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# Highly Skilled Technicians In Higher Education

**A report to HEFCE by Evidence Ltd**

evidence

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## Contents

# 0 Executive summary

## i. Background

- The Higher Education Funding Council for England (HEFCE) commissioned an in-depth investigation of the supply, retention, roles, development and career progression of highly skilled technicians in English university departments. This study is concerned primarily with those in research support roles. It focuses on the way skilled technical support is organised and delivered, by considering evidence from case studies in Higher Education (HE) institutions and comparator organisations

- We have identified a number of serious challenges regarding the need for and use of high-end technical support for HE research that in our judgment merit the particular attention of HEFCE and/or other stakeholders.

- The significance of these challenges should not be underestimated. There is a crisis in the making. It is being forestalled by the capacity of the underpinning fabric – the infrastructure - of the HE research system to accommodate unreasonable impositions. Other studies have shown that this infrastructure is very tightly stretched.

- Highly skilled technical support is essential to good research. The role and status of the technician has changed but the HE system has not responded with the flexibility of other research-based organisations. Instead, individual group leaders committed to the accomplishment of their research objectives have taken ad hoc steps to create new research positions or to find ways around rather than within the present system.

- Evidence suggests that current arrangements for highly skilled technical support are becoming untenable. It seems unlikely that the present management system for highly skilled technical support can continue without necessarily undermining broader aspects of the HE research mission.

## ii. Issues for specific attention

- Career structure. There is a consensus that the ‘Blue Book’ based technician grading and job evaluation scheme is obsolete. The key problem is the threat to recruitment and especially retention posed by the lack of a clear career track that appropriately recognises and rewards those highly skilled technicians working in close collaboration with research colleagues. Local responses to rewarding and retaining key highly skilled staff have consequently appeared, but these may run counter to prevailing national structures and customs. New staff grades could be developed nationally to reflect the career needs of people in highly skilled technical roles and their contribution to world-class cutting edge research. The Funding Council will be aware, however, of the broader context of national negotiations in relation to both a single pay spine and a national scheme for job evaluation.

- Training. Formal opportunities for highly skilled (and other) technicians to obtain training are piecemeal, and training is too often seen as cost rather than investment. While there is general support for the recent development and extension of the Union Learning Fund (ULF) scheme, its relevance to high-end skills is open to question. There is sufficient evidence from this study and the general literature to indicate both the specialised and the dynamic nature of the training needs of those in highly skilled roles in a knowledge economy. The Funding Council and other stakeholders would benefit from a thorough review and audit of skills and training needs and a consideration of how meeting those needs could best be embodied in sector-wide and/or institutional funding arrangements. The aim should be to develop an investment culture for training in which future training opportunities are honed to the particular requirements and roles of highly skilled individuals in research support.

- Funding and continuity of contracts. The uncertain status of funding and the lack of continuity of contracts for staff with high research related skills – often those who 'keep the laboratory world turning' – is problematic. This may threaten the medium-term viability of technical support for research as the present cohort of technicians retires. The Funding Council, Research Councils, major Research Charities and HEIs need to consider this problem insofar as it relates to technical support roles with a view to ensuring that funding and career support horizons are appropriate to maintaining research capacity. As presently constituted, the system for supporting technical support roles in research is unnecessarily opaque and indirectly discriminates against some of the most highly skilled technicians in the UK HE system.

### iii. High skill technical support roles: problems of classification

- The 'highly skilled technician' is a widely acknowledged but ill-defined concept, perhaps associated with inferred skill levels and perceived replaceability. There is an assumption that these highly skilled roles are associated with research, though there is no simple way of distinguishing in existing data sources between those technicians who concentrate on research and those whose duties relate principally to teaching.

- Few criteria consistently distinguish the role of highly skilled technicians from that of other technical staff or research assistants. The extent to which different criteria illuminate the roles of such staff varies between institutions. For example, some HEIs employ staff with well-defined technical roles on research scales with a plethora of job titles. In other HEIs, staff are intentionally appointed as research assistants to perform skilled technical support roles (These staff are not attached to the technicians' job grading and evaluation structure -the 'Blue Book'.)

- Job title, grade or scale are no indicators of function or skill content. Nevertheless, customary demarcations between academic and technical roles persist.

- IT-related roles are an increasingly important element of skilled technical support performed by a range of staff.

## iv. Models of technicians' roles

- We have developed a typology to accommodate and reflect new roles and links with highly specialised equipment. We differentiate higher technical skill levels (in Models A and B) from more general skills (Model C):
  - *Model A*: Process based roles, characteristic of medicine and life sciences. Research focused, with teaching responsibilities. Role requires the ability to draw on scientific theory and its relationship with empirical results. Typically, younger graduates, usually on fixed-term (one or two years) contracts on research grades.
  - *Model B*: Equipment based roles, characteristic of physical and engineering sciences. Research support is predominantly development oriented. Role includes design, modification, development and operation of equipment. Typically experienced and mature with vocational and academic qualifications, on fixed-term (including rolling) contracts, on either technician or (in some cases) research grades.
  - *Model C*: General support across all fields, in larger numbers than more specialised Models A and B. Predominantly teaching/demonstration plus general e.g. health and safety, sample preparation. Less articulation between technician identity and academic organisation. Typically vocational qualifications or experiential learning; permanent on Blue Book grades.

## v. Recruitment and retention

- There are signs of strain in recruiting and retaining skilled technical staff, although there is no *general* supply or retention crisis now or in the foreseeable future. These signs derive principally from the problem of career development for highly skilled technicians. While some HEIs are aware of the problem, there is no generally supported response or pro-active sector wide HR initiative that can address these issues.

- HEIs 'cope' with resource cutbacks, often through ad hoc responses at research group level. These are local and individual approaches to local problems, influenced by a combination of university mission, the disciplinary area(s) involved and the opportunities presented by the local labour market. This responsive approach forestalls the catastrophic crisis, but we believe that it also hides continuing attrition and degradation of cutting edge research performance. Such localised responses create tensions within an HE system more normally characterised by national arrangements for job evaluation, trades union representation and collective bargaining.

- Recruitment and retention can be summarised for two broad disciplinary groups:
  - In bio-medicine/life sciences: units recruit young graduates to largely technical roles, though they may be on research scales. Research grants support only short-term contracts but there is no shortage of applicants. However, those with technical aptitude have no clear career path to follow.
  - In physical sciences/engineering: there is a continuing need for 'traditional' technicians with experience and specialised knowledge essential to maintenance/design of research equipment. Such staff have followed traditional technical careers and vocational training routes, in HE and outside.

Recruitment is from local labour markets but retention is generally not a problem.

### vi. Training and career development

- Recognising quality in technicians' work, particularly at the higher skill end where it interfaces directly with research, is problematic. There is a changing context for highly skilled technical work. Much personal development takes place on the job and integrating formal training opportunities with these on-the-job factors would require a shift from a cost to an investment training culture. The problem is that acquisition of experience and higher technical skills is neither easily accredited nor rewarded through career progression.
- The Blue Book evaluation scheme makes it difficult to reward technical staff who both develop and practise higher technical skills unless they advance into general technical management. Technicians and their representative organisations share the view that the career track for technicians is inadequate. Many HEIs no longer recruit trainees, while for those in post there is only a tenuous link between career development (and reward) and training support mechanisms.
- To reward and overcome development blockages for those practising higher level technical skills some HEIs are switching staff to Academic Related scales. There is no clear or consistent reason why such grades, which exist in all institutions, are not more widely used. Technicians' trades unions acknowledge the problems with the Blue Book but favour retention of a single job structure for all technical staff.

### vii. Management and funding

- There is a paradox: highly skilled technicians (Model A and B) are on short term contracts while general technicians employed for teaching (Model C) are usually on long term contracts.
- Institutionally, customary demarcations between academic and non-academic roles are obstructive. There may be a gap between local management solutions to technical support applied to and by research groups and the perception of technical requirements built into the general institutional resource strategy. We understand that these demarcations of skills and status are part of the picture in national negotiations surrounding pay structures and job evaluation, and they need to be addressed comprehensively.
- Funding for skilled technical support is obtained piecemeal and discontinuously from a portfolio of research funding streams. Institutions do not always feel able to support skilled technical posts in the absence of earmarked funding for the post.
- There is a gap of understanding between principal investigators and research-funding agencies about what technical support can be supported through grants and contracts and what cannot, which could be addressed by improved information.
- Problems arise in capital funding initiatives if technical support is not recognised and planned concurrently with the main facility investment.

## viii. Comparator organisations

- Similarities exist between research management in parts of the private sector and in departmental settings at the leading edge of research excellence in HE. These are most evident where the focus is on critical research and knowledge objectives.
- Management outside HE appears more consistent with the characteristics of a knowledge economy, specifically by better integrating skilled staff. More attention should be paid to such models and the clearer relationship between investment in skilled staff and the expected beneficial returns in research productivity and excellence.
- Units in HE at the leading edge of research are aware of commercial models for technician management and system changes would enable them to realise their aspirations.

## ix. Statistical analyses

- The numbers of staff on technician grades has decreased in science-based disciplines, but has increased in the arts. This latter change may be due to IT and there may thus be a greater decrease of conventional research technicians than the data initially suggest.
- There are more technicians in universities that submit to many units of assessment in the Research Assessment Exercise and there are more technicians in universities with relatively high levels of quality-related research funding (QR). There are relatively more technicians per full-time equivalent academic staff in universities with higher levels of QR funding, but this may reflect the concentration of science-based activity.
- The numbers of scientific and experimental officers are much smaller but there has been no significant drop in numbers in those grades. There is no correlation between the numbers of scientific and experimental officers and the concentration of research funding.
- There are distinct contrasts between universities in the abundance of technicians and the use of Scientific Officer (SO) grades. This may be associated with structure and mission.

## 1 Overview: the organisation and delivery of skilled technical support

There has been little systematic study of the role of the technician in the support and execution of university research. It is timely to review the knowledge base in this area, however, because the development of new technologies, concomitant changes in the nature of scientific research, and rising pressures on the funding and research performance of universities have focused attention on the relationship between research, its enabling technologies and the management of its human and other resources.

This report is focused solely on the role of highly skilled technicians in higher education. It would be naïve, however, to think that all the social and economic issues that affect this group are specific to them or isolated to the HE sector. In End Note 2 to this chapter we point to the significant parallels that can readily be drawn with other skilled craft careers. This may suggest that solutions to emerging problems in the employment and roles of technicians are only partly within the powers of HE management.

A focus on technical staff is an appropriate extension to a history of detailed studies into the need for and role of research students and the work done in the last decade on contract research staff. The Royal Society and other stakeholders have already expressed concerns about the possible erosion of technical support capacity in higher education institutions (HEIs) and the impact this may have on the long-term viability of the research base. There are, for example, questions about the balance between the technical requirements of the infrastructure for delivering teaching as well as research. Because the research environment itself is also changing, better understanding of the current and future requirements of and for highly skilled technical staff is needed.

Not all skilled technical staff are called 'technician'. As research changes, and imposes new technical and technological demands, so the requirements for staff with particular kinds of skills also change. There is a dynamic balance between research that advances the cutting edge of equipment development and research that exploits highly sophisticated equipment and the application of new technologies. Across this balance it may be difficult consistently to maintain historical role delineations between researchers who lead and the staff who support them.

It is against this broad background that the HEFCE invited an in-depth investigation of the supply, retention, roles, development and career progression of highly skilled technicians in English university departments. This study is concerned primarily with those in research support roles. It focuses on the way skilled technical support is organised and delivered in response to a series of key questions:

- Can easily applicable criteria be used to distinguish between highly skilled technicians and either general technical staff or skilled research assistants?
- How difficult is it to recruit and retain skilled technical staff?
- What sort of qualifications, experience, etc are typical of people undertaking technician roles? What terms of employment and rates of pay are typical for technical staff?
- How is skilled technical support organised within universities and departments? How difficult is it

to train staff to fill changing technical demands and how do their careers develop?

- How do universities fund skilled technical posts? Is funding managed to meet planned needs and is it managed centrally or locally?
- Is funding tied to short-term research awards? How do universities factor in the expected need for technical support in planning grant applications and developing their infrastructure?
- How have the numbers of highly skilled technical staff changed in recent years? Does the distribution of skilled technicians relate to the size and complexity of universities and departments? What numbers are likely to be required in the future?

This chapter provides an overview of the findings of our study. It includes reflections from the information collected and highlights issues that may be of concern to the Funding Council, other stakeholders and/or the HE sector generally. Subsequent chapters present more detailed accounts of the site visits/case studies and a review of relevant literature.

## 1.1 'Highly skilled technicians': grading structures and definitions

The Funding Council has defined highly skilled technicians as those 'whose specific skills are necessary to the design, assembly or operation of specialised scientific equipment, particularly where those skills are not generally found amongst workers in technical roles in other sectors or amongst the research staff alongside whom they work'. A key question is whether it is possible to define these high skill roles and distinguish those performing them from other technical staff or from research assistants. This is less easy than might be supposed, for three reasons.

First, technical support for research is provided not just by traditional technicians, but by a range of staff involved in the research process that in most institutions includes scientific and experimental officers, postgraduate research assistants, and post-doctoral researchers. It is not possible to detect a clear or common understanding among HEIs of what is meant by the term 'highly skilled technician'.

Second, neither grading structures nor practice on the ground enable formal recognition of a group or strata of highly skilled people working in technical support roles. The long established operational description of technicians' jobs – formally summarised in the 'Blue-Book' (see the End Note 1 to this chapter) - is no longer a reliable guide to the range of people who might be performing such roles. In some fields of research the opportunity to be a specialist has been removed as university departments and research units look towards the development of pools of multi-skilled technicians (and other roles) who service clusters of technical functions in related areas. In other fields, new technologies make irrelevant the Blue Book's assumptions about work structures.

Third, technical pay scales reflect the logic of a vertical or hierarchical framework, with supervisory and administrative skills seen as key [historical] measures of technical proficiency and responsibility. In recent years these notions have been challenged by the shift towards flatter, more horizontal structures based on teamwork and self-management. At the lower end of the skills spectrum, universities are appointing few or no young trainees; at the upper end, opportunities for skilled technicians also to take on administrative/supervisory roles have always been limited. The result is that staff in skilled research roles may have little scope to advance through the technical pay scales.

It is consequently difficult to delineate a clearly defined or primary group of highly skilled technicians. There are no easily applicable criteria that would consistently distinguish highly skilled technicians from other technical staff or from research assistants. Instead, we find that the organisation and delivery of skilled technical support is finely tuned to the specific activities of individual research groups. Indeed, a substantial part of what defines 'highly skilled' is derived from that specific context. At the level of research groups it becomes possible to identify certain individuals who are considered by research leaders and others to perform highly skilled roles essential to the research activity. These are highly individualised roles in many cases, with few common patterns in the technicians' backgrounds, qualifications, grade or titles.

We believe that it will become increasingly difficult to identify a typical profile or career path in HE or outside, for skilled technicians as for others. Issues relating to the recruitment, retention, development and funding of such key workers is already dealt with on a case-by-case basis, initially at resource centre level, rather than by resort to any institutional or strategic model. Only a few fields maintain the stability once associated with a more or less permanent cadre of career technicians with highly specialised skills necessary to the design, assembly or operation of specialised scientific equipment (we elaborate this below).

There is certainly a consensus in HEIs on the need for advanced technical skills in research, but there is much less clarity about precise roles and designation or how staff performing technical roles can best be developed in terms of skills, career and job security.

The following points summarise the research findings in relation to the criteria distinguishing highly skilled technicians from other technical staff or from research assistants:

- There are grounds for developing new grades to reflect the career needs of people in highly skilled technical roles and their contribution to world-class cutting edge research
- Technician grading and the so-called Blue Book job evaluation scheme are obsolete.
- There is no apparent consensus on the value of the replacement Higher Education Role Analysis (HERA) scheme currently being piloted in a number of institutions.
- For staff on technical pay scales it is difficult to reward higher skills and experience unless they advance either into management or administrative roles, but in these roles they are unlikely to have much opportunity to continue practising their skills at the bench.
- HEIs are switching staff from technician grades to Academic Related and Research scales to overcome development blockages, to reward skills and experience and to create opportunities for access to a different incremental scale.
- Job title, grade or scale are not reliable or consistent indicators of function or skill content. In some HEIs and in some disciplines it is evident that staff with well-defined technical roles are employed on Research scales, both RAIa and RAIb and, in a few cases, RAIII. Job titles include: Experimental Officer; Scientific Officer; Research Assistant; Research Fellow.
- IT skills are a key and increasingly important element of skilled technical support, but a range of technician and non-technician staff may perform IT roles and problem solving.
- The working definition of highly skilled technician, adopted in the research specification, would need to be revised to take account of these complexities.

### 1.2 Roles and tasks: models of technical support roles

Highly skilled technicians work closely with researchers. They attempt to devise solutions to research problems, meshing contextual knowledge in the particular field with an understanding of the science. Those in technical roles close to the research process tend to share the same occupational world and language as academics in their groups. They play a key role in generating the data on which further experiments, analysis, papers, grant proposals and theories are built.

The degree to which technicians are able to contribute to the research process appears to vary, however, both by discipline and according to the traditions of the particular research setting. We perceived a particular contrast - perhaps a contrast emerging from the current evolutionary stage of these sciences - between the physical and biological sciences.

