# HECToR Quarterly Report

## January - March 2010

## 1 Introduction

This report covers the period from 1 January 2010 at 0800 to 1 April 2010 at 0800.

Section 3 summarises service availability and performance statistics for this quarter. Utilisation statistics are also available in Section 3. A summary table of the key performance metrics is included. Section 4 shows Helpdesk statistics.

The Appendices define some of the terminology and incident severity levels and list the current HECToR projects together with their overall utilisation profile to date.

This report and the additional SAFE report are available to view online at http://www.hector.ac.uk/about-us/reports/quarterly/1Q10.php

# 2  Executive Summary

- XT utilisation in 1Q10 was 72.0%, compared to 57.2% in 4Q09. Further details are available in Section 3.2 of the report.

- A Low Priority Access queue was enabled on HECToR on 16th December. This accounted for 15% of the overall utilisation in 1Q10. This initiative will remain in force until the arrival of Gemini in 4Q10.

- As a result of the EPSRC Resource Allocation Panel (RAP) which was held in February, six new projects started on HECToR in March. A total of 26,570,000 AUs were allocated.

- There were 14 service failures in 1Q10 as opposed to 8 in 4Q09. 12 failures were attributed to technology problems compared to 6 in 4Q09. 50% of the technology failures related to issues impacting the High Speed Network. There was one site failure in relation to a fault in the cooling system. The final failure was as a result of a fault on the external 11kV power network. The overall MTBF decreased from 4Q09 from 275 to 157 hours.

- The volume of single node failures has increased from the previous quarter. There were 68 node failures in 1Q10, as opposed to 50 in 4Q09. We are continuing to track and investigate the cause of all failures.

- The X2 Vector system was very reliable in 1Q10. Charging remains suspended on the X2, resulting in an overall utilisation of 56.9%, compared to 46.0% in 4Q09. Further details on X2 utilisation are available in Section 3.2.2.

- At the Helpdesk 1249 queries were resolved, compared to 1062 in 4Q09. User feedback was again varied in 1Q10, with a number of both positive and negative quality tokens received. All negative tokens were received from the n02 consortia in relation to service availability. An analysis of user quality tokens is contained in Section 4.1.

- The HECToR Archive solution was made available for early access users in November. During 1Q10 we have actively encouraged groups to archive data. By the end of 1Q10, 138TB of data had been archived from the Lustre filesystem.

- In 2Q10, the first phase of the Phase 2B upgrade will take place. This will include an operating system upgrade to CLE2.2, the installation of the external Lustre filesystem, and the installation of the XT6.

# 3  Quantitative Metrics

## 3.1 Reliability

The monthly numbers of incidents and failures (SEV 1 incidents) are shown in the table below:

|  | *January* | *February* | *March* |
|---|---|---|---|
| Incidents | **18** | **30** | **36** |
| Failures | **3** | **4** | **7** |

### 3.1.1 Performance Statistics

- MTBF = (732)/(number of failures in a month)

  Quarterly MTBF=(3x732)/(number of failures in a quarter)

| *Attribution* | *Metric* | *January* | *February* | *March* | *Quarterly* |
|---|---|---|---|---|---|
| Technology | Failures | 3 | 4 | 5 | 12 |
|  | MTBF | 244 | 183 | 146 | 183 |
| Service Provision | Failures | 0 | 0 | 1 | 1 |
|  | MTBF | ∞ | ∞ | 732 | 2196 |
| External | Failures | 0 | 0 | 1 | 1 |
|  | MTBF | ∞ | ∞ | 732 | 2196 |
| Overall | Failures | 3 | 4 | 7 | 14 |
|  | MTBF | **244** | **183** | **105** | **157** |

## 3.2 HECToR Utilisation

### 3.2.1 XT Utilisation
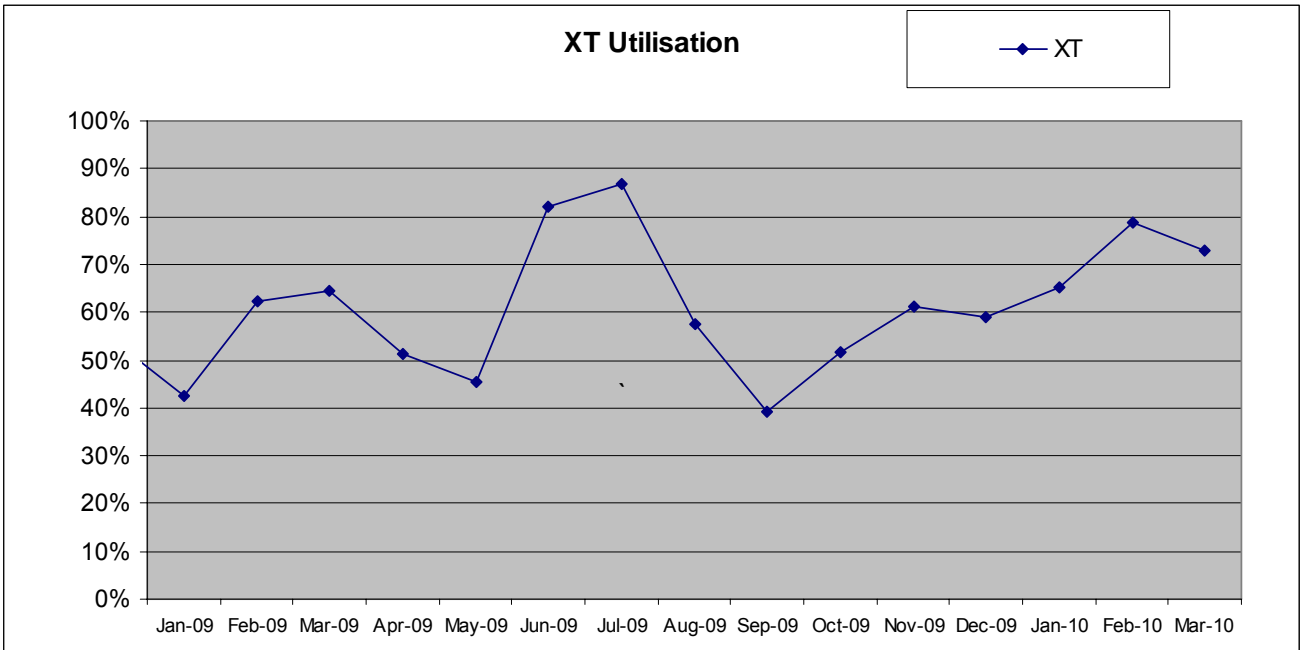


The utilisation quarterly average in 1Q10 was 72%, compared to 57% in 4Q09. Both Capability Incentives and the Low Priority Queue helped increase utilisation.

