being prepared.

5.4.4 The Reality Grid Proposal

A major proposal for a GRID test-bed, called the RealityGrid has been submitted. This objective is to enable the realistic modelling of complex solid and fluid structures at the meso and nano-scale levels, and for the discovery of new materials. High performance computing and visualization are critical to this test-bed. The bid involves a collaboration between a number of high profile groups from different universities and has substantial industrial backing.

5.4.5 GRID-1 submitted to PPARC

A major eScience bid for £3 million has been submitted by PPARC. Manchester's role is to develop the Jodrell Bank pulsar search code in collaboration with Jodrell Bank Observatory and 5 PDRAs have been requested for this work. The other partners are Cardiff on gravitational wave detection and Birmingham on helioseismology.

5.4.6 UK-Access Grid Proposal

MRCCS is partnering CLRC, EPCC, Queen's University Belfast and Imperial College London to establish a UK Access Grid to complement the Manchester node.

5.4.7 EU IST Bid

MRCCS is part of a collaboration with FRZ Juelich, DWD (German Meteo), University of Southampton and Pallas to establish tools to make the leading Grid middleware tools interoperable. Argonne are the US partner and this work has important implications for the UK eScience work.

5.5 Events

5.5.1 Publications

A revision of the Metacomputing paper presented by Fumie Costen at HPCN 2000 was accepted by FGCS (Elsevier), to appear (818).

Stephen Pickles appears as co-author on a paper submitted to Phys. Rev. D.
(<http://xxx.lanl.gov/abs/hep-lat/0103023>)

Paper on resource scheduling submitted by John Brooke and Fumie Costen to Europar 2001.

John Brooke is co-author of a paper on intermittent behaviour in solutions of differential equations recently accepted for publication by Chaos.

John Brooke has contributed a paper to the NATO Advanced Workshop on Dynamical Systems and Dynamics to be published by Springer in June.

5.5.2 Events Attended

John Brooke and Jon MacLaren attended the Global Grid Forum 1 in Amsterdam, March 5-8 and subsequently attended the EuroGrid and DataGrid meetings.

John Brooke gave a presentation at Networkshop 2001 (March 26th) on the Global Metacomputing work.

5.5.3 Other Commitments

John Brooke is Local Chair of Track 16 of Europar 2001 (Cluster Computing) and will represent Track 16 at the final paper selection meeting on April 23rd 2001.

John Brooke is a member of the Program Committee for the I2CS Conference to be held at Ilmenau, Germany in June 2001.

John Brooke has recently reviewed a paper for Astronomy and Astrophysics on nonlinear analysis of the solar granulation.

6 Added Value Services

6.1 Joint Projects

The VIP Laboratory

One of the main goals of the VIP Laboratory is to enable high quality visualisation of data obtained through HPC. Where appropriate, an immersive environment using active stereo can be employed. A variety of research groups are currently using the facility, including applications in engineering, medicine, earth sciences, and building planning. Scientists can visualise their data without having to be skilled computer programmers. The software currently available to them includes AVS/Express multipipe edition, REALAX Virtual Reality software, and MUSE Development Environment 2000. For details on how to access this facility contact Dr Nigel John (n.w.john@man.ac.uk).

6.2 International Conferences

Organisation of the two European conferences to take place in Manchester in the summer of 2001, Europar and Eurographics, are progressing well. Europar will take place on 28th-31st August 2001, and Eurographics shortly afterwards on 3rd-7th September. Web pages are available for both: <http://www.man.ac.uk/europar/> and <http://www.eg.org/egorg2001>

Europar is the major European Parallel Computing Conference with over 400 attendees. In 2001 it is hosted by University of Manchester and is being organised jointly by Computer Science and CSAR/MRCCS. This is part of the CSAR value-added contribution of hosting a major international conference yearly.

Joanna Leng, John Brooke and Kaukab Jaffri of CSAR are on the Local Organising Committee. The closing date for papers submission has now passed (12th February 2001) and sponsorship for the project is being obtained. The Lord Mayor of Manchester has been invited to host the dinner reception at the Town Hall. This has been a major commitment in terms of time for all three.

6.3 Seminars

The following seminars were held in this quarter:

Dr. Dave Stainforth, Dept. of Physics, University of Oxford "Climate Prediction.com: A Multi-Million Member Climate Ensemble Experiment".

John Brookes, MRCCS, University of Manchester "Parallel Finite Element Analysis for Steady-State Navier Stokes Problems".

Milan Mihajlovic, Dept. of Computer Science, University of Manchester "A fast scalable parallel iterative algorithm for the solution of the biharmonic equation".

Omar Rana, Dept. of Computer Science, University of Wales, Cardiff "Building Java Scalable Multi-Agent Systems - Research Issues and Challenges".

Mark Riding/Mary McDerby, MVC, University of Manchester "VR over the World Wide Web".

George Leaver/Paul Lever, MVC, University of Manchester "Parallel Rendering in the AVS/Express Multi-Pipe Edition".

Theresa-Marie Rhyme, "Seeing Environmental Visualization from the Viewpoint of Personalization and Computer Games Technologies".

Rick Peterson, Computer Science, University of Leeds "Automatics mesh generation for fluids problems with free surfaces - the supportable load on a rotating cylinder".