In broad-based physics and engineering research, for example, highly skilled technicians often work closely with academic investigators in the design, building, adaptation and/or operation of specialised equipment used in the research process. The link between the researcher and the technician can be illustrated by an example from a polymer engineering research group where one of the skilled research technicians described his work designing a system to provide accurate flow readouts. He identified three distinct stages. First, he ‘discussed and debated’ with the researcher the nature of the problem and the main research question being investigated. Second, having identified ‘the right questions to ask’ he applied some mathematical logic and a ‘rudimentary’ (in fact far more extensive than he implied) knowledge of programming to write some appropriate software. Third, with the experimentation principles in mind he adapted some equipment, fabricated with the aid of ‘a blob of Araldite’, to carry out the experiment.

Other skilled physics/engineering technicians, particularly those closely associated with items of specialised equipment, described their roles in similar terms. The technicians are seen as possessing the tacit knowledge necessary to design, assemble or operate equipment not just *for* but in collaboration *with* the research community concerned. In the physical sciences and engineering, equipment development is, and is likely to remain, a requirement and perhaps an important focus (there are significant barriers to out-sourcing certain types of precision work).

In other disciplines - broad-based biology is the clearest exemplar - the trend is more towards using the state-of-the-art equipment that has developed over recent years. Highly skilled technical support is now associated with a need for specific expertise to run a service and maintain the facility. In biology, we were told that it was impossible to compete at international level without services of this kind. As one principal investigator commented: ‘It’s the nature of the business’

The pace of change is particularly rapid in fields such as bioinformatics, transgenics, molecular biology, electron microscopy and FACT (fluorescence activated cell technology). Workshop or trade skills, despite being highly skilled in some cases are no longer core for any research-orientated laboratory dedicated to these fields of research. Outsourcing is increasingly common, with further implications for once generic in-house skills.

It is important to note that it is also the case for biology that the system has changed in both the private and public sectors. Private sector growth has created a service industry, for sample processing and data analysis as well as technical supplies, that does not exist in the physical sciences. These changes are impacting on technicians and their work, where the equipment has become secondary to the process. In the bio- and life-sciences it is linked with a trend towards employing graduates on research contracts for roles that hitherto would have almost certainly been located on the technician career structure.

There may, therefore, be some dichotomy in classifying technicians' roles. On the one hand, some disciplines require technicians to be flexible and multi-skilled, so the niche specialist with strongly demarcated roles in the research process is disappearing. Universities are looking for general skills, while interdisciplinarity and the restructuring of academic resource centres is moving towards developing pools of multi-skilled technicians whose role is to service clusters of technical functions in the constituent units. On the other hand, however, there is still a requirement for specialist skills, particularly relating to complex equipment. There is a fear that these skills are in danger of being lost through retirement and restructuring.

We have developed the following typology to try to accommodate and reflect this dichotomy, particularly in relation to the link with complex and highly specialised equipment. We identify three different models of technicians' roles. We have tried to differentiate the higher technical skill levels (in Models A and B) from more general skills (Model C) and to identify the core of technicians' work in relation to research and/or teaching. The typology also establishes an association with the person undertaking the roles in terms of qualifications, experience and so on.

### 1.2.1 Model A: Process based roles

- Characteristic in, but not confined to, medicine and life sciences.
- Predominantly research focused, but also with responsibilities to research students and teaching.
- Responsible for preparation of solutions, samples, datasets, records etc.
- Project based work, using state-of the-art equipment and techniques for processing samples and providing results.
- Work predominantly in lab-based teams with shared identity across technical support/research roles.
- Conduct their own project work largely within established protocols.
- Requires ability to draw on scientific theory and think through the relationship with empirical results.
- Typically high proportion of younger graduates fulfilling these roles.
- Usually fixed-term (one or two years) contracts on Research grades.

### 1.2.2 Model B: Equipment based roles

- Characteristic of physical and engineering sciences.
- Technical support roles in these fields remain predominantly equipment oriented.
- Role is research focused and includes design, modification, development and operation of a range of equipment.
- Repository of local knowledge in relation to the performance of equipment and its modification to the varying needs of research experimentation.

- Not untypical to work primarily on the same equipment over long time frames, but increasingly required to develop new expertise as infrastructure is renewed.
- Close articulation between technicians and culture of the research group.
- Typically experienced and more mature technicians with a mixture of vocational and academic qualifications.
- Usually fixed-term (including rolling) contracts, employed on either Technician or (in fewer cases) Research grades.

#### 1.2.3 Model C: General support roles

- Found across all fields, but in larger numbers than those in the more highly specialised niche roles in Models A and B.
- Predominantly teaching/demonstration roles combined with responsibility for the general infrastructure, especially basic lab procedures including health and safety, preparation of samples etc.
- Primarily responsible for maintaining the general conditions in which other teaching and research takes place.
- Less articulation between technician identity and academic organisation in which they work.
- Typically vocational qualifications and/or experiential learning with long service in the same HEI.
- Usually permanent staff (core HEFCE funding) employed on Blue Book Technician grades.

These are ideal-typical roles and may not be mutually exclusive. Despite their differences, Models A and B can more easily be equated with descriptors of *highly skilled* technical support that are specialist and/or expert, providing outputs that are essential to the research process and involving technicians in a common or shared social world with academics. Model C tends to describe more *general* and, by implication, less highly skilled support roles, often aligned to the teaching (primarily but not exclusively undergraduate) function. These technicians provide the conditions in which the work of others takes place. Although those technicians best described under Model C may exhibit a tendency towards a more separate occupational identity (as technicians rather than research assistants or fellows) than Models A or B, some technicians may nevertheless still possess skills that are essential to the maintenance of the research infrastructure (such as IT specialists).

We recognise that these models portray a complex reality in relatively simple terms. Nevertheless they serve to advance the definition of highly skilled beyond an association between specific technical staff and/or scientific equipment by locating the position of technicians in relation to the broader structures of HE work and the technicians' contribution to the research process.

### 1.3 The supply of highly skilled technicians

The recruitment and retention of technicians is perceived to be a growing problem. Higher education appears, in this sense, to reinforce the feeling that there is a shortage of skilled technical people in the economy that has been expressed by industry in general (engineering in particular), commercial research organisations and National Training Organisations. There is no evidence from our investigation, however, of a general recruitment crisis.

While there is no supply or retention crisis now or in the foreseeable future in most disciplines, there are growing signs of strain and perhaps also of research initiatives foregone or research carried out in a different way because of a loss or lack of skilled technical support. Universities are aware of emerging problems in relation to the supply, training, pay and retention of highly skilled technicians but - as noted above - there is no generally supported, sector wide initiative to deal with them.

The higher education system appears to have been successful in coping with the pressure of resource cutbacks because it is extremely good at responding on a day-to-day basis through ad hoc and informal responses at research group level. Each group finds ways of 'managing' the research it seeks to carry forwards, and of substituting one form of technical support (the highly skilled technician) with another (often a research student or assistant redeployed part-time and supported on an on-going basis by the principal investigator). This flexible approach is a tremendous strength in the HE system and it will forestall any catastrophic crisis, but it leads inexorably to continuing attrition and degradation of the support and infrastructure for cutting edge research performance.

Perceptions of a recruitment problem appear to be based instead on a general unease that there is a looming crisis ahead, a feeling made worse by several related factors:

- HEIs have been restructuring in response to funding pressures. Early retirements, with no apparent replacements on technical grades, create a strong impression that technical support roles are less important, are diminishing in number, which creates real fears regarding the loss of certain core skills.
- Most HEIs no longer recruit young non-graduates as trainee technicians, although the University of East Anglia is an exception within our sample, with a well-developed rolling programme. Larger institutions may have employed 50 to 60 such trainees ten years ago. Today, they typically employ only a handful, or none at all. Again the apparent lack of succession fans fears that technical support is diminishing.
- Stakeholders with an interest in existing and future generations of technicians point to cases of lost and underused skills; often these are a consequence of HEIs' responses to advances in research and technology. But stakeholders are also aware that those being appointed to technical support roles are often employed as postgraduate research assistants (PGRAs) and that such staff lack the packages of training and career advancement associated with traditional Technical grades.
- Research group leaders and members realise the essential contribution to research activity being made by certain highly skilled individuals. They are sensitized to the threat to the group's work should such technicians choose to leave.
- Technicians cannot always be provided with the appropriate

contract, career and salary structure commensurate with their expertise and role within the research process.

Issues relating to the recruitment and retention of the general body of technicians need to be separated from those affecting specialised and high skill roles. Neither HEIs nor comparable research organisations located in the public and private sectors experience general difficulties recruiting graduates to fulfil roles described as ‘research related’, a substantial part of which might once have been termed ‘technical support’.

We have described (above) the rapid pace of change in certain disciplines in relation to both the nature of the science and the new technologies. We were told that the skills and mindset required of these ‘research’ recruits are apparently well matched to the demands of the job. Moreover, it seems that there is no disincentive to recruitment in the short-term, fixed length, contracts for posts associated with short-term project funding (though there may be separate issues in relation to good employment practice).

For other disciplinary fields, the issues are less clear. Because a substantial part of what defines the highly skilled technicians derives from the context in which they work, it follows that there is very little or no market place for such individuals. Not only does this expose the HEIs (and especially research groups) to considerable risk if the technician leaves, it also makes the task of specifying the job, qualifications, experience and particularly training of new or replacement recruits much more difficult.

The case studies of research groups in the engineering and the physical sciences showed that highly skilled technical support staff came from a wide variety of backgrounds. Some have come through the ranks of the traditional technicians; while others have been recruited direct from industry. Some recruitment followed redundancy and there is evidence to suggest that industry’s loss of technicians has been HE’s gain, particularly where retreating industrial employment has left pools of experienced and skilled workers.

These positive aspects of recruitment do not deny the existence of pockets of labour market friction, particularly in and around London, where HEIs reported some difficulty in recruiting technical staff. But, even here, there is a need to distinguish between graduate employment, a market that tends to be mobile and national in scope, and the more vocationally oriented technician market that is generally less mobile and more local in orientation. In the latter instances there appears to be a qualitative difference between industry, which is desperate to get Modern Apprenticeships going but is unable to find the right recruits, and Higher Education, which on the whole is no longer competing in the same market place.

We also note that HEIs’ fears about imminent skills shortages and resulting recruitment difficulties are linked to a general problem of an ageing technician population (typically 45-60 range) and steady decline in the numbers of young people who choose to study mathematics and sciences as a step towards progression in a technically related career.

In summary, we believe that the picture in relation to recruitment and retention can be described for two broad disciplinary groups:

### 1.3.1 Medicine, biology and the life sciences

- Research units/departments in these fields tend to recruit young graduates to fill largely technical roles, though they may be employed on research scales.
- This approach partly reflects funding constraints - research grants and contracts may support only short-term employment contracts.
- There appears to be no shortage of willing applicants – many young graduates in these fields find employment hard to obtain and short-term contracts do not appear to act as a disincentive.
- Despite the apparent flexibility inherent in this recruitment/employment pattern there is a problem of continuity. Turnover of PGRAs and post-doctoral research associates (PDRAs), as well as research-based technical staff, can threaten the stability of procedures and practices. Collective memory of best practice - how things should be done – can be impaired.
- Those with technical aptitude, who don’t necessarily want to register for a PhD but who would like to pursue a technician career, do not have a clear promotional/incremental path to follow. Technicians frequently move on when research grants and contracts end.
- The retention problem can be exacerbated in certain fields/geographic locations because more secure and better paid employment outside the sector is an inducement to leave.
- Funding for core technical staff with high level skills – those able to ‘keep the world turning’ in the laboratory - is problematic. Research Council/charity programme funding (typically five-years in duration) can make major differences to the chances of securing longer-term technical support staff.
- Where technical staff costs are recovered from core HEFCE funds, postholders tend to be typically employed on teaching and/or a mixture of teaching and research duties.

### 1.3.2 Physical sciences and engineering

- There is a continuing need in these fields for ‘traditional’ technicians with accumulated experience and specialised knowledge essential to the maintenance of research equipment.
- Those fulfilling these roles tend not to be younger graduates, but those who have followed more traditional technical careers and vocational training routes, either in HE or outside.
- Recruitment is primarily from local labour markets. Universities located in areas of shrinking traditional industries paradoxically may be well placed to pick up highly skilled technicians able to perform a range of roles. Some recruited in this manner will perform roles above their initial appointment grades.
- Retention of established technicians is generally not a problem (though is contingent on

continuity of funding) - despite low pay and heavy workloads there is a genuine interest in and commitment to colleagues and the work being performed.

- As in the life and biosciences, continuity of contracts, especially in research, can be a problem, and may threaten the medium- to long-term viability of advanced technical support for research activity as the present cohort of technicians approaches retirement age.

## 1.4 Training and career development issues

There is no standard recruitment or development path into highly skilled technical roles. Some staff advance through university technical grades, others are recruited from outside the sector to fulfil specific skilled posts, and yet others are switched (by mutual agreement with research leaders) from academic into full- or part-time technical support roles to enable them to continue contributing their expertise unencumbered by standard academic responsibilities.

The common bond across these roles is specific expertise, usually developed in miscellaneous prior learning and qualifications' experience, and combined with both the capacity and aptitude to learn new techniques and adapt them to new or changing contexts. People performing highly skilled roles may possess a range of qualification-based backgrounds, and individuals with no formal qualifications may work alongside those with doctorates. Similar diversity was found in both HE and non-HE settings. Indeed, the case study IT company claimed that this facilitated the development of high-performance teams capable of recognising and responding to technical support demands from a wide range of internal customers located in various divisions and countries.

Training and career development may be related issues, but they need to be separated for analytical purposes. Capability in terms of skills will impact directly on the capacity of the research base, particularly in relation to the efficient operation of cutting edge experimental equipment and research techniques. Without career development opportunities, however, it is likely that enhancement of individual skills will prove a cost rather than an investment.

### 1.4.1 Training

Highly skilled technicians have chosen a career path that requires them to remain technically competent in their specific fields. To maintain such competency requires fairly continuous opportunities for updating and learning. The perception among representatives of technicians is that there is a growing, but largely unmet, demand for specific, practically oriented, formal training opportunities.

Similar views were expressed elsewhere in the system, particularly in relation to the UK's historical lead on scientific instrument development and the capacity for innovation in this field. For example, among the Research Councils, PPARC supports a course at Birmingham for 'super-technicians' that takes fresh physics graduates and trains them in instrumentation for space research. We understand that EPSRC would also be prepared to pay the costs associated with high skill technical training where this could be justified. Related institutional concerns also surfaced about the renewal of infrastructure sourced from the JIF and SRIF capital schemes. Several researchers and stakeholders intimated that the schemes, although highly beneficial as capital investment to the sector, are being undermined because of a lack of recurrent development funds for individuals to access the necessary training that would best prepare them for operating and maintaining new equipment and for performing sophisticated analytical procedures.

On the other hand, despite these concerns, there is no clear or consistent feedback from researchers to the Research Councils (or the Arts and Humanities Research Board (AHRB)) to suggest deep-seated problems relating to skills development. It is also the case that among both technicians and the Higher Education Staff Development Agency (HESDA) there is some frustration that the resources necessary for the initial regional training programme came from the Union Learning Fund (ULF) rather than from within the sector itself.

There are three possible factors that explain these apparently contradictory signals:

Whilst the sector often possesses the necessary skills, the reality is that these are not always represented evenly in HEIs. This raises another issue: how best to provide for the acquisition of new, cutting edge skills, as well as dropping older skills no longer required. Some argue that the best way forward is through some form of collaboration, regionally or otherwise, this will raise similar issues. At present, however, there is no clear consensus on institutional versus regional and sector wide initiatives and how these should be funded.

The Union Learning Fund (ULF) project started with a focus on running training programmes at a price the HEIs could afford. A few were very basic, but others, for example, genetics and proteins, have tackled higher level areas where technical skills are lacking. We understand that reactions to these courses have been mixed. However, our perception is that highly skilled technician training needs may be only partially addressed in this way. The distinction between different types or levels of formal technical training provides a reasonable explanation of the apparent contradiction between perceptions of need and lack of evidence about shortage.

Underpinning these difficulties is a more general dilemma stemming from resource constraints on staff training. The primary factor here may be cultural as much as financial. In HE, on the other hand, there is some evidence to suggest that the prevailing institutional culture perceives training as more of a cost than an investment. There are clearly funding pressures, but these are impacting on scope for training with several individuals referring to time constraints as a principal barrier. Evidence from the non-HE case studies suggests a balance tilted more heavily in favour of an investment model. We mean by this a culture where training needs are identified and mutually agreed by employer and employee and this is followed through with a commitment to provide the necessary resourcing. This investment culture is premised on the belief that it will further the cause of both individual and organisation. Although pressures from the economic downturn are evident, in general the evidence suggests that this investment culture is robust enough to survive in the organisations we visited. Career development

Related to these issues is the sometimes tenuous link in HE technical support between training and career progression. While many technicians acquire new skills, the motivating factor is often job satisfaction rather than career development.

The problem, reported consistently across the study, is that acquisition of advanced specialist skills is not a sure way of securing career progression. The technician grading structure makes little or no formal provision for those with advanced technical skills to develop their careers other than by taking on additional management or supervisory responsibilities. Those who take this route are inevitably taken further from the workbench and the technology-research interface. Meanwhile, for those wishing to continue in research contexts, the interest in and desire to work with the technology effectively becomes a barrier to career development.