Capability Incentives

Discounting the very large jobs (8192 cores and above), there has been a general increase in the trend of capability usage month on month since October 2009 when incentives were introduced. The very large jobs tend to be run by a very small minority of users.
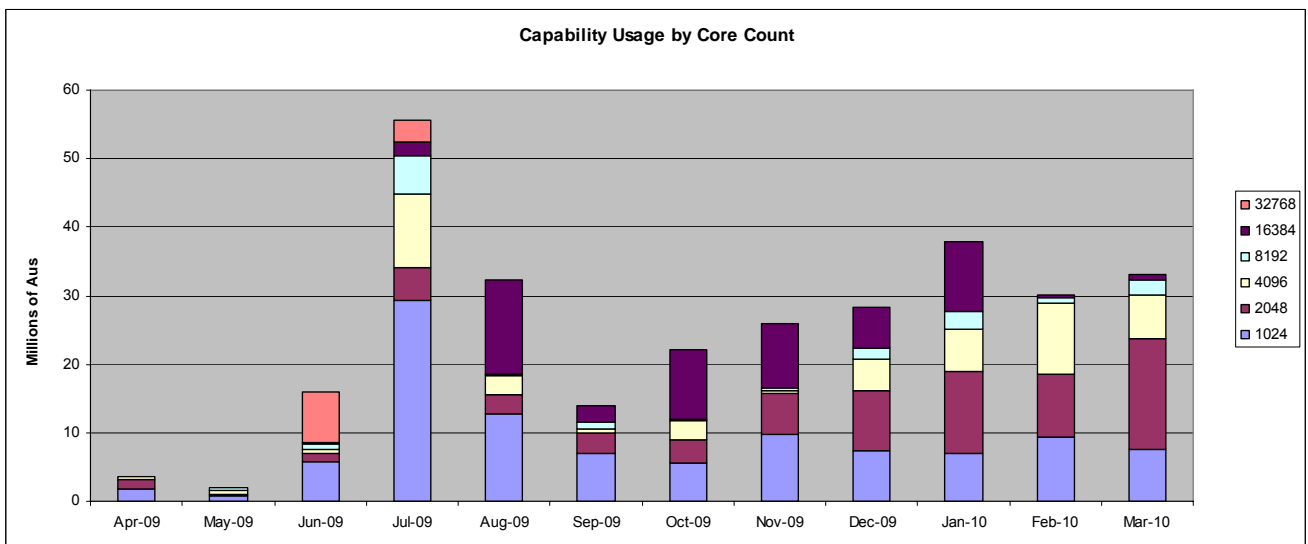


Note: The 32,768 core jobs run in June and July were Linpack runs.

Low Priority Access

A low priority access queue was introduced on 16th December. In 1Q10, low priority access accounted for 15% of the overall utilisation.

**XT Utilisation by AU**
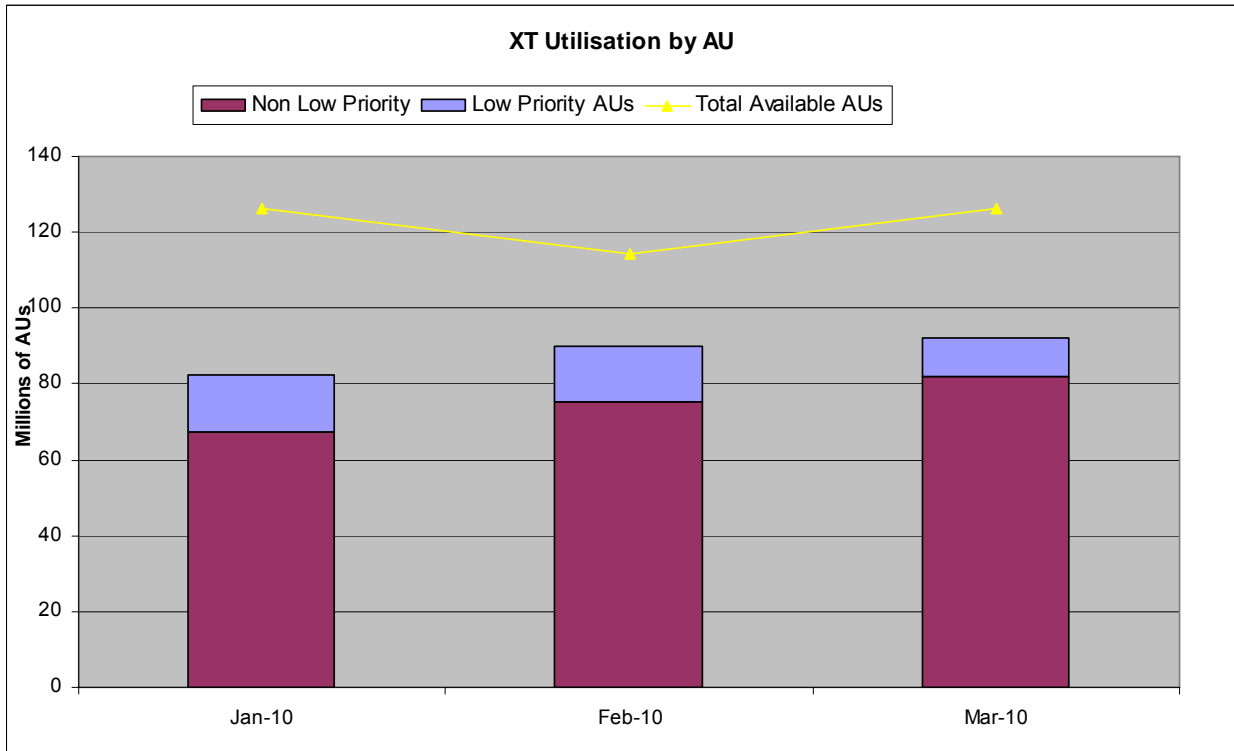


## 3.2.1.1 XT Utilisation by Queue
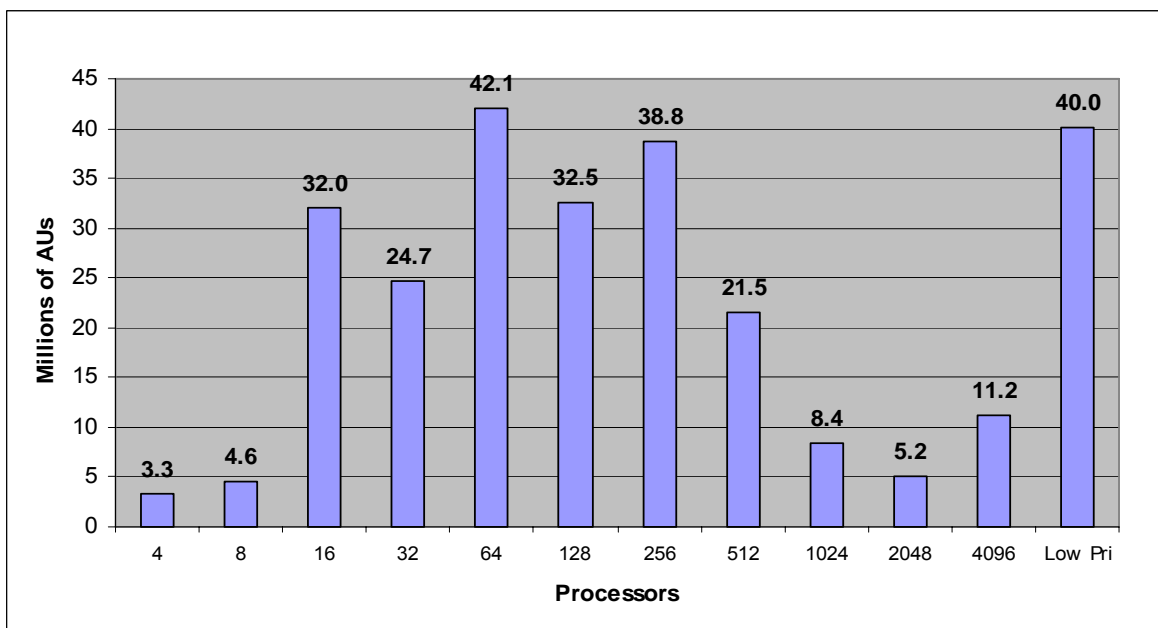
## 3.2.1.2 XT Number of jobs per queue



A bar chart titled with y-axis "Number of jobs" (0 to 30000) and x-axis "Processors". Values shown:

| Processors | Number of jobs |
|------------|----------------|
| 4 | 27236 |
| 8 | 10454 |
| 16 | 23962 |
| 32 | 9833 |
| 64 | 9293 |
| 128 | 3887 |
| 256 | 2187 |
| 512 | 884 |
| 1024 | 324 |
| 2048 | 145 |
| 4096 | 76 |
| Low Pri | 1964 |
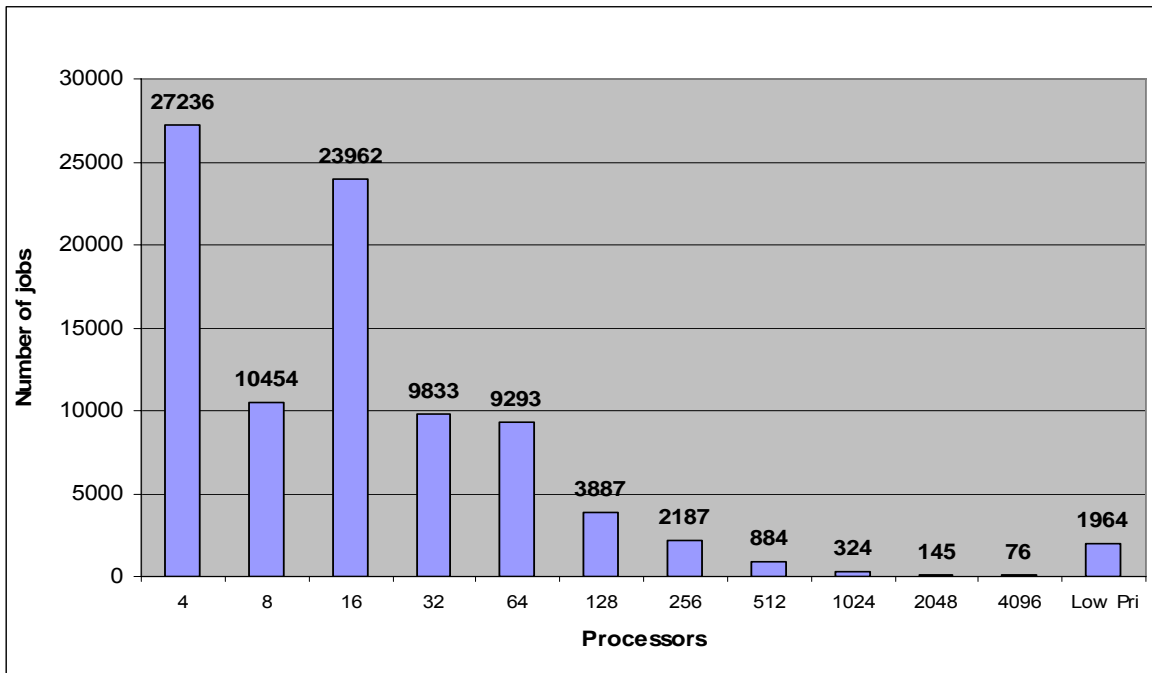
## 3.2.1.3 XT Utilisation by Consortium

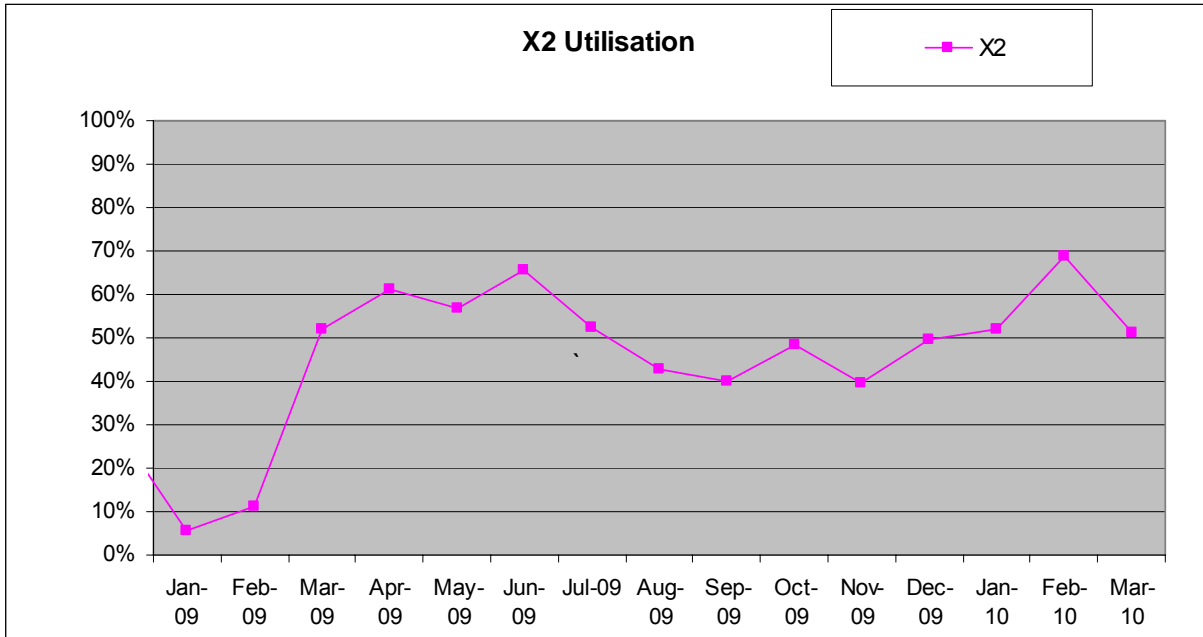| Project | AUs | Raw AUs | Low Priority Discount | Discounted AUs | Number of Jobs | %age of Use | Raw %age | Utilisation |
|---|---|---|---|---|---|---|---|---|
| y02 | 280,900 | 342,188 | 0 | 61,288 | 329 | 0.13% | 0.13% | 0.09% |
| y03 | 0 | 879 | 0 | 879 | 1972 | 0.00% | 0.00% | 0.00% |
| y04 | 4,429 | 4,431 | 0 | 2 | 11 | 0.00% | 0.00% | 0.00% |
| y05 | 111,567 | 140,341 | 0 | 28,774 | 284 | 0.05% | 0.05% | 0.04% |
| y06 | 86 | 86 | 0 | 0 | 2494 | 0.00% | 0.00% | 0.00% |
| y07 | 0 | 5 | 0 | 5 | 4 | 0.00% | 0.00% | 0.00% |
| y11 | 75 | 213 | 0 | 138 | 17 | 0.00% | 0.00% | 0.00% |
| z01 | 412,704 | 559,843 | 0 | 147,139 | 1520 | 0.20% | 0.21% | 0.15% |
| z02 | 2,541 | 7,924 | 0 | 5,383 | 282 | 0.00% | 0.00% | 0.00% |
| z03 | 3,164,796 | 3,729,710 | 0 | 564,914 | 5315 | 1.50% | 1.41% | 1.02% |
| **Internal Total** | **3,977,098** | **4,785,621** | **0** | **808,523** | **12228** | **1.88%** | **1.81%** | **1.30%** |
| c01 | 3,021,632 | 3,472,765 | 0 | 451,133 | 2334 | 1.43% | 1.31% | 0.95% |
| e01 | 3,486,407 | 3,771,281 | 187,425 | 284,874 | 2331 | 1.65% | 1.43% | 1.03% |
| e05 | 21,990,731 | 25,214,928 | 3,094,045 | 3,224,197 | 7287 | 10.41% | 9.54% | 6.87% |
| e10 | 511,843 | 643,329 | 0 | 131,486 | 170 | 0.24% | 0.24% | 0.18% |
| e19 | 6,171 | 6,171 | 0 | 0 | 9 | 0.00% | 0.00% | 0.00% |
| e24 | 14,301,508 | 16,165,575 | 234,420 | 1,864,067 | 2247 | 6.77% | 6.12% | 4.41% |
| e35 | 1,391,423 | 1,671,056 | 0 | 279,634 | 133 | 0.66% | 0.63% | 0.46% |
| e42 | 8,211,112 | 18,840,805 | 10,292,480 | 10,629,692 | 1578 | 3.89% | 7.13% | 5.14% |
| e63 | 2,600,738 | 2,600,867 | 0 | 128 | 717 | 1.23% | 0.98% | 0.71% |
| e68 | 1,220,441 | 14,520,240 | 13,288,511 | 13,299,799 | 1527 | 0.58% | 5.49% | 3.96% |
| e70 | 406,223 | 406,223 | 0 | 0 | 141 | 0.19% | 0.15% | 0.11% |
| e72 | 135,538 | 135,538 | 0 | 0 | 46 | 0.06% | 0.05% | 0.04% |
| e75 | 37,593 | 37,593 | 0 | 0 | 14 | 0.02% | 0.01% | 0.01% |
| e76 | 9,207,364 | 13,913,660 | 0 | 4,706,296 | 77 | 4.36% | 5.27% | 3.79% |
| e81 | 14,591 | 15,212 | 0 | 620 | 7 | 0.01% | 0.01% | 0.00% |
| e84 | 56,301 | 56,301 | 0 | 0 | 674 | 0.03% | 0.02% | 0.02% |
| e85 | 14,581 | 28,782 | 7,919 | 14,201 | 40 | 0.01% | 0.01% | 0.01% |
| e89 | 21,197,835 | 23,332,602 | 1,130,857 | 2,134,768 | 7079 | 10.04% | 8.83% | 6.36% |
| e93 | 177,314 | 184,301 | 0 | 6,986 | 200 | 0.08% | 0.07% | 0.05% |
| e101 | 252,012 | 252,012 | 0 | 0 | 55 | 0.12% | 0.10% | 0.07% |
| e102 | 2,814,993 | 2,949,226 | 0 | 134,232 | 441 | 1.33% | 1.12% | 0.80% |
| e104 | 60,937 | 61,304 | 0 | 367 | 140 | 0.03% | 0.02% | 0.02% |
| e105 | 19,683 | 19,683 | 0 | 0 | 7 | 0.01% | 0.01% | 0.01% |
| e107 | 32,521 | 471,885 | 438,057 | 439,364 | 594 | 0.02% | 0.18% | 0.13% |
| e108 | 130,685 | 133,633 | 0 | 2,948 | 153 | 0.06% | 0.05% | 0.04% |
| e110 | 4,777,189 | 8,350,182 | 3,288,603 | 3,572,993 | 903 | 2.26% | 3.16% | 2.28% |
| e113 | 3,786 | 3,791 | 0 | 5 | 135 | 0.00% | 0.00% | 0.00% |
| e120 | 54,121 | 55,847 | 0 | 1,726 | 144 | 0.03% | 0.02% | 0.02% |
| e121 | 732,330 | 2,384,298 | 1,651,968 | 1,651,968 | 1071 | 0.35% | 0.90% | 0.65% |
| e122 | 1,134,683 | 5,472,052 | 4,307,811 | 4,337,370 | 650 | 0.54% | 2.07% | 1.49% |
| e124 | 3,134,741 | 3,732,665 | 0 | 597,924 | 204 | 1.48% | 1.41% | 1.02% |
| e125 | 628,877 | 686,175 | 0 | 57,298 | 99 | 0.30% | 0.26% | 0.19% |
| e126 | 347,803 | 347,803 | 0 | 0 | 14 | 0.16% | 0.13% | 0.09% |
| e131 | 2,391 | 2,391 | 0 | 0 | 50 | 0.00% | 0.00% | 0.00% |
| e132 | 94 | 94 | 0 | 0 | 24 | 0.00% | 0.00% | 0.00% |
| e134 | 15,946 | 15,946 | 0 | 0 | 6 | 0.01% | 0.01% | 0.00% |
| e135 | 65,923 | 65,923 | 0 | 0 | 274 | 0.03% | 0.02% | 0.02% |
| e136 | 35,939 | 35,960 | 0 | 21 | 57 | 0.02% | 0.01% | 0.01% |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| e137 | 9,483 | 9,483 | 0 | 0 | 19 | 0.00% | 0.00% | 0.00% |
| e138 | 0 | 297 | 0 | 297 | 53 | 0.00% | 0.00% | 0.00% |
| e139 | 201,055 | 234,119 | 0 | 33,064 | 838 | 0.10% | 0.09% | 0.06% |
| e142 | 198,094 | 228,400 | 0 | 30,307 | 10 | 0.09% | 0.09% | 0.06% |
| e145 | 3,217 | 3,217 | 0 | 0 | 21 | 0.00% | 0.00% | 0.00% |
| e147 | 18,982 | 18,982 | 0 | 0 | 35 | 0.01% | 0.01% | 0.01% |
| e148 | 1 | 1 | 0 | 0 | 6 | 0.00% | 0.00% | 0.00% |
| e151 | 110,760 | 110,760 | 0 | 0 | 29 | 0.05% | 0.04% | 0.03% |
| e153 | 462,113 | 462,113 | 0 | 0 | 125 | 0.22% | 0.17% | 0.13% |
| e157 | 8 | 8 | 0 | 0 | 19 | 0.00% | 0.00% | 0.00% |
| u03 | 1,579 | 1,643 | 0 | 65 | 30 | 0.00% | 0.00% | 0.00% |
| **EPSRC Total** | **103,239,289** | **151,127,119** | **37,922,096** | **47,887,831** | **32817** | **48.88%** | **57.19%** | **41.20%** |
| n01 | 8,095,220 | 8,117,748 | 0 | 22,528 | 3231 | 3.83% | 3.07% | 2.21% |
| n02 | 32,117,681 | 33,407,946 | 822,545 | 1,290,264 | 35874 | 15.21% | 12.64% | 9.11% |
| n03 | 41,141,559 | 41,484,862 | 0 | 343,303 | 6898 | 19.48% | 15.70% | 11.31% |
| n04 | 17,700,886 | 18,810,754 | 0 | 1,109,867 | 3808 | 8.38% | 7.12% | 5.13% |
| **NERC Total** | **99,055,347** | **101,821,309** | **822,545** | **2,765,963** | **49811** | **46.90%** | **38.53%** | **27.76%** |
| b09 | 547,695 | 547,695 | 0 | 0 | 213 | 0.26% | 0.21% | 0.15% |
| b10 | 1,832 | 1,833 | 0 | 1 | 134 | 0.00% | 0.00% | 0.00% |
| b100 | 26,804 | 27,852 | 0 | 1,048 | 34 | 0.01% | 0.01% | 0.01% |
| **BBSRC Total** | **576,331** | **577,381** | **0** | **1,049** | **381** | **0.27%** | **0.22%** | **0.16%** |
| p01 | 2,699 | 2,861 | 0 | 162 | 130 | 0.00% | 0.00% | 0.00% |
| **STFC Total** | **2,699** | **2,861** | **0** | **162** | **130** | **0.00%** | **0.00%** | **0.00%** |
| t01 | 1,465,395 | 1,465,487 | 0 | 92 | 613 | 0.69% | 0.55% | 0.40% |
| x01 | 757,580 | 1,983,832 | 1,223,580 | 1,226,252 | 1071 | 0.36% | 0.75% | 0.54% |
| x03 | 323,791 | 323,791 | 0 | 0 | 100 | 0.15% | 0.12% | 0.09% |
| x04 | 279,003 | 284,494 | 0 | 5,491 | 71 | 0.13% | 0.11% | 0.08% |
| x05 | 751,049 | 834,036 | 0 | 82,987 | 299 | 0.36% | 0.32% | 0.23% |
| **External Total** | **3,576,819** | **4,891,641** | **1,223,580** | **1,314,822** | **2154** | **1.69%** | **1.85%** | **1.33%** |
| d03 | 76,145 | 105,195 | 0 | 29,050 | 143 | 0.04% | 0.04% | 0.03% |
| d04 | 3,008 | 7,132 | 0 | 4,124 | 541 | 0.00% | 0.00% | 0.00% |
| d11 | 4,774 | 4,774 | 0 | 0 | 103 | 0.00% | 0.00% | 0.00% |
| d14 | 697,922 | 922,279 | 0 | 224,357 | 173 | 0.33% | 0.35% | 0.25% |
| d15 | 985 | 985 | 0 | 0 | 108 | 0.00% | 0.00% | 0.00% |
| **Directors Time Total** | **782,833** | **1,040,365** | **0** | **257,532** | **1068** | **0.37%** | **0.39%** | **0.28%** |
| **Total** | **211,210,417** | **264,246,298** | **39,968,220** | **53,035,881** | **98589** | **100.00%** | **100.00%** | **72.03%** |