By contrast, in the two non-HE case study research organisations the career structure made clearer provision for those technical support staff wishing to adhere to a technology, rather than management, track. For example, in the IT company it is possible to rise in rank and pay more or less in parallel with those on managerial tracks. Highly skilled technicians, with several years experience and a record of high performance, can earn in the region of £40,000 plus other benefits such as a company car, a figure far in excess of comparably skilled staff in HE. This structure recognises that skilled technical staff work closely with other staff, and may well lead project teams that include some staff of more senior rank.

The paradox in higher education is that institutions already have the means at their disposal to deal with some of the problems stemming from uncompetitive pay and poor career development opportunities for highly skilled technicians, by using research and other grades. Some research units/resource centres do make use of these grades. For example, we encountered several examples of staff fulfilling high level technical support roles with titles such as Principal Research Fellow, Senior Research Fellow, Experimental and Scientific Officer.

The evidence suggests that switching staff to these grades (and titles) may encounter several obstacles. As one Research Group leader explained: ‘This is an academic institution and it likes people to have academic qualifications’. At the time of the research it was certainly the case that prevailing academic cultures, committee structures and procedures, and funding difficulties (see below) were cited as significant deterrents to promoting the careers of those providing ‘super-support’ rather than run-of-the-mill technical support.

These issues will be of concern to several stakeholders, including the HEFCE, Research Councils, Universities UK and HEIs. More work needs to be done to understand the specificity of training paths for technicians, particularly at the higher skill end of their work where there are considerable overlaps between contextual and technically based knowledge requirements and the theory driven, scientific knowledge, associated with the researcher. This has implications for the training of researchers. Evidence from some of the Research Councils supports the desirability of interaction between methods and design to assist in the development of researcher capabilities and suggests that the involvement of highly skilled technicians is a part of the package. Post-doctoral researchers also spend time on such work (which itself has implications for their own career development). The desired outcome therefore is to combine science background and technical skills. Training and career development opportunities of those following technician tracks would undoubtedly benefit from better articulation with this broader aim.

We suggest that three specific issues need attention:

- Training opportunities for highly skilled technicians should be reviewed and audited. Training in some fields can be complex and expensive. In some cases very little training is available. The future development of training opportunities needs to be carefully honed to the particular requirements and roles of highly skilled individuals in the research process.
- Attention should be given to the changing context of highly skilled technical work. Immersion in the job remains important. Highly competent technicians need an understanding of science, technical ability in relation to complex technology, knowledge of systems and people. Much of their personal development takes place on the job. Integrating formal training opportunities with these on-the-job factors requires a shift from a cost to an investment training culture (see paragraph 44c). This culture of learning will need to be sophisticated and will need to cross academic and professional boundaries.
- It would be good HR practice to investigate different models for developing new advanced technical support grades/career structures for those able to contribute to world-class research. Retention, development and performance are intimately linked and need more explicit recognition in the sector.

## 1.5 Funding and managing technician roles

Funding and management issues underpin the retention, training and career development issues. The Royal Society Report (1998, especially pp 4-5) made cogent arguments about the specific problems of securing continuity of funding for technical support that stem from the dual support system. And there and elsewhere across the sector a concern is expressed about the viability of the ‘well found laboratory’ under present funding arrangements.

These are familiar arguments about resources stretched too thinly and need not be rehearsed here. Three areas of concern relating to funding and management must, however, be reported in the specific context of technical support roles.

### 1.5.1 Project funding and the ‘well found laboratory’

Too many research grant applicants couch requests for technical support in general terms without providing proper justification, according to both the Research Councils and charities. These bodies are clear that well-justified cases for technical services are only infrequently rejected. The Research Councils are robust in their view that project applications will not be rejected on the grounds of technical costs.

Finding funding for highly specialised technologists (i.e. those at the cutting edge in a highly specialised field) can nonetheless prove difficult according to some we interviewed. Staff in skilled technical support roles (operating at equivalent level to a principal investigator) find that although in principle they can be co-applicants on grant proposals, in practice it is impossible to do if they need to recover their own salary costs. This is deliberate policy for one funding charity, so as not to discriminate against applicants for other Fellowships.

It is also the expectation that project grants cover the salary costs of technical staff only for the percentage of time relevant to the named project, and this applies for charities and for the Research Councils. Grant holders report, however, that this does not necessarily correspond to a manageable balance (of salary across external funding sources) for the employer.

### 1.5.2 Institutional and researcher perspectives

The general institutional perception is that researchers in general do not include sufficient costs in their applications to cover specific technical support. The principal reason reported by researchers for undercosting technical requirements is to avoid rendering total project costs uncompetitively high. It is fear of an unsuccessful application that drives behaviour.

Research grant and contract officers report that they try to 'educate' their university's principal investigators in the importance of securing proper cost recovery. Despite this, their staff confirm that it is difficult to overcome the impetus derived from fear about the fiercely competitive search for grants. It was also reported that securing funding from other sources compounded the problem. For example, where contracts with industry are sought, researchers may have a sense of the budget likely to be involved. They tailor their project specification to suit and technical support costs may be one of the first items to be trimmed if budgets are tight.

Funding time frames are insufficiently long to provide the necessary continuity for technical support roles, according to many principal investigators. This was a problem identified not just by HEI based researchers, but in the case-study government research laboratory, where the shift towards a customer-contractor model had imposed much tighter cost recovery and commercial income targets. Conversely, the IT company appeared much more able to fund a wide range of activity, from long-term blue-skies research to leading edge development closer to market. Comments from those in HE suggest that even the availability of large Research Council platform and programme grants extending over five-year time frames has not stemmed concerns about securing adequate resources for specialised high-skill technical support roles.

There is a paradox across the system that underscores these insecurities. Technicians whose duties are primarily teaching related – and perhaps in general less likely to possess the highly-specialised skills that are difficult to replace – are most often employed on long-term or open-ended contracts that are supported from core HEFCE funds. Technicians who are primarily research related, by contrast, even where they are working in internationally excellent research teams, tend to be employed on fixed-term or rolling contracts that are supported from project funds. The fragility and fragmentation of project funding ensures that for technicians, like many of their researcher co-workers, job insecurity is endemic.

The obstructive and divisive nature of the historical demarcations between academic and non-academic roles cannot be underestimated. In many of the leading research groups we met, this barrier is broken down where the contribution of the technical specialist is more overtly recognised. More broadly across the system, the continuing use of old pay-scales and employment structures reinforces the divide unnecessarily and to the detriment of the best research outcomes.

### 1.5.3 The management challenge

Managing the technical support environment is complex. The evidence is that much of the management role is retained at the level of research departments and centres. It is here that modes of work organisation are devised. Their success or otherwise reflects the drive and ingenuity of research directors and principal investigators in devising their own solutions to recruitment, retention, and contractual problems relating to highly skilled technical roles.

There are funding and management stresses between operational units and the broader structures of institutions and funding bodies. With few exceptions, however, HEIs appear to have no developed strategic response to the changing environment in which their highly skilled technicians are working. This is compounded by a lack of sophisticated management information about roles and associated skill levels, and about the changing diversity of highly skilled technical demands in different disciplines. Restructuring may consequently be informed by a less than strategic view of which core technical skills should be retained and which can be more easily lost. Funding for technical support in some units has to be cobbled together from several sources, and survival in contractual terms becomes hand to mouth.

While there is not yet conclusive evidence that the capacity of the research base is being impaired for the want of technical support, it is apparent that short-term, highly localised problems do arise. The price of maintaining general research capacity is undoubtedly the intensification of work felt by technical support staff, usually in association with their research colleagues. Several technicians admitted that, although they were committed to the work and to their colleagues, they would not recommend the job to anyone else.

### 1.5.4 Comparing HEIs and other organisations

Visits to two non-university institutions took place, one to a public sector research establishment and one to a high-technology industrial research laboratory. The purpose of these visits was to explore the ways in which the issues surrounding the employment and roles of highly skilled technicians were managed in these other environments and to see whether alternative models of good practice were available.

Particular characteristics that were highlighted by these visits included:

- More integrated and effective management of research and its technical support.
- Clearer teams, flatter hierarchies and smarter objectives for technical support.
- Formal recognition of the particular roles of a group of people who are ‘highly skilled technicians’.
- A management model that seemed better to reflect notions of a knowledge economy, where individuals are differentiated less

by hierarchy and more by their skills and capacity to innovate.

- Research and highly skilled technical staff on similar or equivalent pay-scales, receiving similar treatment and parity of esteem within the organisation, and working under equivalent systems of training, development and reward.

Some broad conclusions can be put forward from our findings, although this survey cannot by any standard be regarded as comprehensive:

- There are striking points of similarity between actual and aspirational research management in parts of the private sector and in departmental (not institutional) settings at the leading edge of research excellence in HE.
- Similarities are most evident where there is a common mission focus on critical research and knowledge objectives. For much of HE, its diverse mission may be too complex for such an approach readily to be adopted.
- Approaches outside HE are of wider interest because they appear more consistent with the characteristics of a knowledge economy, specifically by better integrating skilled staff.
- Elements of alternative good practice exist that provide the basis for a pathway of transition between public sector and commercial research management, which different departments and institutions will venture along to different distances.
- Units in HE at the leading edge of research are often well aware of these better models for technician management that would help them achieve their objectives.
- Key changes in the institutional and system structure, including the time frame for funding research staff, would enable these research groups to realise such aspirations.

## 1.6 Present and future requirements for technical and research support staff in universities

Data on staff can be found in a number of statistical sources, including the returns to the Research Assessment Exercise (RAE), Higher Education Statistics Agency (HESA) databases and university annual reports. Problems with such data are significant but the greatest difficulty is the inconsistent nature of data for this group, presumably because they are often seen as adjunct rather than core to the academics on which such returns focus. It is therefore difficult to make any sensible statistical analysis of most of these data for this purpose.

The RAE data appear to offer a higher degree of consistency. Universities return staff data to each RAE and include in this a measure of the numbers of technicians associated with each Unit of Assessment (UoA). These data seem to be comparable and appropriate for a number of reasons: many universities agree that the technician workforce would be seen as a good reflection of research capacity; there is a common set of staff definitions issued centrally; the census is carried out at the same date for all; and the data are known to be audited.

Because data are returned not only for technicians but also for other support staff, such as scientific and experimental officers, there is some inconsistency in interpretation and use of such grades.

The data allow us to make several kinds of analytical comparison:

- Compare across subjects, because staff are associated with the disciplinarily based UoAs
- Compare across time, because these UoAs were used in both 1996 and 2001
- Compare technician and other support staff numbers with other indicators of size (QR core income) and diversity (number of UoAs used by institution)

There are some disjunctions in the data, because returns made under one UoA for one RAE may be transferred to other UoAs at another date. The technician data also cover all technical grades, including both general laboratory technicians as well as highly skilled research technicians. Nonetheless, overall these provide the best available overview of changing numbers.

The following points emerge from the tables and graphs in the statistical Annex:

- The numbers of staff on technician grades have decreased in science-based disciplines, but have increased in the arts. Since this latter change is due to increased IT demands there may be a greater decrease of conventional technicians in the sciences than the data initially suggest.
- The numbers of scientific and experimental officers is much smaller but there has been no significant drop in numbers in those grades.
- There are more technicians in universities that submit to many UoAs in the RAE and there are more technicians in universities with relatively high levels of QR.
- There are relatively more technicians per FTE academic staff in universities with higher levels of QR funding, but this may reflect the concentration of science-based activity.
- There is no correlation between the numbers of scientific and experimental officers and the concentration of research funding.
- There are distinct contrasts between universities in the abundance of technicians and the use of SO grades that may be associated with structure and mission.

## 1.7 End Note 1 – The Blue Book

The grading structure for technical staff employed in pre-1992 universities is determined by the *Manual on the Job Evaluation Grading Scheme for Universities' Technical Staff Structure* - the so-called **Blue Book**. With some 50 national benchmark job descriptions the Blue Book has provided a national grading and promotions structure for technicians since the 1970s. It was subsequently updated by agreement between the Universities' Committee for

Non-Teaching Staffs, and Manufacturing, Scientific and Finance (MSF), the National Union of Public Employees and Amalgamated Engineering Union. While most job evaluation schemes are normally subject to a regular cycle of review and updating, we understand this to have been the Blue Book's only major review during its thirty-year life span.

The scheme as operated since 1990 uses a Factor Plan based on nine job factors, each being broken down into levels to enable assessors of job descriptions to select the appropriate level for each factor. The factors covered include: Education; Experience; Supervision Received; Supervision Given; Relationships; Work Complexity; Accuracy & Dependability; Mental Strain; and Hazards. Technicians' grading associated with Blue Book assessments runs from A to I. Salaries at the time of writing range from £9,866 at the bottom of A to £29,004 (including discretionary point) at the top of I.

Career research technicians tend to be covered by a 'career' Grade D (£14,270-18,619 including discretionary points). If roles are more specialised and/or complex then employment tends to be on E or F Grade. However, towards the top - and by inference this might be taken to mean the most highly skilled technicians - the employment structure of technicians is a grey area between technical and research grades. The upper grades G, H and I are traditionally reserved for superintendent roles. In recent years we understand these top grades have tended to be removed to Academic Related, with supervisory roles being integrated with responsibility for budgeting/purchasing, i.e. a general manager type role.

Most commentators agree that the structure is now obsolete. Although the aim of the Blue Book was to benchmark and allocate technical jobs in a systematic and fair manner, the evidence is that, for some years, those on technical grades have been squeezed into the middle grades. At the lower end, universities are appointing few, or no, young trainees. At the upper end, opportunities to take-on administrative or supervisory roles are limited.

On the basis of the evidence collected in this study three principal reasons can be identified for this obsolescence. First, the establishment of the Blue Book structure reflected broader trends in the post Second World War rise of technical occupations. It was during this time that the term 'technician' began to be applied more generally to laboratory work and extended into universities as their research activity expanded. Organisational logic was to embed the employment, co-ordination and direction of technical staff within a vertical framework characteristic of large-scale organisations. Hence, the technician's structure was premised on acquisition of supervisory and administrative skills as key measures of technical proficiency and responsibility, particularly for promotion purposes. Such emphasis, of course, resonated with established modes of organising technical work elsewhere in the economy, with co-ordination and monitoring tasks performed by supervisors (or, in laboratories, superintendents). In recent years these notions have been challenged by the shift in many work organisations towards flatter, more horizontal structures based on teamwork and self-management. Similar changes in university research have exposed the Blue Book's limitations, particularly in relation to the role of highly skilled technicians.

Second, as this report and other literature have argued, changes in the nature of work and organisations demand that technicians (and other research workers) are increasingly required to be multi-skilled. In some fields of research the opportunity to be a highly specialised or niche specialist has been removed as university departments and research units look towards the development of pools of multi-skilled technicians who service clusters of technical functions in related areas. In addition, high-performance research has increasingly required technicians to be able to immerse themselves in the research process, to understand research aims and contribute to getting results. They have been encouraged to acquire relevant scientific qualifications, to participate in research team meetings, to read relevant literature before setting out on practical work and to attend lectures to maintain awareness of the latest thinking.

Third, some universities (or departments within universities) have developed local employment and grading practices that place technical support roles outside the Blue Book structure. Such practices include: the employment of younger graduates funded from ‘soft money’ (i.e. research grants and contracts) to conduct largely technical roles; shifting skilled and experienced staff from Technician to Research or Academic Related grades – in effect creating a hybrid role as ‘super’ or ‘advanced’ technicians often under the title of Experimental or Scientific Officer; and the development of separate, institutionally based, versions of the Technical grade structure. As the Royal Society Report (1998) *Technical and research support in the modern laboratory* observed, technical and research support roles have to be understood in terms that are not confined to those employed as ‘traditional’ technicians. Such roles are performed by a range of staff including: postdoctoral research associates (PDRAs); postgraduate research assistants (PGRAs); and scientific support staff. The motives for these practices are entirely pragmatic, reflecting not just changes in research activities, but concerns about recruitment of technicians in some cases, their retention in others, as well as a widespread perception that the Blue Book structure provides insufficient opportunity (and incentive) to reward those staff who have developed their technical skills and experience.

The net effect of these factors is to render the Blue Book a less than reliable guide to the shifting nature of technicians’ work in universities, the type of people who might be undertaking technician roles or their terms of employment and rates of pay (insofar as an unspecified number of staff will be performing technical roles but not be employed on the designated technician scale).

We understand that a new job evaluation tool for the sector (HERA) developed by a consortium of over 100 institutions has been piloted, but we are unable to report on the significance of this scheme in relation to technical support roles.

## 1.8 End Note 2 – Technicians and Plumbers

After visiting several universities and talking to staff in a wide range of research groups, it has become apparent that the issues surrounding the roles and employment of Highly Skilled Technicians in the Higher Education sector reflect the changing conditions for work in the much broader context of the UK economy.

In little over a generation we have moved from HE as an elite path that led into a well understood range of professional careers to HE as the normal step for something like one-third to half of school leavers. Many youngsters who previously would have taken an apprentice route as a trainee in a skilled craft now have the opportunity to go directly into a university. Graduate expectations have yet to catch up with this rapid change, however, and a consequence is a mismatch between expectations that emulate those of the previous generation and the realities of graduate job supply, which cannot absorb the new demand for traditional graduate roles.