## 3.2.2 X2 Utilisation



X2 utilisation in 1Q10 was 57% compared to 46% in 4Q09. The decision was taken by EPSRC in 1Q10 to extend the suspension of charging on the X2 through to the end of 2010.
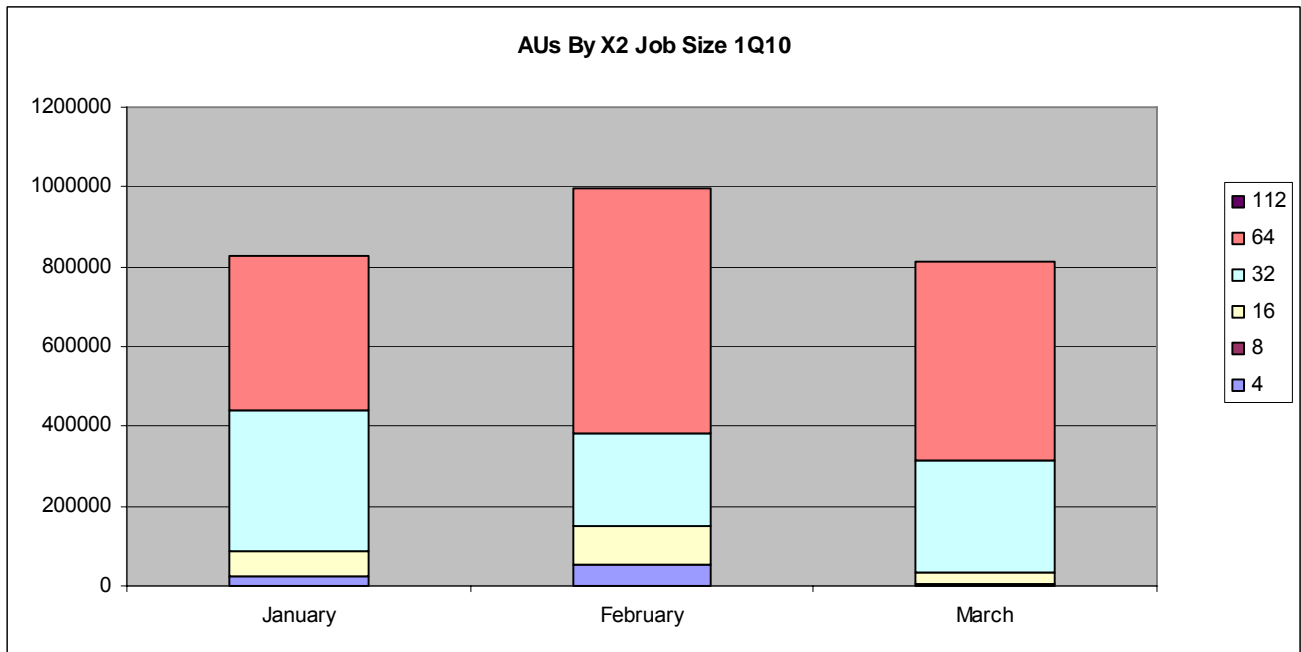
## 3.2.2.1 X2 Utilisation by Consortium

| Project | AUs | Raw AUs | Low Priority Discount | Discounted AUs | # of Jobs | Raw %age | Utilisation |
|---|---|---|---|---|---|---|---|
| y02 | 0 | 156 | 0 | 156 | 10 | 0.01% | 0.00% |
| y05 | 0 | 671 | 0 | 671 | 35 | 0.03% | 0.01% |
| z01 | 0 | 1 | 0 | 1 | 9 | 0.00% | 0.00% |
| z03 | 0 | 230 | 0 | 230 | 8 | 0.01% | 0.00% |
| **Internal Total** | **0** | **1,058** | **0** | **1,058** | **62** | **0.04%** | **0.02%** |
| e01 | 0 | 1,569,430 | 0 | 1,569,430 | 437 | 59.45% | 33.80% |
| e05 | 0 | 708,268 | 0 | 708,268 | 358 | 26.83% | 15.26% |
| e24 | 0 | 260,895 | 0 | 260,895 | 113 | 9.88% | 5.62% |
| e42 | 0 | 328 | 0 | 328 | 314 | 0.01% | 0.01% |
| e75 | 0 | 81,123 | 0 | 81,123 | 150 | 3.07% | 1.75% |
| e85 | 0 | 9 | 0 | 9 | 1 | 0.00% | 0.00% |
| e89 | 0 | 18,107 | 0 | 18,107 | 13 | 0.69% | 0.39% |
| **EPSRC Total** | **0** | **2,638,160** | **0** | **2,638,160** | **1386** | **99.93%** | **56.82%** |
| d04 | 0 | 858 | 0 | 858 | 376 | 0.03% | 0.02% |
| **DirectorsTime Total** | **0** | **858** | **0** | **858** | **376** | **0.03%** | **0.02%** |
| **Total** | **0** | **2,640,077** | **0** | **2,640,077** | **1824** | **100.00%** | **56.86%** |

## 3.3. Performance Metrics

| Metric | TSL(%) | FSL(%) | Jan-10 | Feb-10 | Mar-10 | 1Q10 |
|---|---|---|---|---|---|---|
| Technology reliability (%) | 85.00% | 98.50% | 98.4 | 96.9 | 97.9 | 97.8 |
| Technology MTBF (hours) | 100 | 126.4 | 244.0 | 183.0 | 146.4 | 183.0 |
| Technology Throughput, hours/year | 7000 | 8367 | 8504 | 8379 | 8047 | 8310 |
| Capability jobs completion rate | 70% | 90% | 96.9% | 100.0% | 97.7% | 98.20% |
| Non in-depth queries resolved within 1 day (%) | 85% | 97% | 100.0% | 100.0% | 98.9% | 99.6% |
| Number of SP FTEs | 7.3 | 8.0 | 8.1 | 8.7 | 9.4 | 8.7 |
| SP Serviceability (%) | 80.00% | 99.00% | 100.0% | 100.0% | 97.2% | 99.0% |

*Colour coding:*

| | |
|---|---|
| Exceeds FSL | |
| Between TSL and FSL | |
| Below TSL | |

# 4. Helpdesk

A total of 1249 queries with a specified service metric were completed in this period.