Technology has, at the same time, impacted on many traditionally non-graduate jobs. Mainstream craft trades such as building, electrical services and plumbing demand increasing levels of regular retraining, updating and certification. Lifelong learning is as much a part of the 'trades' as of any other career requiring a high skills base. For those who work with skilled technicians in any craft area this increase in skills' demands is self-evident. The technology is powerful but complex and the operating regulations are stringent. Thus, the architect (professional equivalent of the academic in research) consults key individuals with plumbing and electrical skills (craft equivalent of the highly skilled technician) to determine best solutions to implement plans as well as employing them to carry out the work. For those less familiar with the work, however, historical perceptions surrounding 'manual' trades obscure the changed reality. This is as true in universities as elsewhere in society.

Because trade and craft careers continue to be regarded as having low social esteem, despite the reality of both demand for essential services (income for skilled craftsmen may exceed £50,000 per year) and the skills level required, the supply of trainees is now too low to replace the current stock of skilled craftsmen. The individual who would formerly have taken the apprenticeship route is no longer ready to consider tradecraft as a career when he or she has a degree under their belt. Concern has recently been expressed that, as the present generation of plumbers retires, so there will be a genuine crisis in service supply. The British Plumbers Employers Council expects a shortfall of 29,000 qualified plumbers over the next three years alone.

The issues for highly skilled technicians in research are not fundamentally different to any other skills area. Pay has often been low, skills levels have been unclear, career structures have been poor, and esteem has accrued to research leaders rather than their teams. Those who might have gone through NVQs to follow a technician career in a university or elsewhere now go direct to university to study. To attract these people to take up posts that provide the critical underpinning for the research process requires a significant overhaul in both career structures and employment attitudes, which is the conclusion also reached by leading institutions in the building and plumbing sectors.

We have found evidence that the management challenge has been addressed in the private sector and is well recognised among leading research groups in the public sector. Both groups acknowledge their dependency on cutting-edge technical support. But it has yet fully to penetrate systematically across the broad sweep of the universities. One may speculate about the cultural factors that will have to be overcome before the UK research base can adequately respond.

# 2 Site visits and case studies

## 2.0 Institutions contributing to this study

1. A number of universities, colleges and other institutions supported our work in this study. Some of these were case study sites, others were stakeholders (see Chapter 3) that we visited or which supplied detailed information, and others made specific inputs.

We are very grateful for the support of all the individuals involved, who are not named for obvious reasons of confidentiality, and for the information supplied by staff in universities' administrative units in Registries, Finance, Human Resources, and Research Grants & Contracts.

Arts and Humanities Research Board

University of Birmingham

University of Bradford

Central Science Laboratory

Coventry University

University of East Anglia

Royal Hallamshire Hospital

Hewlett-Packard Ltd

Higher Education Staff Development Association

University of Huddersfield

Imperial College of Science, Technology and Medicine

Institution of Incorporated Engineers

Institute of Science Technology

King's College London

University of Leeds

MSF, the Manufacturing Science Finance Union

University of Sheffield

University of Surrey

The Wellcome Trust

In the following sections, the names of specific organisations have been replaced by codes (HST01-HST12, not in alphabetical order) to preserve agreed confidentiality.

## 2.1 HST01

### 2.1.1 Institutional perspective

It was generally agreed that highly skilled technicians are operating at the edge of knowledge. They need to span understanding of the machinery and of the process this supports, and understanding of the science that provides the purpose. For many researchers, technicians are ‘the glue that holds the science together’.

The university has established a Technicians’ Working Group, which produced a paper on the current and future roles of technicians in the institution. Technicians are rationalised into a smaller number of science workshops, rather than as formerly being based in individual departments. This has led to better sharing of skills. Technicians now make many more decisions in their own right than was true a decade ago – they are described as ‘working to objectives, not to directives’.

The teaching role of technicians, especially in IT related activities, is an important role for some. It has meant that they may move into being paid on academic related scales. There are different roles for technicians in different disciplines: e.g. Environmental Science has grey areas – ESRC funding and the social science element of much research means that a lot of ‘technical’ support (literature searches, data analysis etc) is done by staff on administrative pay-scales. What is unclear is what the balance of this is in terms of ‘highly skilled’, and it may be necessary to have a flexible definition to accommodate this variability.

The traditional hierarchies of esteem remain strong, or are perceived by many to do so. Some academics have first-rate technical skills, but it is thought that some would be offended if they were referred to as technicians. It is also felt that there are polarised views among the academic staff: some value technicians’ opinions; but some are perceived to have an ‘I’m the academic so do as you’re told’ attitude.

Long and continuous service in association with one laboratory or research group is now a rarity, and there tends to be a process of continuous redeployment to new areas. Technicians feel powerless in this management process. They were said often to resent being moved on from one research project to another every 2-3 years, however, and look for more continuity in their work. This is contrasted with established technicians who have an important role in advising Principal Investigators at the grant application stage as to what is possible, and what different elements might cost in time and money. This adds value to both the group’s work and to the quality of employment.

Postgraduate research students (PGRs) at HST01 do not generally take on technical roles – indeed neither unions nor senior management would approve of such a practice. Sometimes PGRs might carry out technical processes, however, as part of their training and professional development. A research assistant is paid only £15k whereas a Technician on scale D would be paid £18K. It was suggested that, due to resource shortfalls, Principal Investigators now tend to appoint the latter ‘even though they can’t wire up a 13amp plug or discriminate between a left hand and right hand thread’.

In recent years technicians have started to move further up through the university hierarchy, e.g. the head of audio-visual services was formerly a technician, and similarly the top technician in a laboratory is now re-titled laboratory manager rather than laboratory superintendent.

While some technicians were said to be studying, e.g. for part-time masters degrees in analytical chemistry, there were other technicians who remained focused only on traditional craft knowledge. It was felt by a number of interviewees that there was some antipathy to learning theory. Manufacturers' training courses were a key learning area, usually attended on the back of acquisition of new pieces of key equipment. More structured and general training was rather sparse. New technician trainees all have A- levels. To continue their development through the FE route now requires significant travel, as this is no longer available locally.

It was widely agreed that good people get more responsibility and get promoted. Each individual would be treated on their merits in terms of their career progression – this partly reflects the small size of the institution, which allows a less rigid career structure, and supports more fluidity and flexibility. Even if technicians do not move over to academic related scales, there are opportunities to progress up the academic support ladder and this has very high ceilings. It is unlikely that a technician would be able to progress to being a pure academic, however, though they may be able in some cases to apply for research grants as Principal Investigators in their own right.

There were very substantial concerns from technical staff about the extent to which they see themselves as funded by soft money (i.e. through grants with finite lifespan). Research Councils were understood now to be prepared to fund technical services as part of a research grant – whereas this was not the case 10 years ago. It was questioned as to whether Principal Investigators are competent, however, to make an effective costing and to cover the real cost of technical support for grant applications. It was feared that sometimes the problem was that academics asked for less than they could get for this element of a proposal so as to make their work appear inexpensive.

There was a suggestion that some people who actually worked as technicians were not called that because some funders (charities were cited as an example) would not fund such posts. It was said that they have an attitude that a 'properly run university should provide its own technical staff as part of the package'.

Gender issues as described in the US (see Barley in Literature Review) are not reflected in practice at HST01, though that might have been the case 5-10 years ago. The majority of technicians in biology are women (in contrast to 20 years ago). It is now the case that low pay often means that there is a trend to think of a generic technician's job as a household's second income. On the other hand, there was some suggestion that female staff are buying into continuous learning more than male colleagues.

There were suggestions that inefficient use of skilled technical staff was actually increasing costs to the academic staff base in an inappropriate way. This seemed to grow out of misdirected attempts to save costs by academics taking on roles rather than delegating and there was a general need to reflect on the opportunity cost of academics carrying out technician roles themselves. A specific example was that of staff in life and environmental sciences who carried out extensive fieldwork trips that might be efficiently carried out by technicians alone to free up academic time.

Technicians are amongst the longest serving staff in the university and are not seen as a particularly mobile staff group. Traditionally, they are not offered relocation costs, unlike academic staff, although some specialists now come from far afield. Succession planning is a major concern at HST01 and a traineeship scheme has been developed to address this.

Low pay is not an obstacle to recruiting most of the time, although Human Resources believed that sometimes it becomes so with IT technicians. The Trade Union view was also that some posts remained unfilled at the moment not because of lack of money but because no suitable applicant came forward to take them up. Salaries and conditions of employment are comparable to e.g. a specialist research laboratory on a neighbouring science park. The main competition for these people was thought to be not with industry but with secondary school science departments.

Casualisation is not generally seen as an issue: about 80% of technical staff are on permanent appointments with 20% on fixed term contracts to service a particular research project. Sometimes roles are outsourced if capacity or competence are not available amongst core staff. This can affect the technical infrastructure of the laboratories: 'I've put hundreds of thousands of pounds worth of equipment into skips because no-one at the university can make it work any more'.

The decrease in the absolute numbers of technicians, especially relative to student growth and the maintained numbers of academic staff, is seen as problematic by Trades Unions.

## 2.2 HST02

### 2.2.1 Institutional Perspective

The roles of technicians at the university are changing. On the one hand, technicians are increasingly multi-skilled and the number of niche specialists is declining. This reflects the approach of the university in favouring general skills and the development of pools of multi-skilled technicians whose role is to service clusters of technical functions. But in practice research technicians are now more than ever required to innovate, such as adapting machinery to new purposes. This requires that they have knowledge of how machines work and an understanding of the requirements of research. Although the trend is towards increasingly automated tasks it was stressed that the technician still needs to know the basic underpinning processes. In some areas the requirement for specialist skills is still very important. The concern however is that these skills are being lost through retirement and restructuring, and at the moment there is insufficient retraining to replace such specialists. Whether or not the university will continue to recognise the technician role in the future is something of an open question. One perspective on this is that technicians are 'a dying breed', being displaced both by job redesign and the renaming of roles.

The essence of being a technician was described as someone who was hands-on, and who would be needed to fix things when they went wrong. This requires hybrid skills that are relevant to research work, a capacity for patient self-directed work and training. With research in particular, highly skilled technicians would be expected to know the background to research, what sort of results are expected, to be able to spot spurious results and to know why these occurred, and to feed results into the research process. In support of this role, some technicians have been encouraged to sit in on meetings of the research team, and to read relevant literature before setting out on practical work. HEFCE's definition of highly skilled technicians was described as being too focused on the relationship with equipment and not representing other types of highly skilled work such as experts in biological fields.

Technicians also have a role in the training of students and technicians on junior grades in the use of equipment and other research techniques, including how to make up solutions and handle equipment. Although this work is generally not regarded strictly as teaching, the fact that it should be was put forward strongly since it provides a key means for transferring knowledge. Indeed, it was noted that this function provides continuity for the research system at a time when the employment of PDRAs and PGRAs is increasingly transient. Other teaching related work for technicians includes organising classes and the materials for practical work.

Technicians now work more than ever in collaborative (horizontal) settings, this being in part a response to the declining numbers of technicians and their multi-skilled nature. It is said that a further feature of this is a merging of technician and research roles, as technician roles are increasingly being taken over by research assistants, although whether this represents a real change in responsibilities or whether in fact research assistants are now employed as technicians by another name was said to be unclear. Yet in spite of the important role played by many technicians, they are seen as mostly still having a hierarchical relationship with academics.

The grading structure for technical staff is determined by the ‘Blue Book’ which uses a 9 point factor plan, broken down into levels, against which points are allocated. The factors covered include: Education; Experience; Supervision Received; Supervision Given; Relationships; Work Complexity; Accuracy & Dependability; Mental Strain; Hazards. Grading runs from A to I, and salaries from around £10,000 up to nearly £30,000. Career research technicians tend to be covered by a career Grade D (£14,270-18,619), and for complex roles employment tends to be on E or F Grade. Towards the top – in effect the area where highly skilled technicians work - the employment structure of technicians is marked by a grey area between technical and research grades.

Most technicians at the university are employed at D/E/F grades. The higher grades on this scale at G/H/I were formerly reserved for technician managers although now they have been moved to the Academic Related scale. The technician management role has been transformed into a wider management role that includes responsibility for budgeting and purchasing decisions. Overall, it was suggested that there has been an upward drift of grades such that it is easier than it was 10 years ago to be appointed to the G/H/I grades.

The technician role requires increasingly high levels of academic training, and indeed many technicians at the university now have degrees or higher qualifications, in contrast to what was traditionally a more ‘vocational’ educational background. Yet the more academic training of many technicians was also attributed partly to the demise of polytechnics and the decline of opportunities to go through the vocational training route.

The university as a whole is said to have lost ‘quite a few’ technicians, mainly through early retirements. Anecdotally, textiles and civil engineering were referred to as areas where this has occurred. Although it was said that the university had not experienced any particular recruitment problems, the nature of recruitment has changed. For lower grade technician posts the university expects to recruit people with degrees who, in many cases, regard a period as technician as a stepping-stone towards other things and the means by which to acquire work experience. The problem is that few new technicians see this as a career. There are though very few trainee technicians at the university. Whereas ten years ago there would at any one time have been 60 or so technicians, today there are probably fewer than six.

The contractual position of technicians varies across the university, although most new technical staff tend to be employed on fixed-term contracts. Indeed, the age profile of core technical staff at the university is increasing. In some departments the technicians are charged primarily to research grants and the technicians will move from project to project according to need and the availability of finance. But even raising the funding for such posts is not straightforward. If a grant proposal contains specific mention for a technical role then this will be costed in, although it appears there is pressure against doing this in general, on the grounds that it makes proposals appear too costly. Some departments, such as mechanical engineering, have a pool of core-funded staff.

## 2.3 HST03

### 2.3.1 Institutional perspective

As one of the UK's major research universities, HST 03 stresses the importance of its technical support staff as a key component in meeting this role. But it is also clear that the university is currently thinking hard about its current and future needs for technical support, including issues such as overall numbers and the number of staff on 'core' as against 'soft' money. At the moment, total numbers of technicians per FTE academic staff at the university are low compared to national figures.

It was reported that technicians as a group broke down into essentially two broad types: the 'standard' technician who is mostly associated with the maintenance of facilities including research equipment, and the highly skilled technician who is more involved in the research process and therefore may be credited on academic outputs. Highly skilled technicians were seen as often, although not exclusively, being linked with an item of specialist equipment and in areas of high capital investment. For HST 03 some recent investments in major facilities that require the services of highly skilled technicians include an electron microscopy unit, a biomedical research unit, and an Interdisciplinary Research Centre (IRC) in materials. It was noted that not all highly skilled technicians are associated with an item of research equipment – Medicine being a prime example. Fundamentally, the highly skilled technician was seen as someone who had the capacity to innovate.

As an employment category, technician no longer exists, with technical clerical and manual roles now classified as 'support staff'. In line with this change the Blue Book is no longer used and has been replaced with a system of staff grades on a scale from 100 to 700, based on Hay, and supposedly reflecting the knowledge component of jobs. There is a gradual shift of staff in technical roles moving from the 'support' to the 'academic-related' scale. Indeed, it was reported that at the higher skill level it was difficult to distinguish between technicians and academic related staff. For the longer-term there is discussion about still more radical changes such as a shift of all technical support staff to the academic-related scale and even the amalgamation of the academic and academic related categories.

The number of formally recognised technical posts at the university is between 400 and 500; the Union figure for 2000 was 580. By definition these are mostly traditional technicians. What is clear is that numbers have been declining. The Union estimate is that numbers have declined by half over the last 10 years. This was attributed partly to the demand for such staff decreasing, with a shift away from practical laboratory work to more computer-based teaching and research. For highly skilled staff in technical roles only estimates are available. This group, which covers those on academic, academic related and support contracts, is believed to number 300 to 400.

Turnover of technical staff at the university is low generally, apart from in the biosciences where it is much higher. Where technical staff are still being recruited, this is on a case by case basis. The university has now stopped its annual recruitment of technicians into a central training programme, with the argument that 'the university can no longer afford to have supernumerary technicians.' Some specialised areas though are treated as special cases. For example, the university has made efforts to ensure that it retains glass-blowing skills amongst its technical support.

But the ability to recruit and retain technical staff over the long term is becoming a major concern. That this hasn't already become a serious problem, especially in areas where private sector pay is far higher, was attributed to the standing of the university as a good employer. But it was felt that the current situation is not sustainable and the university will find it increasingly difficult to recruit trained staff. Part of the proposed solution will be for the university to 'grow our own' for the more highly skilled technical posts, which in turn will require the development of a proper career structure. Other approaches to the problem that are being examined include a novel scheme for technician employment described as a Midlands Regional Staffing Agency. This would provide a pool of technical support staff shared between several universities.

University administrators highlighted the important role that highly skilled staff will play in the future of the university sector generally, especially in the way they provide continuity against the more transient character of the academic staff; 'academics come and go, these people don't'. Consequently the best technicians are respected and nurtured, 'like gold dust'. If these staff are to be retained more attention will need to be given to technicians' career structures.

Training is carried out mostly through on the job processes, which typically involve junior technicians being assigned to more senior member of staff. The use of Senior Experimental Officers - administrative members of staff with technical expertise - has also proved useful in this process.

Increased use of computers has placed major up-skilling pressures on technicians. This is found not only in the need to work with sophisticated equipment but also in the role highly skilled technicians continue to play with informal teaching and tutoring to postgraduates on the use of equipment. New technology has also changed the working practices of technicians, requiring them to be more flexible and less likely to be tied to a single laboratory.

The fact that many technicians now have highly skilled roles, plus the increasing numbers who have degree level qualifications, are reported as factors behind the improving attitudes towards technicians by academic staff in the workplace. Despite this, 'old-style' perceptions of technicians as low-quality manual support were still to be found, especially regarding women and younger technicians.

There was a strong sense that while some technicians have been expected to have higher levels of skill/training, the pay on offer hasn't kept pace with this or with what is on offer outside the university.

### 2.3.2 School of Biosciences

The School has a 'pool' of technicians, which in terms of their research-related work, are assigned to funded projects. This approach has replaced the previous model in which technicians worked with research groups, which was regarded as too rigid. The system works because laboratory based staff have broadly similar areas of expertise. One or two highly specialised technicians are allocated specific roles, such as responsibility for complex and expensive equipment, and whose services will be 'bought' on a project-by-project basis. Technicians will also have some specific skills in areas like safety, project management, and laboratory management.

Many of the technicians in the group have vocational training such as through the HNC/HND. This is seen as providing the sorts of skills that are not found with degree or postgraduate training. It was also stressed however that technicians working in biology need special skills, over and above those found generally amongst university technicians as a whole. There was said to be a shortage of these technicians in the UK and hence recruitment can be difficult. Sometimes staff are poached from other universities. The genomics group has recently begun employing graduates to fill technical posts, although their lack of practical skills is seen as a problem.

The roles of technicians in this school were seen to have changed in two main ways. First, safety in research laboratories has become critical, moving from being almost ‘non-existent’ to a crucial part of experimental science. Much of this appreciation of safety issues resides in the technical staff themselves. The second major change has been the development of much more sophisticated research equipment and instruments, which for the life sciences has been very significant even over the last 5 years. As a result, technicians were said to be moving from being passive actors in the research process to far more active participants.

#### 2.3.3 School of Physics and Astronomy – Particle Physics Group

The group currently comprises 25 academics including postdoctoral research fellows, 10 graduate students and 3 technicians.

The research work of the group involves very long-term collaborative experiments at particle accelerator facilities in Europe and the US. The work of the technicians is mostly to build the very large detectors that are at the heart of the experiments. They have a substantial amount of discretion in how they organise their work and have highly specialised skills that are developed through the job. Although they are involved in the development of the instruments this does not cover the design of the experiment nor its running. Technicians will however attend the locations where the experiments are conducted, mostly at CERN (the European Particle Physics Laboratory in Geneva), in order to maintain the technology. What this adds up to is that the technician and the academic roles within the group were reasonably distinct and well specified. Certainly there was very close working in projects that typically were of very long duration, although there didn’t appear to be much crossover between the different work domains. The only possible exception to this is the technician work involving support to fourth year student projects, although this probably doesn’t account for more than 10% of the time.

The technical support function within the group is substantially smaller than it once was. 10 years ago there were 5 technicians where now there are only 3, and this might fall to 2 in the near future. In addition there has been quite a lot of upheaval amongst the current technicians; the senior technician was due to retire at Christmas and the other 2 were recruited only over the last 2 years. The decline in technician numbers was said to be affecting both the morale of the current technicians who are pessimistic about future opportunities, and the academic staff in the group who are said now to have to undertake some work formerly done by technicians.

One of the major difficulties for career progression with the technicians in the group is not only the current decline in technician numbers but the long-term nature of the experiments, which inherently have many work peaks and lows. In these circumstances, managing proper training and personal development programmes was said to be extremely difficult. Technicians working with the group expressed their frustration at the lack of career development opportunities.

Overall the position of technical support with the group did not appear to be very healthy. Recent attempts to recruit were described as 'disastrous' because of both very low numbers and poor quality of applicants. The long-term nature of the involvement with research projects requires individuals with very specialised skills that simply can't be found in the wider labour market; past experience has always been to train individuals to undertake the work. Moreover, funding conditions were likely result in a cut in the current technical support strength. From the technician's perspective the situation was reported as being especially gloomy, with low pay combined with poor career prospects. Difficulties in accessing training, especially external training courses, were also cited as a concern.

## 2.4 HST04

### 2.4.1 Institutional perspective

HST 04 is well known for its industrially focused teaching, with disciplinary strengths in areas that include Pharmacy, Business Management and Modern Languages. Over the last 10-15 years the university has undergone quite significant changes and is reported currently as being at a transitional phase in its organisational structure. It has 23 academic departments grouped into 7 schools. Departments within the schools retain some identity, although this varies case by case. Deans are the main budget holders, though some department heads retain devolved budgets and IRCs hold their own budgets.

Highly skilled technicians are acknowledged to play an important part in university work although there is no formal recognition of the role. The Blue Book has been identified as the source of problems when dealing with staff who are highly skilled. Difficult individual cases have required the involvement of the HR department and the academic related panel, sometimes being resolved by transferring the technician to the Experimental Officer grade on the academic-related scale.

The majority of technicians are on permanent contracts based on core funding. Funding of technicians through research contracts is seen as problematic. Although the university does a great deal to support the preparation of research proposals including costing, there is a perception that the funding market, which covers academic and industrial funders, is reluctant to pay the true or necessary costs of technical support. There was a suggestion that this highlighted a possible lack of institutional self-confidence in HST 04 being too prepared to sell itself short.

Initiatives to rationalise departmental structures have brought some changes for technicians. In Pharmacy for example, it is proposed to create a central technical support facility for several areas including Pharmacy, Chemistry, and Biomedical Sciences. It was pointed out however that this will raise issues with training strategy, redeployment and training, all areas where technicians have expressed concerns.

It is estimated that HST 04 has around 10 to 20 technicians that are funded entirely off research grants with ‘quite a few others’ who are part-funded, although definitional problems make precise figures impossible.

As far as recruitment is concerned, HST 04 has perhaps the most difficulty attracting lower skill technicians, Pharmacy being highlighted as an area with particular problems of this sort.

### 2.4.2 IRC in Polymer Engineering

The IRC is a large research laboratory, reportedly employing more technicians than the university engineering departments. All of its technicians are employed as Research Technicians on research contracts. The centre is funded through a combination of EPSRC grants and industrial contracts, with the work organised through a series of overlapping teams. With projects typically supporting a technician for a quarter or half time, the technicians themselves will work across several projects at any one time. They need therefore a broad base of skills. Cross-subsidising technicians between projects is also common. Although few projects actually need a full-time technician, it was suggested that part of the reason for the sharing of technicians was because funding agencies are reluctant, or are perceived to be reluctant, to pay for proper technical support. It was said that this was not such a problem with PGRAs or PDRAs. There are no formal job descriptions for IRC technicians and their qualifications and backgrounds tend to vary, with a mixture of formal qualifications and practical skills. The centre also has an Experimental Officer whose role is positioned somewhere between the highly skilled technicians and the researchers.

Technicians are becoming more integrated into the research process, especially where this involves the manufacture or operation of an item of experimental equipment, and the technicians are often credited on academic papers. The centre has fairly horizontal relationships between the different staff groups in which the boundary between some types of technical support and research work have become blurred. This works both ways, with for example some of the PDRAs being expected to get involved with routine technical tasks. Changing technology is also important in this respect and is the cause of changing technicians' roles in areas such as mechanical engineering, where the work is increasingly being replaced by electronics and computing. Nonetheless, at the moment technicians and Experimental Officers are still viewed as quite separate in terms of career path or aspirations compared with the academic researchers.

Most of the training for technicians occurs informally, often on the job following a trained worker. Due to the specialised nature of the work, most of which was specific to a particular location, there were said to be limited opportunities for training through the HEI and indeed the institutions are not well set up to provide this. In this respect, it was noted that the institution did not have any formal mechanism to share existing technicians' expertise. Equipment suppliers provide other training, though some technicians are given day release for part-time study as well, even though this imposes a significant drain on the IRC resources.

Most technician recruitment is from the local labour market through local advertising. This has proved to be an effective mechanism, although the success is credited partly to the fact that the centre has ring-fenced finances and can make its own decisions without heavy bureaucracy.

Usually technicians are employed on one-year rolling contracts. The centre being the focus of investment in new equipment and other developments has helped staff retention; technicians see themselves as part of something moving forward.

### 2.4.3 Cancer Research Unit

The unit has an Experimental Officer (EO) as laboratory manager. Most of the time scientists and postgraduates at the unit do their own analytical work and one of the duties of the EO is to ensure that postgraduates have been trained in the appropriate techniques. Graduates are preferred when recruiting technicians - there is currently only one non-graduate technician – on the basis that during the course of their work they would need to know as much about the scientific context as the functional aspects of the experimental equipment. Technicians are expected to anticipate experimental outcomes and make appropriate adjustments to the analytical equipment as the results are produced.

The manufacturers of laboratory equipment provide training through short on-site courses. Although most of the equipment is usually supplied with detailed manuals, these are normally only of use when the user is already a specialist in the operation of the equipment. Equipment suppliers can also arrange customised training, although there is a problem of perception in that this is often regarded as being relatively expensive despite the fact it will be a small proportion of the cost of the equipment.

It was suggested that the unit probably had at least two of what could be described as highly skilled technicians, although it was also stressed that in some respects the boundary between their roles and the work of the academic researchers was very unclear. Technicians were regarded as essential and fully integrated members of the research team, getting the normal share of credit in academic papers. Traditional academic hierarchies were identified as being not well adjusted to this working style. Overall, the point to be underlined was that the unit required highly skilled people in all roles and the concern was that there would not be an adequate supply of such individuals. The unit has to deal with individuals being poached by industry – as occurred recently with a graduate technician responsible for the mass spectrometer – and already has to recruit technicians nationally rather than locally as would have been the case in the past. No serious recruitment problems have been experienced so far although it was widely agreed that rolling contracts, poor salaries and a lack of career track were not likely to help the situation.

## 2.5 HST05

### 2.5.1 Institutional perspective

The roles of and structure for highly skilled technicians at HST 05 university reflect its position as one of the post-1992 new universities and its heritage of providing a strong technical rather than research-based education, with a focus on the needs of the local community and economy.

The technician role at HST 05 is broadly defined. A wide variety of posts are classed as technician although technician may not necessarily be referred to in the job title. They range from the manual trades to specialised laboratory managers and cover 5 technician grades – Technical assistant, Technician, Senior Technician, Chief Technician, Technical Services Manager. Of these, 'Technician' is the 'career' grade. Although university senior management agreed with the concept of the highly skilled technician there is no formal recognition of this role within the grading structure. One suggested rule of thumb indicator of the highly skilled technician was whether or not research comes to a halt when the technician is absent or on leave.

The university is organised into 7 schools, each one with technicians managed by a Technical Services Manager who will oversee perhaps 4-5 technician groups. Each technician group is headed by a chief/senior technician who will typically be in charge of 4-6 technicians.

Administratively, technicians are a part of the Administrative Professional Technical and Clerical Staff (APT&C) grade which comprises about 1000 staff, of which approximately a quarter to a third are technicians. Technician numbers at the moment are stable, although some restructuring of academic units around 6 years ago saw numbers decline. Against this apparent stability there has been a steady change in the skills profile of university technicians. Although precise figures are not available there has been a decline in the number of 'traditional' technicians and a significant increase in the number of IT-related technicians. IT technicians now represent more than 50% of all technicians, mostly employed either by the centrally organised Computing Services, which has around 80 posts, or within the individual schools. As regards technicians' age profile, there is a broad spread from 20 to 60, although a significant proportion is above 50, especially those with mechanical and workshop skills.

For most technicians, teaching support work in the laboratories and workshops takes precedence and defines the work routine; research related work occupies the remaining time, in particular in out of term time. But very few technicians work predominantly on research. There is also a sense that the range of tasks covered by technicians is widening – increasingly technicians are being asked to undertake quasi-teaching work such as 'specialist skills instruction' as was reported for Art and Design. This change may be linked to the decline in numbers for the related roles of Experimental and Development Officers, posts that were designed to bridge academic and technicians' roles.

For some technicians, their role and recognition within the university structure is still overlaid with issues of hierarchy and status and the perception, even though this is changing rapidly, that they are viewed as low-grade support workers.

For analytical purposes the university has adopted a categorisation to reflect the different organisational contexts in which technicians are employed - large units (Engineering, Art and Design, Science and Environment) have 30-40 technical staff per unit; medium-sized units (Maths and Information Science, Health and Social Sciences and Teaching and Learning Support Unit) have 10-15 technical staff per unit; small units (International Studies and Law, Business Library) have 2-3 technical staff per unit. Within large and medium-size units technicians are organised into functional teams in which skills and expertise reflect the role of the team. There are between 5 and 7 functional teams in large units. Teams in medium size units have only 2-3 members. Typically, each team is managed by a Chief Technician.

As with the 85% of university staff that are on permanent contracts, the majority of technicians are supported through core funding from HEFCE. Technicians funded through ‘soft’ funding sources are also given a secure contract whenever possible if there is stability in the source of funding. Research grants typically contribute shares or parts of a technician support, enabling these to be brought together to form a whole post.

Technicians are managed through a parallel non-academic management structure, which from the technicians’ perspective is reported to give them a separate non-academic identity.

As regards skills development, on the job training, working in small teams and shadowing experienced members of staff, were generally cited as the most important mechanisms. At a more structured level, technicians will sometimes attend courses organised by the vendor of new equipment, and the Staff Development Unit at the university offers training in general skills areas such as word processing. There is relatively low-level use of the Union Learning Fund/HESDA courses. Access to training programmes is at the discretion of the Dean, where the main criteria used is the degree to which the activity will enhance the performance of the school and the university rather than the personal needs of the individual. It is however fairly common for technicians to be supported in taking part-time degree courses where of course there is a significant individual benefit. The real concern among technicians, which was portrayed by the Union representative as an issue of equal rights, is how the current approach results in policy being locally determined across the university.

Technician recruitment is handled on a case-by-case basis without a central programme. It is said that the well-stocked pool of craftsmen in the HST 05 area has been important for recruitment into ‘traditional’ areas such as engineering. As regards technician qualification levels, these are reported to vary according to the discipline, with for example the ‘traditional’ technician in engineering disciplines less likely to have an academic qualification and normally coming from an HNC/HND background. This picture however is changing and already some disciplines such as ‘environment’ only recruit from amongst graduates.

A widely cited concern, certainly with the potential to impact on future recruitment and retention, was the perceived difficulty of career progression. The technicians’ perspective was that promotion was too closely linked to the availability of an existing post rather than merit alone. Furthermore, one of the key criteria for promotion, the experience of working in several teams, was only available in the larger units. A Technical Forum Working Group has recently reported on training and career development issues. Lack of promotion opportunities was said to impact especially on the retention of highly skilled and ambitious technicians. Another factor likely to affect retention is whether the technicians are able to work on up to date equipment. ‘Lack of modern equipment is more of a threat to research here than the supply or competence of our technical support.’ HST 05 has recently seen a highly qualified technician who was responsible for a specialised item of equipment move to another university, partly, it was said, because the HST 05 equipment was very old. The university NMR machine is 17 years old and the electron microscope 19 years old. Nonetheless, overall turnover of technicians at the university is said to be low.

Many technicians and managers express concern that the current position with technicians isn’t sustainable. Current staffing levels are too low, there is too much reliance on exploiting spillovers from the HST 05 local labour market, and the gap between pay at the university and what is available outside is increasing and hence becoming a serious problem. There is also the view that concentration of research on a few key centres in the HST 05 region will make it even harder for ‘peripheral centres’ such as HST 05 to recruit technicians. Some have argued for HST 05 to find resources internally for investment in research equipment thereby boosting research capacity, which in turn would also have the indirect effect of making the university more attractive to future technicians.

### 2.5.2 School of Engineering – Mechanical and Automotive Engineering

There are 6 mechanical laboratories supported by a Chief Technician and 4 technicians. The Chief Technician has significant administrative responsibilities including appraisals, budget control and spending, team briefing, training and coaching staff, and recruitment. With the university-wide review of departmental structures 6 years ago the number of technicians in the team was cut by a third. There is low or virtually no turnover, with the current team of technicians all of which are in their late 40s or above.

The primary responsibility of technicians is supporting undergraduate student projects as part of the teaching programme – it was said that support to research was ‘fitted in’ on a negotiated basis. The allocation of the technicians and the planning of work is decided by the Chief Technician following negotiation with the academics concerned.

Technicians provide continuity and a base of tacit knowledge on equipment operation, which has been accumulated over many years. This is not easily transferable. On day-to-day matters, technicians have a high degree of freedom in their job execution and have a line management structure that is separate from the academics. Yet in terms of work itself, many technicians have very close links with the academic research staff and students - ‘much of the research is technician driven’. As an example, it was reported that some research students had a closer working relationship with the technician than with their supervisor.

In spite of these many overlaps, technicians retain a separate identity from that of the academics. Technicians do not see themselves as academics although they provide a key contribution to academic work. This generally comes through experimental design and implementation and less so with results analysis which, partly because of the heavy IT component, is an area where these technicians were said to be less comfortable. There is no general practice of crediting technicians on academic papers, apart from a footnote acknowledgement if the technician has made an important contribution, although equally there is no evidence that technicians are unhappy with this.