## Helpdesk Targets

| Metric | Pass | Total | Fraction | Target |
|--------|------|-------|----------|--------|
| All queries finished in 1 day | 1044 | 1048 | 99.6% | 97.0% |
| Admin queries finished in 1 day | 969 | 973 | 99.6% | 97.0% |
| Queries assigned in 30 min | 1229 | 1235 | 99.5% | 97.0% |
| Technical assessments in 10 days | 31 | 37 | 83.8% | 97.0% |

## Queries by Service Metric

| Service Metric | Queries | Percentage |
|----------------|---------|------------|
| Automatic | 679 | 54.4% |
| Admin | 294 | 23.5% |
| In-depth | 164 | 13.1% |
| Technical | 75 | 6.0% |
| Technical assessment class-1a | 15 | 1.2% |
| Technical assessment class-1b | 10 | 0.8% |
| Technical assessment class-2a | 8 | 0.6% |
| Technical assessment class-2b | 4 | 0.3% |

## Queries by Category

| Query Category | Queries | Percentage |
|----------------|---------|------------|
| New User | 190 | 15.2% |
| Set group quotas | 154 | 12.3% |
| Set user quotas | 106 | 8.5% |
| New Password | 79 | 6.3% |
| User behaviour | 75 | 6.0% |
| Access to HECToR | 74 | 5.9% |
| None | 71 | 5.7% |
| 3rd Party Software | 56 | 4.5% |
| Add to group | 52 | 4.2% |
| Disk, tapes, resources | 49 | 3.9% |
| Node Failure | 46 | 3.7% |
| Batch system and queues | 46 | 3.7% |
| Compilers and system software | 36 | 2.9% |
| Join Project | 32 | 2.6% |
| New Group | 29 | 2.3% |
| User programs | 24 | 1.9% |
| Login, passwords and ssh | 21 | 1.7% |
| SAFE | 19 | 1.5% |
| Archive | 16 | 1.3% |
| Other | 14 | 1.1% |
| Update account | 11 | 0.9% |

| | | |
|---|---|---|
| Create certificate | 10 | 0.8% |
| Remove account | 9 | 0.7% |
| Grid | 8 | 0.6% |
| Courses | 7 | 0.6% |
| Delete from group | 5 | 0.4% |
| Static website | 4 | 0.3% |
| Performance and scaling | 2 | 0.2% |
| Porting | 1 | 0.1% |
| Network | 1 | 0.1% |
| Delete from project | 1 | 0.1% |
| Delete Certificate | 1 | 0.1% |

## Queries by Handler Category

| Handlers | Total | Admin | Automatic | Technical | In-depth | Technical assessment class-1 | Technical assessment class-2 | %age |
|---|---|---|---|---|---|---|---|---|
| USL | 361 | 273 | | 40 | 48 | | | 28.9% |
| CSE | 120 | | | 2 | 81 | 25 | 12 | 9.6% |
| OSG | 737 | 21 | 679 | 25 | 12 | | | 59.0% |
| Cray Systems | 31 | | | 8 | 23 | | | 2.5% |

### 4. 1 Quality Tokens

A number of quality tokens were set by users during 1Q10.

| *Project* | *Negative Tokens* | *Positive Tokens* |
|---|---|---|
| e24 | | 3 |
| e102 | | 5 |
| e136 | | 4 |
| e142 | | 5 |
| n02 | 18 | |
| **Total** | **18** | **17** |

As above, all negative tokens were received from the n02 group. These were all in relation to service downtime and came from two users. The majority of positive feedback can be linked to a specific user query where the user had interaction with one of the support teams.

This is a pattern which can be seen on the service as a whole. Since the beginning of the service, a total of 63 negative tokens have been set, of which 55 have been set by n02, and the remaining 8 by another 3 projects. Again, the negative feedback was primarily in relation to the availability of the service. In contrast to this, 124 positive tokens have been set in the same period by a total of 15 projects. Our European users on the e24 (DEISA) project have been by far the most positive, with a total of 35 positive tokens and no negative tokens.

## *Appendix A: Terminology*

**TSL** : Threshold Service Level

**FSL** : Full Service Level

**SDT** : Scheduled Down Time

**UDT** : Unscheduled Down Time

**WCT** : Wall Clock Time

**MTBF** : Mean Time Between Failures = 732/Number of Failures

**SP** : Service Provision

**SP Serviceability%** = $100*(WCT-SDT-UDT(SP))/(WCT-SDT)$

**Technology Reliability %** = $100*(1-(UDT(Technology)/(WCT-SDT))$

## Incident Severity Levels

**SEV 1** — anything that comprises a FAILURE as defined in the contract with EPSRC.

**SEV 2** — NON-FATAL incidents that typically cause immediate termination of a user application, but not the entire user service.

The service may be so degraded (or liable to collapse completely) that a controlled, but unplanned (and often very short-notice) shutdown is required or unplanned downtime subsequent to the next planned reload is necessary.

This category includes unrecovered disc errors where damage to file systems may occur if the service was allowed to continue in operation; incidents when although the service can continue in operation in a degraded state until the next reload, downtime at less than 24 hours notice is required to fix or investigate the problem; and incidents whereby the throughput of user work is affected (typically by the unrecovered disabling of a portion of the system) even though no subsequent unplanned downtime results.

**SEV 3** — NON-FATAL incidents that typically cause immediate termination of a user application, but the service is able to continue in operation until the next planned reload or re-configuration.

**SEV 4** — NON-FATAL recoverable incidents that typically include the loss of a storage device, or a peripheral component, but the service is able to continue in operation largely unaffected, and typically the component may be replaced without any future loss of service.

## Appendix B: Projects on HECToR

| Code | Title | Funding Body | Class | PI | Total AUs allocated | AUs used | AUs left |
|------|-------|--------------|-------|-----|--------------------:|---------:|---------:|
| **EPSRC Projects** | | | | | | | |
| c01 | Support of EPSRC/STFC SLA | EPSRC | Class1a | Dr Richard Blake | 30,803,723 | 17,912,265 | 12,891,458 |
| e01 | UK Turbulence Consortium | EPSRC | Class1a | Dr Gary N Coleman | 483,969,876 | 6,975,705 | 476,994,171 |
| e05 | Materials Chemistry HPC Consortium | EPSRC | Class1a | Prof C Richard A Catlow | 1,139,124,000 | 63,533,888 | 1,075,530,112 |
| e10 | GENIUS | EPSRC | Class1a | Prof Peter Coveney | 10,248,188 | 6,102,922 | 4,145,266 |
| e24 | DEISA | EPSRC | Class1a | Mrs Alison Kennedy | 168,707,436 | 66,294,262 | 102,413,174 |
| e34 | Hydrogen vacancy distribution in magnesium hydride | EPSRC | Class2a | Prof Nora de Leeuw | 100,000 | 34,124 | 65,876 |
| e35 | Non-adiabatic processes | EPSRC | Class1a | Dr Tchavdar Todorov | 12,246,862 | 4,158,494 | 8,088,368 |
| e42 | Computational Combustion for Engineering Applications | EPSRC | Class1a | Prof Kai Luo | 32,000,001 | 27,268,884 | 4,731,117 |
| e59 | Turbulence in Breaking Gravity Waves | EPSRC | Class1a | Prof Ian P Castro | 708,922 | 440,752 | 268,170 |
| e63 | UK Applied Aerodynamics Consortium 2 | EPSRC | Class1a | Dr Nick Hills | 30,925,323 | 13,409,853 | 17,515,470 |
| e68 | Hydrogenation Reactions at Metal Surfaces | EPSRC | Class1a | Prof. Angelos Michaelides | 50,000,000 | 33,136,164 | 16,863,836 |
| e70 | Computation of Electron Transfer Properties | EPSRC | Class1a | Dr Jochen Blumberger | 1,160,000 | 947,534 | 212,466 |
| e71 | Simulating the control of calcite crystallisation | EPSRC | Class1a | Prof John Harding | 40,403,522 | 40,203,133 | 200,389 |
| e76 | HELIUM Developments | EPSRC | Class1a | Prof Ken Taylor | 42,521,798 | 27,044,253 | 15,477,545 |
| e77 | Porting of DFT/GW Codes | EPSRC | Class2a | Prof Maria Merlyne DeSouza | 160,000 | 60,676 | 99,324 |
| e81 | e-Collision experiments using HPC | EPSRC | Class2a | Prof NS Scott | 257,095 | 25,697 | 231,398 |
| e84 | Vortical Mode Interactions | EPSRC | Class1a | Dr Tamer Zaki | 9,600,000 | 75,114 | 9,524,886 |
| e85 | Study of Interacting Turbulent Flames | EPSRC | Class1a | Dr N Swaminathan | 5,588,610 | 2,064,863 | 3,523,747 |
| e89 | Support for UK Car-Parrinello Consortium | EPSRC | Class1a | Dr Matt Probert | 360,000,001 | 103,478,779 | 256,521,222 |
| e90 | Network modelling of wireless cities | EPSRC | Class2a | Prof Jonathan M Pitts | 100,000 | 58,605 | 41,395 |
| e92 | Dynamo Action In Compressible Convection | EPSRC | Class1a | Mr Paul Bushby | 4,075,000 | 74,433 | 4,000,567 |
| e96 | Materials Property Relationships | EPSRC | Class2a | Dr Shoufeng Yang | 100,000 | 0 | 100,000 |