The training of technicians occurs mostly on an *ad hoc* basis, with on the job training the main method used. Courses run by the university were used for basic skills areas. There was very little opportunity for external training.

Although the system seems to work well enough at present, some concern was expressed about how things would develop in the future. Little thought appeared to have been given to the problems or otherwise of recruiting, or the training of young technicians, partly because with a stable workforce this hasn't been necessary.

#### 2.5.3 School of Science and the Environment

There are 43 technicians in the school all of which undertake both teaching and research support, with teaching taking priority during term-time. The lack of research-dedicated technicians is seen to be a problem, since equipment sometimes ends up not being fully used or the laboratory may not be serviced sufficiently for some experimental processes to take place.

There is a lot of overlap between the work of technicians and the academics. Indeed, many technicians are reported as seeing themselves as co-professionals bringing their own contribution to the research process. As a reflection of this, technicians who make major inputs to research work are often named as co-authors on that work. Academics do not have line management responsibility for technicians, whose assistance is negotiated on a case by base basis, although mostly very informally.

Again reflecting the close links between the academic side and technician support, an intermediate grade between Senior Technician and Technical Services Manager has been created for technicians who take on demonstrating roles, replacing PGRAs who formerly did this work.

Out of the 43 technicians in the school, 15 now have degrees and 4 technicians currently are studying for Masters degrees. Indeed the proportion of technicians with degrees is growing. However not all technician positions require degree level qualifications – for the technicians whose job is to construct equipment in the workshop, vocational qualifications such as HNC/BTEC are seen to be more appropriate. IT technicians are also less likely to have degrees. Technicians with demanding technical roles and those who have teaching responsibilities are generally expected to have degrees.

As regards the age profile, the school has two cohorts of technicians. The first has an average age of around 50-55, with staff that have been at the university for more than 10 years and who are unlikely to leave until they retire. The second has staff in their 20s, who are recent graduates, and who will typically stay for 3-5 years then move, possibly into teaching jobs.

The school claims to follow the university HR policy for training which allows for around 5% of a technician's time to be spent on some sort of formal training, in addition to possibly more time spent on informal learning approaches. The policy when purchasing new equipment is always to include training in its use as part of the specification. Other learning approaches which are used include the network of contacts both within the university and beyond such as suppliers, colleagues in other HEIs, and net searches to find technical data / information.

### 2.5.4 School of Art and Design

IT support is seen as the key technical role in the department. There isn't a demand for much specialist equipment and where this does exist, the school follows a procedure, based on so-called 'competence cards', to allow widespread access without the need for technician support.

The practically oriented nature of art and design means there is a major role for technicians at all levels of activity – undergraduate, postgraduate and researchers. Technicians have a large degree of autonomy and there is considerable overlap between researchers, technicians and teachers, for example with technicians running workshops to reduce the teaching load. Technicians are playing a critical role in developing the specification for a new SRIF-funded facility, reflecting their understanding of current and future research needs across the school.

Many researchers themselves have a practical background and do not need technical support. Yet there is little slack in the system and monthly academic/technician liaison meetings are used to sort out workloads and priorities.

Technology and techniques are changing rapidly in this area, placing pressures on technicians to acquire new skills. This also means more specialisation, with the examples given including 3D digitisation and modelling or developing web based distance learning. The basis for technician training in the school is through self-managed development; around 4% of the School's budget is spent on staff development.

Many of those employed as technicians are in fact practising artists or sculptors, and many of these also have degrees. There is a strong sense of staff having chosen the technician route rather than teacher/researcher. Art and Design also has a reputation for poaching the best technicians from other schools. Technicians in the school are mostly in their 30s and 40s, with one-third women and two-thirds men. This compares with the situation 7 years ago when technicians were nearly all male.

## 2.6 HST06

### 2.6.1 Institutional perspective

This is a medium sized HEI with around 17,000 FTE students, focusing as with many other new universities, on its teaching role and as a key partner in the local economy. It has a relatively small research profile although it has strengths in non-science technical areas such as music, history and social work.

The work of technicians at the university reflects its teaching focus, with nearly all employed to support the teaching programme. It is estimated that across the university as a whole there are fewer than 6 technicians whose main role is to support research work, and these are mostly employed to support the operation of major items of specialist equipment such as the NMR machine and the mass spectrometer.

Staff at the university are organised into 3 groups – senior, academic and support. The support group, known as Administrative Professional Technical and Clerical (APT&C) covers the staff employed as technicians. There is no separate employment category for technicians, nor is there for highly skilled technicians.

Technicians are generally regarded as being the biggest challenge for the staff grading system, which struggles to acknowledge highly specialised technical skills in particular. It was noted also that the pay/grading system didn’t work particularly well in cases where there was a high-demand from the labour market for the skills. The conventional descriptions of academic and technician were seen to be restricting in cases where special measures were necessary to recruit or retain an individual with particular skills. Some staff that are nominally employed as academics will also spend part of their time on technician related tasks.

The concept of the highly skilled technician was understood by senior management to exist although it was not recognised in any formal sense. In administrative terms there is the perception of an overlap between the highly skilled individual and the individual who might be difficult to replace, possibly with unusual skills. Estimates of the number of highly skilled technicians across the university as a whole were between 10 and 15.

There are estimated to be around 100-150 technicians at the university as a whole, compared with 700 academics. Technician numbers are fairly constant, with low rates of staff turnover. The one exception is with computing technical staff where high turnover has been a problem.

The strong although steadily declining manufacturing base in the HST 06 area has made it relatively easy over recent years to recruit qualified technicians in areas like mechanical and electrical engineering and chemistry. Given also the low turnover of technician staff, recruitment has not been a major concern nor particularly has been the issue of staff retention.

In areas where highly qualified skills are required such as the operation of major equipment, the policy has been to create the appropriate conditions to encourage staff to stay, including issues such as access to training. Where there have been staff departures from key posts it appears that these have been dealt with relatively easily, although sometimes through rather fortuitous occurrences rather than the application of well developed plans. Senior management are aware of the risk to university activities posed by lack of continuity in these key roles. However, they believe such roles are both relatively few in number and if an emergency arose could be managed on a case-by-case basis. One considered possibility would be to encourage graduate students to undertake some of the technician work. More generally, management note that the current resourcing conditions in the UK mean it is much easier to obtain high cost specialised equipment than it is to find the staff with the appropriate qualifications to operate the equipment, or indeed the academics to exploit its potential.

Training occurs mostly on the job, and on entry staff would usually go through a 6-month probationary period. With highly specialised research and teaching equipment, staff have been able to attend the courses and training run by the manufacturers, including international forums to share experience. Highly qualified technicians are given the opportunity to attend academic conferences where appropriate.

### 2.6.2 School of Applied Sciences

The school was created from the merger of several departments, some mainstream science such as chemistry, biology and geography, and others from outside this group such as hospitality management and transport and logistics. On the technical side there is a separate structure including a School Services Manager with overall responsibility, a Chief Technician and around 35 technicians.

Technicians are organised as a central resource. The work of technicians is geared almost exclusively around the teaching timetable apart from periods when there are no students around and when technicians' time is deployed according to need. In practice each technician will have a technical area of work in which they specialise, and be based most of the time in the same laboratory. Out of the 35 technicians in the school, only 4 were recognised as being highly specialised. Two of these were responsible for large items of equipment – the NMR machine and the mass spectrometer – and the other two were responsible for looking after a laboratory each.

Operation of the NMR machine is currently the responsibility of a PhD qualified technician. By his own admission the job could be handled by an individual with far lower level qualifications and indeed could be set up to operate on a semi autonomous basis. The advantage of using such a highly qualified operator was seen to come with the value-added that could be provided with set up and results interpretation. The attraction of the job was identified as being the problem solving tasks that were thrown up, although the individual involved was also able to maintain close contact with the research applications.

### 2.6.3 School of Engineering

The school has around 900 FTE students, and 35 academic staff plus other research staff. There is a technical resources manager with overall responsibility for the facilities and the technicians, of which there are 16 including the manager, and 1 technician whose responsibility is solely towards research. Technicians mostly have backgrounds in mechanical and electrical engineering and computing, and a growing number have degree level or higher qualifications, often acquired part-time while in the job. Staff turnover staff is very low, the most recent recruit arriving around 8-10 years ago, but the age profile of staff is also high – the average age of technicians is late 40s and early 50s.

While the main responsibility of the technical staff is towards support tasks associated with the teaching programme, encouragement is also given to technicians having an involvement with teaching itself, such as through demonstrating work. On the research side, technicians' participation is mostly through the design, implementation and operation of the experimental equipment.

The lack of an adequate career path was highlighted as a pressing concern. But this was also linked to the suggestion that it was necessary to recognise academic and technician aspirations separately. Thus it was neither practical, given the administrative difficulties already evident with the operation of the current system, nor appropriate, if technicians were to be further encouraged to aspire towards shifting onto the academic scale as their route forward.

## 2.7 HST07

### 2.7.1 Biochemistry Centre

The centre works across biology and biochemistry and has 15 academic staff, each with at least one programme grant with a typical annual value in excess of £500k. The estimated turnover for the unit is in excess of £10m per year.

The centre was established in response to the need for improved technical facilities including highly skilled technicians. The current head had returned to academic life in the early 1990s after a ten-year gap and observed a serious decline in the level of available technical support for academic research. Moreover this was seen to be an ‘order of magnitude’ less than could be expected in industry. There had been a trend of moving technician posts onto soft money, which could then not be maintained due to funding gaps and failure to recover overheads correctly. The Research Councils and charities such as the Wellcome Trust were not used to funding named technician posts.

After the failure of an initial plan to secure support to fund new senior technical fellowships, the centre was set with a Wellcome programme grant for 5 years covering both the building and facilities and the costs of 5 highly skilled technicians. A condition of the grant was that HST 07 would pick up the funding for these posts for the longer term, so the staff are assured of employment continuity beyond the 5 years. All of the technicians’ posts are associated with state of the art equipment, where there is a need for specific expertise to run a service and maintain the facility. The service is often in demand elsewhere in the department. Areas covered include bioinformatics, transgenics, molecular biology, electron microscopy and FACT (fluorescence activated cell technology). This sort of facility was seen as the absolute ‘bottom line’ if the research was to contribute at an international level.

In the first proposal for the facility it was suggested that the funding would also cover a post in DNA sequencing, although this was subsequently dropped in favour of an outsourced service offering a 24-hour turnaround. Outsourcing is now (or could be) also used for a variety of process tasks associated with the research - including antibody production, transgenic animals and peptide sequencing – as well as workshop or trade skills, glass work and internal laboratory restructuring.

The staff recruited into what nominally were the technician posts are seen as ‘technologists’. These people contribute scientifically and academically and keeping them is seen to provide essential ‘continuity in highly skilled support services and avoids loss of our capabilities’. It was difficult to categorise people in terms of required background and scales for posts a priori. Grades were fitted to the people and all have gone on to the Academic-Related and not Technician grades. This case was seen as typical of the trend within the sector. The sort of posts that were open for a non-graduate and that would give them time to build up the required level of competency to become a highly skilled technician have probably disappeared.

More generally, there was a strong feeling that the career structure for technicians was a mess. A clearer path is required for long term career development for those staff who are not going to go on to become Principal Investigators, but who are required to maintain the research impetus and are a core part of a cutting edge team.

One additional problem is that HE doesn't offer the flexibility that industry would have. You have to be able to cope with shifting people around between grants. In industry people on contracts would simply have to change teams as the company directed.

It was suggested that those working in the biomedical research sector have over the last 5 years come to recognise the need for reorganisation through larger teams and centres. Resources need to be concentrated to support large groups, which will justify the research support structure. The whole area of technical support needs to be evaluated to clarify roles and address management support as well. It was accepted also that what applies for this area doesn't necessarily work elsewhere; the biosciences generally only buy state of the art equipment while with broad based physics (including engineering) equipment development will continue to be a requirement. Any changes to university research have to take account of the system as a whole and for biology the system has changed in both the private and public sectors. There are many more players (including some very large public sector centres such as the Sanger Centre at Cambridge), a great deal more money, international industrial input and a range of supply companies to match. The university system should recognise the opportunity to buy specialist services from small biotechnology companies.

### 2.7.2 High Energy Physics Group

This one of the largest High Energy Physics groups in the UK. It is involved in large-scale experiments at international sites in Switzerland (CERN), Germany (Hamburg) and California. The group numbers 80-90 people in total, who are split into two broad teams. Staff work closely together within a fairly flat organisational structure, and with blurred distinctions between technical and academic roles. This is a long-term business; experiments can take 5-10 years to develop and then be run for a further 10-15 years.

Technicians are often responsible for organising experiments at CERN and in many cases they straddle the academic and technical support roles, with relatively few operating purely at a technical level. Due the nature of the research activity, the group makes a significant contribution to the manufacture of experimental equipment. A quoted example of the technician role was the specialist in the design of magnetic shielding for photo-tubes, in which the focus was on design and construction. Although technicians are rarely engaged in experimental analysis, they are operating at the highest academic level in terms of engagement with the science and other members of the teams.

The sense of overlap between technician and academic within the group is confirmed by the fact that many who are doing what are nominally technical support roles, are employed as research designated posts, such as Principal Research Fellow, Research Fellow and Research Officer. Some of these have in fact transferred from formal technician roles, although this is difficult and occurs rarely.

The group does also have a cadre of more conventional technician roles, described as 'technicians proper', but these were also seen as operating in highly skilled roles. Examples included a mechanical workshop manager and someone employed primarily for his ability to cut metal. Perhaps highlighting the difficulty of using 'highly skilled' as a working description to discriminate between technicians, the metal worker is regarded as probably the most highly skilled of all those in technical support:

‘We wanted to keep him at all costs’. He was dissuaded from emigrating to Australia! Finally, a small group of possibly less skilled technicians, many of which work part-time, are also seen as making a major contribution.

In keeping with the varied nature of technicians’ roles and their backgrounds, there is no such thing as a typical career structure. Training involves staff attending courses, especially those provided by manufacturers. But the main problem is identified as having the ability, or not as is currently the case, to reward development through the pay scales. Some form of super support scale, replacing the current technical scale, was proposed. It is also worth noting that the employment situation is more difficult when individuals are employed on technicians’ rather than academic scales; with academic scales there is far more flexibility that the head of the research group can exploit.

In recruitment, a basic criterion that applies to technicians equally as it does to academics is their overall competence at a world level. This was defined as finding, ‘people who you can put on the world stage and not be ashamed of them. You can send them to any meeting and they can talk for themselves. They will not let us or themselves down. These are people who have evolved and developed over years.’ But finding the right people is not seen to be easy, especially in electronics. Because the research is moving fast it is important also to avoid searching for clones who might leave or retire. Furthermore, there is a certain wariness in the need to make viable choices: university employment practices were said not to be well adapted to dealing with ‘poor’ appointments. Because the group operates with a flat structure it attempts to get people who can work closely together. Most technicians are recruited direct from industry, but it was admitted that it is difficult to know where to advertise.

Although it was remarked that, ‘Money and job security are not the reasons why people come to the team’, the situation is becoming more unsustainable; a ‘looming crisis’ is spoken of in terms of recruitment and retention. Most of those doing technical support work have been on a succession of fixed-term research-funded contracts for many years, often the contract rolls over every four years; thus in principle they could lose their jobs every four years. Salaries although going up slowly are way out of line with what industry can pay. The situation is getting worse. To the Research Councils and other funders there was a plea: ‘They should accept there’s a problem for our type of group - just as there are lecturing staff, there should be a limited number of people - in open competition - for people to have lifetime careers as support physicists. This would be very beneficial, particularly in terms of job security.’

There was also a suggestion that the situation with this group was compounded by the hierarchical nature of universities which were said not to give due to credit to work in Physics. Another issue was how forthcoming moves by PPARC to tighten control over project funding might exacerbate the position.

## 2.8 HST08

### 2.8.1 Institutional perspective

There are nearly 1,300 research staff at HST 08, many on temporary research contracts, and around 487 technical staff, although this includes some nurses and audio-visual staff. Although precise figures are not available, it is suggested that most of the highly skilled technicians are found in biomedical sciences.

Administratively the most major recent change has been the merging of 3 technician scales into one, thereby replacing former titles such as MLSO with grade points. There is no overarching definition of what describes a technician, partly because of the variety of tasks involved. In particular there is acknowledged to be some blurring at the margin between the roles of junior researchers and technicians. This highlights the more general problem of the technician post losing its separate identity, as technician staff are said increasingly to aspire towards employment on research-related scales. HST 08 administrators point out that this is not altogether helpful, and argue that there are clear differences, in terms of character and capability, between technicians and research staff. Cases of technical staff transferring to research roles and then finding difficulties with the more conceptual side of the work were highlighted.

Technicians funded on soft money in general have 3-year contracts and usually leave, or find their contract is not renewed, at the end of this term. There is around 40% annual turnover of these externally funded technicians. It is suggested however that recruiting for such short-term posts is generally not a problem as there is a surplus pool of potential applicants for general technician roles in London. This is less true where highly skilled posts are concerned; technicians working in the animal house was one such example given. Such high levels of churn are for the moment accepted, albeit with a sense that they impose serious costs to continuity for the institution, as skills are lost and new entrants require training. The real test will come in the future when the bulge of technicians aged 40+ begin to leave the system.

A challenge for HR management is how to shift the skills and activity profile of the core-funded technicians away from some of the traditional electrical and mechanical areas and more in the direction of research-based work. It was pointed out that new technology has in many areas shifted the burden away from teaching related work such as demonstrating and laboratory support. Some of the changes likely to occur in the future will be linked with strategic reviews at the college as a whole. Currently a restructuring review is taking place of the Schools of Physical Sciences and Engineering. This coincides with a recent review of engineering in the region, which also looked at the state of technical support and the availability of traditional technicians. Other current work includes strategic plans being developed by the Schools of Health and Life Sciences and Biomedical Sciences. The bottom line however is that HST 08 does not plan to have any serious cuts in the level of technical support but seeks first to make more effective use of the ones it has and be more efficient in charging the true costs of overheads, including technical support, where these apply.

Technician training is mostly achieved through on the job following of experienced technicians, or short courses at the workplace such as half or full day technical seminars run by other technicians. There was some criticism from older technicians that the institution did not allow the time to be found or encourage a culture in which training could take place. Technicians no longer enter training programmes at the start of their employment.

### 2.8.2 School of Health and Life Sciences – Division of Life Sciences

The division was formed in 1992 from the combination of several former departments – including biochemistry, microbiology, and environmental science – and brought together 80 academics and around 40 technicians. Now there are 47 academics and 28 technician positions, which doesn't include the technicians for specialist units such as the 3 technicians working in the electron microscopy unit which operates at school level. There is a plan for more specialised technicians with such units – e.g. a genome centre for genome polymanipulation which will have one technician appointed from the Life Sciences division. Historically around three-quarters of technicians in the division have been supported out of research grants

Up until a year ago the majority of technicians were supporting teaching as their primary activity, consistent with the large numbers of undergraduates. In turn, relatively little time was available for research. It was noted that this organisational feature determined the culture of the division – the notion of 'where you hang your hat' was seen to shape individuals' approach to the work and helped to describe how technicians would tend to congregate in teaching preparation rooms, even when teaching loads were relatively low.

To break this link with teaching and change the culture, the division was reorganised. This took advantage of the division moving from its previous site, which required a new planning process and the disposal of large items of scientific equipment. Key to the reform process was the creation of research groups (3 in life sciences –cell biology; molecular genetics, environmental science) each with technicians associated with them. Through this process more emphasis has been given to technicians' work in research rather than teaching. For example, in the area of molecular genetics and microbiology there are 6 labs with a total of 17 academics and 16 researchers – technicians are placed into research laboratories and involved in projects and training in modern techniques, which are then transposed into teaching. The planning of technicians' activities is achieved by a daily meeting between the head of the research groups and the head of the technicians. Technicians' work profiles vary according to the time of year i.e. whether it is in term time, and as a result of exceptional events such as the disposal of equipment or maintenance/repair activities.

In terms of working style and conditions, the technicians reported that there is a tendency to specialise in the research group with which you work – there is not much movement between the research groups. The job of technician has also become more technically demanding - technicians now do more of the work of post-doctorates and research assistants, which is exaggerated because of the high turnover in these groups. The working culture of the research laboratory is reported as having changed a great deal over the last 20-30 years. Where once there was a clear hierarchy, this has been mostly replaced with a flatter structure in which technicians are seen more as co-workers. Technicians are getting more recognition on academic papers and in some departments, although not this one, are credited as first author.

Training is reported as mostly occurring through a process of 'self-directed learning', as a continuous process. Finding the available time for training is reported as not being easy, as also is finding the money. From the technicians' perspective it was reported that the college has a tendency to say it doesn't have the money for manufacturers' courses. Linked to training issues are the skills possessed by new recruits. The tendency now is to employ technicians with degrees although the job of technician requires basic practical skills, which were once the core part of a technician's training; it is said that these practical skills are sometimes not found with today's graduates.

An issue highlighted for concern was the declining overall numbers of technicians. When the division was created there were 7 Superintendent level technicians where now there are just 3 technicians in supervisory roles, and at lower grades. For technicians, one of the major issues is the lack of a recognised career path. It is said there is a 'log-jam' in getting promotion. Further still, the feeling is that technical skills are not always recognised in the criteria for promotion, which requires taking on administrative work or working in a specialist unit.

Recruitment of technicians can now be quite difficult. Although turnover is low, this has partly been achieved because the number of posts has been cut in the last few years, which has been absorbed by those intending to leave without the need to find replacements. Recently it was extremely difficult to attract applicants even to a HEFCE-funded position. Anecdotally it is reported that technician posts 40 years ago would have attracted 40 applicants, whereas a recent advert produced only 6 applicants.

Some differences were reported as regards the ease with which Research Councils are prepared to support technical costs. This was said to be more straightforward with the MRC than the BBSRC, although NERC were said to be trying hard to improve their performance in this area.

There are 2 major problem areas that will need addressing in the future. The declining number of technicians is certain to affect how far they can operate as the underpinning mechanism for the transfer of research techniques; and grant applicants will need to be a lot smarter in claiming for technical support. On the latter of these points, the school has already developed a policy to strengthen the administrative efforts at costs recovery. Most worryingly however as an indicator of the future health of the technical support function. Few if any of the technicians interviewed would be prepared to recommend this career to others.

### 2.8.3 School of Medicine - Division of Medical and Molecular Genetics - Genetic Instability and Complex Disease Research Group

The Medical School at HST 08 is divided into 10 divisions. Some of these pursue basic research but there are also interactions with the local NHS Trusts. Only a small minority of the staff, generally Principal Investigators and research group leaders, have HEFCE-funded permanent contracts. Mostly these staff will have teaching and administrative duties while running a research group funded entirely on grants from MRC, Wellcome and other medical charities. The rest of the research staff, who are employed as PGRAs or PDRAs, in general are on short-term contracts ranging from 1-5 years in the case of MRC or Wellcome, although typically lasting for three years.

The PDRAs range from experienced researchers in their 40s, to young staff on first projects; they constitute the core of the research effort. By contrast, PGRAs have a more ambiguous role in that for many they are testing out whether they are interested in pursuing a research career. Some go on to do a PhD, while others leave. Many of the PGRAs fill technical support roles, indeed it seems that this is the most common way in which such roles are filled. In this division there is only one HEFCE-funded technician who is a laboratory manager.

Technical support roles are broadly subdivided into three types. First is the IT support technician, who will be a graduate, and is supported by a mixture of funds, including NHS funding. This person will do programming for the storage of medical data, installation, purchasing, and general maintenance/advice. This role is absolutely critical to the operations of the division although carries no teaching or direct research functions. Second is the records oriented technician, appointed to deal with the records of a cohort of patients that are part of the research programme. Individuals are responsible for thousands of records, genetic typing, DNA extraction, sample storage/identification, plates for analysis, DNA screening/sequencing etc. Although the tools are sophisticated, the tasks are relatively repetitious and apply well-developed protocols. Regular attendance at lab meetings is required although it is not expected that the technician would have critical comments to make or creative contributions to the research. Third, is the animal oriented technician who is responsible for dealing with mice for genetic development work.

It was reported though that there is a serious gap in the technical support function. This is seen inn terms of finding someone who will be core funded, who will ‘keep the world turning’ and hence will know their way around techniques, samples, databases, ordering etc. Such a person would bridge the work of the PDRAs who were said generally not to have the capacity or interest to care about the continuity of the overall infrastructure.

Most of the technical support staff in laboratory areas will also often do original bench work. This is a deliberate strategy to avoid mindless or repetitive work and to maintain their interest. In some laboratories there is also a policy of recruiting what are referred to as ‘supertechs with a PhD’. A ‘supertech’ will run a project area, pursued in a semi-independent manner, but will help with laboratory management tasks such as the safety committee, documentation, rotas of tasks, preparation of growth culture media etc. Further still, it is reported that some laboratories expect all staff to share some of the routine tasks, such as the production of standard reagents. In theory this means that everyone spends a little time contributing to preparation but this provides better overall availability for essential materials and bench equipment.

From the technicians’ perspective, there was some suggestion that there is an anomalous relationship between the position of PDRAs and technicians employed as PGRAs. PDRAs earn more although in many labs will do very much the same work as technicians. Indeed many technicians are expected to spend some of their time teaching new research techniques to PDRAs. The technicians report being very sensitive to status issues.

It is said not to be difficult to recruit graduate technicians, for example into the RA1a and RA1b roles. One reported occasion saw over 100 applications for a post. The problem for those in such roles is the lack of a career structure. PGRAs who undertake technical support work but who do not have formal academic experience including a PhD would find it impossible to progress on the research scale. A solution that may be available to some is to transfer to the support staff scale that would be appropriate to their work and hence would have more of a career track. The lack of stable funding also affects career development. It was noted that while it may be possible to build a career on long-term programme grants, on project grants this simply does not happen.

#### 2.8.4 School of Biomedical Sciences/School of Medicine - Centre for Developmental Neurobiology

The centre, which spans 2 different schools - School of Biomedical Sciences and the Medical School - has 23 Principal Investigators and 150 researchers including PhDs. Fifteen of the Principal Investigators are permanent and 8 are on a 5-year contract, and each has their own research group.

The centre has only 1 core-funded technician and there are only 4 core-funded technicians across the two schools, with 7-10 technicians in total in the schools. Technicians at the centre are spread between research groups; many technical support roles are also filled by PDRAs. The one HEFCE-funded technician at the centre is actually employed as an administrator.

A case was described of one research group, which may or not be typical. One year ago the Principal Investigator lost the technician that worked for him. This was an ex-student of the Principal Investigator, employed on a one-third post for a year. The technician involved was uncertain about building an academic career and eventually departed for a completely new direction as a nursery nurse. The outcome is that the Principal Investigator now has to fill the gap himself, which means spending more time on operating equipment and teaching research techniques. The situation was contrasted with how it was 25 years ago. At that time HST 08 funded technical posts as part of the infrastructure. Not only has this gone, it is reported that HST08 is now entering another round of shedding technical staff. Another reported contrast was with the funding Research Council’s own research units, which it is claimed, have dedicated technical staff. The irony is that it is said there is no obvious shortage of people wanting to become technicians; one estimate given is that 50% of post-doctorates would be happy to be involved with research but without the responsibility of being set on a career path that would move onto running a lab.

## 2.9 HST09

### 2.9.1 Institutional perspective

HST 09 administrators acknowledge the existence and importance of highly skilled technicians, although note the difficulty of finding an easy description of the role, which needs to be seen in context. Historically such technicians would have been involved in the development and manufacture of research and teaching instruments and with some exceptions this role has mostly disappeared, being replaced by specialist instrument manufacturers. This has been accompanied by changes in technology, which have seen a shift from complex mechanical engineering to electronics. Interpretations of 'highly skilled' are also to a considerable extent dependent on context. For example, in some disciplines or even with some academics the use of sophisticated IT will be seen as highly skilled whereas this may be routine for other disciplines and often with younger academics. Total numbers of technicians at the university have been reduced from about 280 in the 1970s to around 120-130 today, of which 10-15 are understood to be highly skilled technicians.

In many areas, technology and particularly software has also partly replaced some of the tacit skills that were once important, for instance the interpretation of experimental results from complex machines like NMRs.

Around 3 years ago the university brought in a devolved administration, which deals with employment and payment issues at a school level. This introduced other changes such as the amalgamation of technicians into school-level workshops, and also led schools to think hard about budgets and structures, such as the distinction between Technical and Experimental Officer roles. The new system has more flexibility and allows market supplements to be paid where necessary to recruit and retain. The 'Blue Book', often regarded as a brake on innovation and effective staff management, has mostly been superseded.

Most technicians at HST 09 are on long-term contracts, the rest being on rolling fixed-term contracts. Technicians tend to combine both the research and teaching roles. There is a view held by some that there are insufficient margins on research to support dedicated research technicians, possible explanations including the relatively small size of research groups at HST 09 and the problems of ensuring cross-group co-operation.

Highly skilled technicians' roles are seen now to overlap in some cases with those of Experimental Officers (EO). The principle being adhered to is that EOs are research driven, but it is also true that those seen as highly skilled technicians are often on EO grades. There was some questioning over whether other institutions had had similar experiences and over the extent to which HST 09 had been able to maintain the separate identity of the technician. In this context it was argued that there should be a national development programme, although one that is sensitive to regional differences, to resolve such grading or identity concerns. Some work in collaboration with HST 08 has already started towards the development of a common technical and non-academic staff training structure linked with a job evaluation programme.

Retention rates for technicians are generally good at the university although where highly skilled technicians are concerned there was a general perception that exceptional efforts had been or would be made to ensure individuals would stay. This would include use of pay supplements up to ‘market’ rates.

The high cost of living in the HST 09 area presents a problem generally for recruitment to the university, including technicians. A further factor is the existence locally of other significant employers of technicians. Although recruitment was cited as an area of concern there appears to be some flexibility in the system to deal with problems as they arise. An example referred to was that of the glass blower technician, the last one of which HST 09 lost in the late 1980s. At the time the worry was that the lack of these key skills would severely interrupt research in some areas such as Chemistry, although the simple solution was to contract this work to an equipment supplier and rethink some of the experimental processes. There is no evidence that any line of research has changed as a result of not having an in-house glassblower.

As regards training, the university supports generic soft skills training – for example in areas such as health and safety - but leaves specific training mostly to resource centre budgets and local decision-making. Some of those interviewed felt that there was a problem with the lack of structured skill development. There are some on-site courses in specialist areas, often from suppliers when new equipment is installed, but technicians are rarely sent on courses. One interesting development is the emergence of knowledge networks in which highly skilled technicians share their experience with their peers in other universities e.g. in microbiology procedures.

The training needs and technical qualities of the technician were contrasted with academics, who are said now to have fewer hands-on skills.

The Union perspective is that the university has a good industrial relations record, which includes things such as Union participation on interview panels. The role and recognition of highly skilled technicians has been an area where there has been a great deal of work involving the unions. Although the university developed a Factor Plan based on the ‘Blue Book’ to deal with cases such as the holding of special skills but without supervisory responsibilities, it was never implemented. The practice now, which is to promote technicians to the EO grade in recognition of such skills, has generated further issues such as the possible erosion of differentials with other staff groups.

Looking to the future, it was noted that the choices about technicians and technical support are partly determined by the structural changes to the research funding system. The emphasis on collaborative research with industry tends to favour outsourcing in technical support areas. Indeed, the degree of complementarity with a group’s technical capacity is becoming a criterion for selecting collaborative partners.

More generally there was some faith in the view that HST 09 had begun the process of modernising its approach to technicians. ‘We are already living in what other university’s look at as the future…our cadre of old technicians is disappearing, and the second generation of techs are more flexible, innovative, and more prepared to move between the university and private sector.’

### 2.9.2 Ion Beam Centre

The Ion Beam Centre (IBC) is a national-level facility supporting HST 09 and other UK research groups, which comprises 3 large instruments, each costing around £1m. The core funding from EPSRC supports around 8 research and technical staff. New technicians are recruited as juniors with HND or BTEC qualifications rather than degrees, with both in-house and external training used to bring them up to speed. Although the departure of technicians is always a problem, experience has shown that the team of 8 can co-operate to plug any short-term gaps.

Since the 1970s the facility has evolved considerably. The instruments now are much newer with fewer components manufactured in house, the effect on technicians being less time spent on maintenance and more time for system enhancements. This places different demands on technicians, including the need to think more flexibly and innovatively. Accompanying this change, over the same period technicians have been gradually shifting onto the Experimental Officer grade, which also offers better pay and promotion opportunities. Some see this as a steady integration of research and technical staff.

The sourcing of equipment from outside the university has led to long-term relationships with equipment manufacturers, with IBC technicians involved in detailed interactions to develop innovative modifications to the equipment.

In summary, the highly skilled technician has been an essential part of the IBC although concern is now being expressed about retaining and recruiting and the need for improvements with salaries and career development including grading issues.

### 2.9.3 School of Biology

There have been significant changes to the organisation of technicians in the school and its laboratories, the principal ones being declining numbers, a more flexible approach to the allocation of tasks, and greater pressure on the need to recover costs through grant funding. Some of the changes have been due to new technology; such as the introduction of the gene sequencing machine which, for effective and safe operation requires significant technical support. A consequence of these changes is that increasing amounts of technical work are now undertaken by PGRAs who tend sometimes to be seen as a supply of unaccounted for labour.

### 2.9.4 School of Materials - Polymer Materials

In the past the school's technician workforce, mostly composed of mechanical generalists, worked on non-specialist technical support. Declining student numbers forced a rethink, with first the number of technicians falling by half and those left being used in more specialised roles. Some staff moved to a new central engineering workshop while the others focused on technical support areas such as designing and building equipment, laboratory rather than workshop-based support and new responsibilities with health and safety. The technicians were all core funded and were expected to work flexibly around the school, departments being forced to compete to attract this technical support.

The polymer composites group, which started its work in the 1980s, was a special case in that it had sufficient funding to support a specialist technician. The individual who was recruited had materials technology experience, having previously worked in industry, and has been with the group ever since, being supported through a continuous series of research contracts. The work covered by this technician has changed considerably over the last 15 years mostly with computer assisted testing and analysis replacing mechanical testing, although this change mirrors the far more widespread use of

IT for technicians of all grades and specialisms.