| Code | Title | Funding Body | Class | PI | Total AUs allocated | AUs used | AUs left |
|------|-------|--------------|-------|-----|---------------------|----------|----------|
| e98 | Non-linear magnetohydrodynamic modelling of tokamak plasmas | EPSRC | Class2a | Mr Ian T Chapman | 100,000 | 26,287 | 73,713 |
| e100 | Large scale MD and quantum embedding for biological systems | EPSRC | Class2a | Prof Zheng X Guo | 100,000 | 27 | 99,973 |
| e102 | Numerical investigation of aerofoil noise | EPSRC | Class1a | Dr Richard D Sandberg | 6,484,191 | 5,890,731 | 593,460 |
| e103 | Micromagnetic simulations on HPC architectures | EPSRC | Class2a | Dr Hans Fangohr | 100,000 | 0 | 100,000 |
| e104 | Fluid-Mechanical Models applied to Heart Failure | EPSRC | Class1a | Dr Nicolas Smiths | 2,400,000 | 63,497 | 2,336,503 |
| e105 | Joint Euler/Lagrange Method for Multi-Scale Problems | EPSRC | Class1a | Dr Andreas M Kempf | 1,300,000 | 297,323 | 1,002,677 |
| e106 | Numerical Simulation of Multiphase Flow: From Mesocales to | EPSRC | Class1a | Prof Kai Luo | 3,650,000 | 0 | 3,650,000 |
| e107 | Parallel Brain Surgery Simulation | EPSRC | Class1a | Dr Stephane P. A. Bordas | 6,000,000 | 152,695 | 5,847,305 |
| e108 | Unsteady Propeller Noise | EPSRC | Class2b | Dr Sergey Karabasov | 415,632 | 158,100 | 257,532 |
| e110 | Computational Aeroacoustics Consortium | EPSRC | Class1a | Prof Paul Tucker | 39,100,000 | 12,852,860 | 26,247,140 |
| e113 | [dCSE] MRBV ? Massive Remove Batch Visualizer | EPSRC | Class2b | Dr Martin Turner | 85,440 | 25,121 | 60,319 |
| e114 | [dCSE] OpenFOAM | EPSRC | Class2b | Mr Paul Graham | 100,000 | 0 | 100,000 |
| e115 | Multiscale Modelling of Biological Systems | EPSRC | Class2a | Prof Jonathan W Essex | 100,000 | 0 | 100,000 |
| e116 | Scaling and Benchmarking Spectral Codes | EPSRC | Class2a | Dr Benson Muite | 100,000 | 19,133 | 80,867 |
| e117 | Binding free energy estimations | EPSRC | Class1b | Dr Carmen Domene | 12,247,664 | 253,457 | 11,994,207 |
| e118 | Adaptive coupled radiation-transport and fluids modelling. | EPSRC | Class2a | Prof Christopher Pain | 100,000 | 0 | 100,000 |
| e119 | Nanoscale Energy Transportation | EPSRC | Class2a | Dr Dongsheng Wen | 100,000 | 0 | 100,000 |
| e120 | [dCSE] FF Transformations for plasma simulations | EPSRC | Class2b | Dr Colin M Roach | 200,000 | 54,944 | 145,056 |
| e121 | [dCSE] Improving Performance using Wannier functions | EPSRC | Class1a | Prof Maria Merlyne DeSouza | 2,680,305 | 1,113,900 | 1,566,405 |
| e122 | Multiscale Modelling of Magnetised Plasma Turbulence | EPSRC | Class1a | Dr Colin M Roach | 65,000,000 | 12,366,078 | 52,633,922 |
| e123 | Finger-jets and turbulent structures | EPSRC | Class2a | Dr David Ingram | 15,040 | 0 | 15,040 |
| e124 | Compressible Axisymmetric Flows | EPSRC | Class1a | Dr Richard D Sandberg | 22,887,943 | 5,156,758 | 17,731,185 |
| e125 | Full configuration interaction quantum monte carlo | EPSRC | Class1b | Dr Ali Alavi | 3,324,825 | 913,052 | 2,411,773 |
| e126 | Clean Coal Combustion: Burning Issues of Syngas Burning | EPSRC | Class1a | Prof Xi Jiang | 9,984,000 | 1,408,747 | 8,575,253 |
| e127 | Alternative drag-reduction strategies | EPSRC | Class1a | Prof Michael Leschziner | 7,000,000 | 144 | 6,999,856 |
| e128 | Rate-Controlled Constrained Equilibrium | EPSRC | Class1a | Dr Stelios Rigopoulos | 6,230,000 | 0 | 6,230,000 |

| Code | Title | Funding Body | Class | PI | Total AUs allocated | AUs used | AUs left |
|------|-------|--------------|-------|-----|--------------------|---------|----------|
| e129 | Novel Hybrid LES-RANS schemes [ICL] | EPSRC | Class1a | Prof Michael Leschziner | 7,500,000 | 0 | 7,500,000 |
| e130 | Novel hybrid LES-RANS schemes [MAN] | EPSRC | Class1a | Prof Dominique Laurence | 10,500,000 | 0 | 10,500,000 |
| e131 | Direct Simulation of a Pure Plume impinging on a density surface | EPSRC | Class2a | Dr Maarten van Reeuwijk | 200,000 | 2,391 | 197,609 |
| e132 | Parallel Version of a Design Sensitivity Tensegrity Code | EPSRC | Class2a | Prof Rod Smallwood | 200,000 | 11,753 | 188,247 |
| e133 | Implementation of Established Algorithms to Extend HELIUM | EPSRC | Class2b | Prof Ken Taylor | 400,000 | 0 | 400,000 |
| e134 | Numerical Simulation of Turbomachinery Flows | EPSRC | Class2a | Dr Francesco Montomoli | 200,000 | 16,419 | 183,581 |
| e135 | DNS of unsteady turbulent flow over a smooth or a rough surface | EPSRC | Class2a | Dr Shuisheng He | 200,000 | 91,361 | 108,639 |
| e136 | Modelling the UK Wind Power Resource | EPSRC | Class2a | Dr Gareth Harrison | 200,000 | 133,877 | 66,123 |
| e137 | Turbulent Pipe Flow | EPSRC | Class2a | Prof Dwight Barkley | 200,000 | 199,832 | 168 |
| e138 | [dCSE] Naturally occurring magnetic mineral systems on HECToR | EPSRC | Class2b | Prof Wyn Williams | 400,000 | 77 | 399,923 |
| e139 | Scalability Optimization for Largescale in-silico Simulations | EPSRC | Class2b | Dr Gernot Plank | 400,000 | 238,126 | 161,874 |
| e141 | A numerical study of turbulent manoeuvering-body wakes | EPSRC | Class1a | Dr Gary N Coleman | 16,350,000 | 0 | 16,350,000 |
| e142 | A Study of Doped Semiconducting Nanowires | EPSRC | Class2a | Mr Arash A Mostofi | 200,000 | 198,094 | 1,906 |
| e144 | Numerical Simulation of Rotating Stall and Surge | EPSRC | Class1a | Dr Mehdi Vahdati | 1,266,001 | 0 | 1,266,001 |
| e145 | UK-SHEC Consortium | EPSRC | Class1a | Dr T.J. Mays | 1,191,899 | 4,453 | 1,187,446 |
| e146 | G protein-coupled receptor dynamics | EPSRC | Class2a | Dr Irina Tikhonova | 199,680 | 0 | 199,680 |
| e147 | Scale adaptive simulations of turbulent flows | EPSRC | Class2a | Prof Oubay Hassan | 200,000 | 18,982 | 181,018 |
| e148 | Adding the molecular dynamics functionality to the quantum | EPSRC | Class2b | Prof Dario Alfe` | 400,000 | 1 | 399,999 |
| e149 | Fractal-generated turbulence and mixing: flow physics and | EPSRC | Class1a | Prof Christos Vassilicos | 51,920,000 | 0 | 51,920,000 |
| e150 | Actin and tubulin polymerisation | EPSRC | Class1b | Dr Pietro Ballone | 1,800,000 | 0 | 1,800,000 |
| e151 | Fine-scale turbulence in mixing layers | EPSRC | Class1b | Dr Bharathram Ganapathisubramani | 1,270,000 | 194,644 | 1,075,356 |
| e152 | Turbulent entrainment | EPSRC | Class1b | Dr Maarten van Reeuwijk | 7,500,000 | 0 | 7,500,000 |
| e153 | Maya Blue Hybrid Materials | EPSRC | Class1b | Dr Antonio Tilocca | 2,000,000 | 745,801 | 1,254,199 |
| e154 | Fast proton transport in biological systems | EPSRC | Class1b | Dr Carole A Morrison | 2,000,000 | 0 | 2,000,000 |
| e155 | Modelling Cholesterol Deposits | EPSRC | Class1a | Dr David Quigley | 10,000,000 | 0 | 10,000,000 |
| e156 | Metal Conquest: efficient simulation of metals on petaflop | EPSRC | Class2b | Dr David Bowler | 400,000 | 0 | 400,000 |

| Code | Title | Funding Body | Class | PI | Total AUs allocated | AUs used | AUs left |
|------|-------|-------------|-------|-----|--------------------|---------:|---------:|
| e157 | Global stability computations of separated flows | EPSRC | Class2a | Prof Jitesh S B Gajjar | 200,000 | 8 | 199,992 |
| e162 | Study of Energetic Materials | EPSRC | Class2a | Dr Carole A Morrison | 201,600 | 0 | 201,600 |
| e163 | Numerical Simulation of Spontaneous Ignition | EPSRC | Class2a | Prof Jennifer Wen | 200,000 | 0 | 200,000 |
| c01 | Support of EPSRC/STFC SLA | EPSRC | Class1a | Dr Richard Blake | 30,803,723 | 17,912,265 | 12,891,458 |
| e01 | UK Turbulence Consortium | EPSRC | Class1a | Dr Gary N Coleman | 483,969,876 | 6,975,705 | 476,994,171 |
| e05 | Materials Chemistry HPC Consortium | EPSRC | Class1a | Prof C Richard A Catlow | 1,139,124,000 | 63,533,888 | 1,075,530,112 |
| e10 | GENIUS | EPSRC | Class1a | Prof Peter Coveney | 10,248,188 | 6,102,922 | 4,145,266 |
| **NERC projects** | | | | | | | |
| n01 | Global Ocean Modelling Consortium | NERC | Class1a | Dr Thomas Anderson | 30,343,840 | 24,108,587 | 6,235,253 |
| n02 | NCAS (National Centre for Atmospheric Science) | NERC | Class1a | Dr Lois Steenman-Clark | 207,768,327 | 122,268,474 | 85,499,853 |
| n03 | Computational Mineral Physics Consortium | NERC | Class1a | Prof John P Brodholt | 284,142,416 | 166,386,474 | 117,755,942 |
| n04 | Shelf Seas Consortium | NERC | Class1a | Dr Roger Proctor | 46,009,435 | 45,604,176 | 405,259 |
| **BBSRC projects** | | | | | | | |
| b08 | Int BioSim | BBSRC | Class1a | Mr Mark M Sansom | 866,000 | 909,998 | -43,998 |
| b09 | Circadian Clock | BBSRC | Class1a | Prof Andrew A Millar | 2,000,000 | 549,363 | 1,450,637 |
| b10 | SPRINTing with HECToR [dCSE] | BBSRC | Class2b | Mr Terry Sloan | 400,000 | 4,543 | 395,457 |
| b100 | Widening the BBSRC HPC User Base | BBSRC | Class1a | Dr Michael Ball | 10,000,000 | 26,804 | 9,973,196 |
| b11 | ExeterBioSeq | BBSRC | Class2a | Prof Richard ffrench-Constant | 200,000 | 0 | 200,000 |
| **STFC projects** | | | | | | | |
| p01 | Atomic Physics for APARC | STFC | Class1a | Dr Penny Scott | 3,020,000 | 2,699 | 3,017,301 |
| **External projects** | | | | | | | |
| t01 | NIMES: New Improved Muds from Environmental Sources. | External | Class1a | Dr Chris Greenwell | 4,113,669 | 2,275,913 | 1,837,756 |
| x01 | HPC-Europa | External | Class1a | Dr Judy Hardy | 5,046,434 | 3,564,563 | 1,481,871 |
| x02 | BlueArc (TDS) | External | Service | Mr M W Brown | 1,000 | 0 | 1,000 |
| x03 | Prospect FS | External | Class1a | Mr Davy Virdee | 484,000 | 323,791 | 160,209 |
| x04 | Futuretec | External | Class1a | Mr Davy Virdee | 1,591,200 | 1,152,994 | 438,206 |

| Code | Title | Funding Body | Class | PI | Total AUs allocated | AUs used | AUs left |
|---|---|---|---|---|---|---|---|
| x05 | FIOS | External | Class1a | Mr Davy Virdee | 805,100 | 760,866 | 44,234 |
| **Director's time** | | | | | | | |
| d03 | EUFORIA | DirectorsTime | Service | Mr Adrian Jackson | 2,200,000 | 1,243,228 | 956,772 |
| d04 | MSc in HPC | DirectorsTime | Service | Dr David Henty | 93,500 | 61,167 | 32,333 |
| d11 | NAIS | DirectorsTime | Service | Prof Mark Ainsworth | 416,667 | 7,147 | 409,520 |
| d12 | CoE HiGEM | DirectorsTime | Service | Dr Len L C Shaffrey | 10,000,000 | 0 | 10,000,000 |
| d13 | CoE SENGA | DirectorsTime | Service | Dr Stewart Cant | 10,000,000 | 0 | 10,000,000 |
| d14 | CoE HiPSTAR | DirectorsTime | Service | Dr Richard D Sandberg | 2,000,000 | 1,780,582 | 219,418 |
| d15 | HPC-GAP | DirectorsTime | Service | Dr David Henty | 2,033 | 1,037 | 996 |
| d16 | ETC | DirectorsTime | Service | Dr Lorna Smith | 501,000 | 0 | 501,000 |
| d18 | FireGrid HPC | DirectorsTime | Service | Prof Arthur S Trew | 100,001 | 21 | 99,980 |
| d19 | OpenFOAM Demo | DirectorsTime | Service | Dr Alan Gray | 250,000 | 0 | 250,000 |