The school also employs Experimental Officers, who in general have higher-level qualifications, are seen to be more in touch with the research process and whose responsibilities would include running suites of instruments such as the electron microscope. EOs are loosely referred to as ‘white coats’ and technicians as ‘brown coats’, however in many cases the boundary between these roles is not very clear. EO is often seen as attracting more esteem than technician, and there has been some regrading of technicians moving to become EOs. Moreover there is a general upward shift in the skills required and qualifications for technicians and EOs, which means normally recruiting only graduates, and even in some cases making replacements by appointing into research positions.

In summary, highly skilled technicians are at the heart of the research and teaching of the school and its research groups, providing continuity and a huge wealth of experience. However, the roles they occupy are difficult to describe or relate to the broader employment structure; the individual often defines the role. If or when people leave, finding replacements will not be easy. Other concerns include the difficulty of generating funding from Research Councils, especially where the technician concerned is not well known.

## 2.10 HST10

HST 10 has a strong research base in science, medicine and engineering and a well-developed infrastructure of technician support, mostly in these areas. In broad terms the picture appears relatively stable with the number of technicians the same today as it was in 1995, both in absolute terms and as a proportion of academic staff - 612 techs out of 5393 academic staff. Turnover of technicians is also relatively low. Against this picture there are signs of growing difficulty in recruiting in certain areas such as medicine and the biosciences, and strong arguments to suggest that the current position isn't sustainable over the medium-term. In leading research fields where the job specification now requires graduate entry or higher, it is almost impossible to offer a realistic career path sufficient to retain high quality staff.

Like several other universities based in centres of declining manufacturing, HST 10 has been able to recruit technicians from the wider labour market for the city and region, in which over the last 15 to 20 years there has been a surplus of skilled labour. Added to this, the lack of competition from private sector employers has in effect allowed the university to pay relatively poorly compared to rates of pay that might be available using a national comparison. For example, the lack of a well-developed microelectronics-engineering sector in the HST 10 region has been cited as a major reason why the university has been able to retain for so long the key expertise it needs to run centres such as the EPSRC centre for III/IV semi-conductors. This picture might be changing however, as evidenced by the wholesale 'poaching' last year of a significant number of staff working at this centre by a major UK semi-conductor firm. While there is certainly evidence to suggest that in some areas HST 10 technicians are prepared to trade the benefits of university employment against the higher pay that could be obtained in the commercial sector, in other areas, especially those where the gap is greatest and getting bigger, the current picture is likely to change.

HST 10 uses a combination of the 'Blue Book' and its own 'Factor Plan' to decide grading issues. In principle this should allow greater flexibility in determining job descriptions and the appropriate rewards for each individual. Further it is claimed that this approach has removed some of the reported bias in the Blue Book, which, according to critics, links seniority with management. One of the objectives behind this move has been to allow technical skill to be properly acknowledged. It is certainly worth noting however that on this issue there is some disagreement between management and staff perceptions. It is claimed that when seeking promotion it is far easier to demonstrate suitability through acquiring even a fairly low-skill clerical role than developing a new technical competence.

The highly skilled technician is understood in exist in practice although there is no formal recognition in the grading structure. The explicit reference to a technician linked with an item of equipment was rejected as being too narrow. At senior levels there is some blurring between the technician posts, academic and academic related work and, it was reported, that the pay and conditions for fast track technicians are not much different from those of junior academics.

Some senior technicians such as Laboratory Superintendents have in some cases been able to move onto the academic-related grading structure to posts such as Experimental Officer, although the extent to which this has actually happened on a routine basis is difficult to determine. An expansion in the number of posts in the highly skilled area was cited as a major growth trend for the university, paralleled by de-skilling in some areas as a result of technological change and new modes of teaching and research.

From the Union perspective there is concern that whilst the number of technicians has stayed the same at the university, the amount of work expected of each has increased, in line with the increased volume of teaching and research that is carried out. For the technicians it is reported there is a growing feeling of stretch, which for some is reaching the limit. It is reported there is less time to spend on developing new skills and with this comes a sense of ‘flying by the seat of your pants’.

Across the university, approximately 30% of technicians are now employed on research grant funding and this proportion is rising. The research councils and other charities are viewed as being reasonable in terms of supporting shares of technicians for each research grant, although some comments also pointed to variations between these sources, with the MRC in particular seen as more difficult.

Recruitment to technician posts is increasingly with graduates only, although it was pointed out that the extent to which this represents a real increase in skills levels or the fact that more young people today have degrees is impossible to separate out.

### 2.10.1 Department of Electronic and Electrical Engineering - EPSRC central facility for III/IV semi-conductor fabrication

The department is a major research performer and received a 5* in the 2001 Research Assessment Exercise. It is split into 2 research groups, semi-conductors, and electrical machines and devices; and 3 research clusters. The III/IV central facility is a national-level research support centre with funding of around £7.5m over a 4-year period. Formerly this was supported by a rolling grant but is now funded by a fixed-term contract, which in fact is reaching the point where renewal will be required.

The department has 37 academic and academic related staff, with 30 technical staff including those on short-term contracts; and 14 administrative/secretarial staff. These numbers have stayed approximately the same over several years but there is a trend towards contract staff – approximately one-third of the technicians are now contract staff. In addition to these numbers the department has 20-30 research assistants and around 20 postgraduates. Out of these staff numbers, the EPSRC facility supports 2 full time members of staff plus one funded research post – there are 7 other PDRAs on soft money and 6-7 technicians.

Although technician staff numbers have stayed relatively static, with increased overall workloads this means there is more individual pressure. One of the problems cited as leading to this situation was the belief that grants for major equipment items did not include sufficient funding for the costs of installation. It was stated that this situation has become considerably worse over the last 10 years. On the other hand it was suggested that getting

Research Councils to pay 20% of a technician's time for a research project was relatively straightforward. There was no suggested variation between the Research Councils in terms of their propensity to pay for technicians' time.

Where formerly technicians were assigned to a member of academic staff, they now operate mostly on a 'pool' basis. For many technician staff the teaching-related work takes priority, 'It has to be done whereas research is done on a first come first served basis.' This work typically includes demonstrating, although not generally working closely with PhD students. Some technicians will spend most of their time working with an item of research equipment, which, it was suggested, is deemed to be more interesting and has higher status value than working with students; hence it is popular. Technicians' roles have changed as the technology has changed. In the past more technicians' time was spent maintaining equipment, which is now mostly handled by the equipment manufacturers.

Although academic staff and technicians work closely together, each group is regarded as having quite different roles and responsibilities. There appears to be a fairly traditional demarcation between the supposedly technically oriented skills of the technician and the theory driven work of the academic and researcher. 'The big difference is that technicians don't have PhDs.' Some argued that the roles in the department were well defined. The need was for technicians to fit into a process rather than be originators, as it was suggested was the case in the electronics industry, and for this relatively low-level skills were more appropriate. Other comments suggested more hierarchical barriers at work in the department. Some attempts have been made to remove these through initiatives such as encouraging technician participation at department seminars although several of those interviewed noted that some progress needed to be made in this area. No fault was attributed to either party. Indeed, technicians were reported to be equally capable of observing old-style cultural stereotypes.

So far as crediting technicians on academic papers is concerned, in the past there was a policy not do so but now this is handled more flexibly. Often technicians are acknowledged and in some cases they have full academic authorship status.

As regards training, most of what is done is either 'on the job' or using courses provided by equipment manufacturers. It was felt however that most formal training would not be appropriate to the needs of departmental technicians. One avenue being considered for further development was how to institute better sharing between research-intensive facilities at a national level as a means to unlock the huge experience base of such technicians; it was reported that this issue was discussed at last year's first meeting of the association of higher education technical managers. Another problem highlighted, in this case one with serious implications for the future, was the suggestion that increased individual workloads make it far less easy than in the past for older technicians to spend time with young trainees.

In general external research contracts are funded with a part of a technician and these are brought together into a pool, often to support the employment of a higher-grade technician than claimed for on the contract. Some senior technicians have been in the department a long time but the lack of contract security especially for younger staff is reported to have an undermining effect on confidence. Despite this, there is a high level of retention of contract staff when they come to the end of their contracts.

Recruitment to the department has not been a problem so far, especially if comparisons are made with other departments across the university. However, retention of staff is becoming a problem, especially younger staff. Last year Marconi ‘poached’ several of the department’s technicians from the semi-conductor facility, offering reputedly nearly double the salary being paid by the university.

Career path issues were highlighted as another area of concern, and one that may in time affect recruitment and retention. In the high-level technician position it is said to be difficult to make progress without taking on administrative duties. The question was raised, ‘why is there not an equivalent of Reader for technicians.’ Further still, moving from technician to research grades is very difficult and quite rare. One case was raised of a technician ‘filling the shoes’ of an academic member of staff who had departed, but who nonetheless found it difficult to be formally confirmed in this job.

Older technician staff tend not to have degree level qualifications, even though some have since obtained these as part time students. More of the younger technicians have degrees, although one comment suggested that this was certainly not a necessary requirement for recruitment. One academic reported it was preferable to recruit those with vocational and practical skills rather than those with degrees.

Opinions differed about how the department would be able to support technical work in the future. Some comments suggested that the current position was unsustainable with an ageing technician workforce, and with relatively poor levels of pay and lack of a proper training structure there was little likelihood of finding effective replacements. Other opinion suggested that recruiting at relatively low skill levels and then supporting internal training would not be a problem, particularly in comparison with areas such as London or South Wales that have to compete with large electronics employers in the private sector. With this view went the suggestion that UK universities in this research area had better technical support than often is the case in the UK and Japan, and that the real problem was with finding suitable PhD candidates in the future.

### 2.10.2 Medical School – Division of Genomic Medicine

The Medical School has recently gone through a major restructuring – 34 departments have been reduced to three divisions of which the Division of Genomic Medicine is the largest with 350 members of staff. The division is organised around 3 academic research themes. Research in the division is carried out by three different groups of academics – university academic staff, consultants from the NHS and individuals who manage to combine both roles.

As a result of the process through which the division was created, there is a sense of the current organisation having ‘inherited’ its current resources, including those of staff. The point was highlighted by reference to the slightly anomalous position of MLSO qualified technical staff in the division.

The division has both core funded and grant funded technicians – there are around 34 people on core-funded positions and approximately the same on contracts. However since a number of the core-funded staff are working part time, the figures equate to about one-third of the FTEs from core funds and two-thirds from contracts.

How technical support staff actually works in the division seems to be a product of both historical and practical constraints. Funding pressures have led to more and more ‘pool style’ operation for technicians, and in this respect the division has gone further than other divisions. Indeed, the traditional mode of working was for technicians to be assigned to an academic staff member. With some older academics and those that can generate significant amounts of funding this model is still in place, even in the Genomics Division. This pattern of different relationships was said to be difficult to manage and in some cases the cause of some resentment – ‘some senior technicians and older academics have a cosy relationship which gives the technicians involved quite an easy life’. The management of technicians, apart from those assigned directly to academics, is by a Divisional Superintendent.

Recruitment of technicians is exclusively from amongst candidates with degree level or above qualifications; typically a 2:1 standard is required. Retaining technicians however is a major problem. Most of those recruited on contracts will leave at the end of the fixed period. This is partly because of the uncertainty of the funding but also a reflection of the poor overall levels of pay and poor career prospects. The effect is to attract mainly people seeking to gain short-term experience. Some young technicians will be looking to expand their practical experience before going on to a PhD; others will simply be seeking one short-term fill-in job before the next one. It is said to be very rare now to find a young recruit who will hope to develop a career as a technician. Even those that are said to have genuinely enjoyed the work will normally find better opportunities elsewhere – the Genomics Division recently lost two such young technicians to the Forensic Science Laboratory.

Overall, recruitment is said to be very difficult. One recent example given was for a HEFCE-funded post, which required a graduate with a minimum of 7 years’ experience to manage a team of 30 technicians and for which there were only 5 applicants. More generally, it was said that whereas 6 or 7 years ago an advert placed in the New Scientist would attract applicants from around the country, today most applicants will be from the local area.

Career prospects for technicians in the division were said to be very limited. For example, it was reported as extremely rare for anyone to be promoted onto the academic-related scales. These limitations were said to be exaggerated by the opportunities that could be found elsewhere, such as with major drug companies.

Strong criticism was made about the ‘Blue Book’ and ‘Factor Plan’ in particular as the bases for grading decisions. The Blue Book was described as a ‘dinosaur’, which laid too much emphasis on management responsibility. It was said that to get someone promoted through use of the Blue Book you had to show ‘what else they do’, besides the science work. Other criticisms were made about the Staff Review and Development Scheme, which although designed to promote the leadership effectiveness and awareness of staff, was said not to work well with older staff.

The age profile of the core-funded staff in the division is increasing. Most of the MLSOs for example are 50+. This fact plus the difficulties of retaining staff in junior positions was highlighted as being a real threat to the sustainability of the technical function within the division. It was said that this will be a very major problem if nothing changes over the next 10 years.

## 2.11 HST11

### 2.11.1 Institutional perspective

The case study examines the position and role of technicians in a government agency providing science, services and consultancy to government departments/agencies and to other users in the commercial sector. The HST 11 Chief Executive wants to see development of the agency as ‘a centre of excellence for science supporting the sustainable management of agriculture, the rural environment and the safety of the food supply chain’ (Annual Report & Accounts 2000-01). HST 11 works within cost recovery and commercial income targets. Key parts of its business include contributions to the regulation and surveillance of veterinary medicine residues, GM crops, industrial crops and applications, food and water analysis, and isotope and chemical analysis of food adulteration. Its analytical techniques are considered state of the art and include chromatographic techniques and continuous-flow isotope ratio mass spectrometry (IRMS) techniques. In addition HST 11 offers customers diagnostic technologies, ecotoxicology services and information services.

HST 11 is organised into two divisions. Within these division there are 7-8 science groups specialising in particular fields of work. The core operating units are teams, of which there are between 40 and 50. In total there are approximately 600 staff plus 50 or so students, visiting workers, ‘seasonal’ staff etc. Approximately 80% are direct income earners.

As a civil service organisation, HST 11 used to employ three classes of staff:

Scientific Officer - graduate entry - head up investigative projects/contracts

Experimental Officer - non-graduate, tend to study part-time at evening class

Scientific Assistants - essentially technicians, involved in set-up, management, supplies.

> This structure was replaced in 1974, after the recommendations of the Fulton Commission on the Scientific Civil Service, by an integrated single structure with 7 grading bands.

Band 3 Scientific Officers (SO) - requires a degree and covers posts responsible for analysis, technical equipment, report writing.

> Recent job description for a Band 3 Nematologist: Purpose of post: Responsible for processing of nematological samples. Provide advice to colleagues and external clients on the biology and control of nematodes. Supervise research and development work in field. The requirements are: A degree or equivalent (e.g. minimum three years’ relevant experience), previous lab experience, knowledge/practical experience of analytical procedures and equipment e.g. Gas Chromatography, UV spectrophotometry, High Performance Liquid Chromatography, work to strict quality criteria, good organisational skills. Previous experience with control and preparation of analytical standards, prior experience of an analytical quality system, ability to lead, encourage and train colleagues where required.

Band 2 Assistant Scientific Officer (ASO) and Laboratory Assistant (LA). ASOs are a training grade, non-graduate entry, usually aged 18-22 and encouraged to build skills and study for HNC on day release, then degrees.

> Recent job description for a Band 2 Assistant Analytical Chemist: Purpose of post: Prepare samples, extracts and standard solutions for pesticide residue analysis. The requirements are: 5 GCSE passes (include. English and Maths/or Science or two years' relevant experience). Experience using computers, good team worker, flexible approach to work, ability to remain calm under pressure. Previous experience of lab work, and of working in an analytical chemistry or trace organic laboratory. A scientific qualification, preferably in Chemistry beyond GCSE/O-level, with experience in wet chemistry extraction and clean-up procedures, and experience of GC and/or HPLC.

It is difficult to form a comparison between HST 11 grades/roles and technician grades/roles in HE. Workers, including technical staff, at HST 11 are employed (mainly) in permanent civil service posts. It is possible to ascend the grading structure through promotions and a system of in-post promotion, based on an annual test. Promotion can be based on taking on supervisory/management responsibility, but it is also possible to progress by acquiring additional technical competence.

### 2.11.2 Recruitment and retention

Recruitment to Band 2 is the most problematic. HST 11 will attempt to recruit from the labour market of c.18-22 year-olds interested in science as a career, but with no experience in HE. This market tends to be local and its members not very mobile. Band 3 staff and above were described as less of a problem to recruit. Large numbers of graduates apply for these posts. On the whole they tend to be mobile and recruited nationally. Pay is arranged on a complex system of overlapping bands. B2s (non-graduates) earn in the region of £11.5k while B3s (graduates) in their early 20s earn in the region of £14k.

Retention of Band 2/3s has been difficult and HST 11 has been losing staff to other science related organisations in the commercial sector. Retention of competent chemistry analysts is particularly difficult. Surveillance work is much in demand. The work is highly sophisticated, but once skills are mastered much of the work becomes routine, but performed under time and cost pressures. There is a lack of rapid promotion opportunities at HST 11.

### 2.11.3 Roles and progression

Technicians/researchers - employed on Bands 2/3, provide advice and problem solving. For example, a Band 3 worker will typically be responsible for accepting samples, performing analyses, reporting, organising the staff ('buying' in staff from other teams where necessary), and will frequently also have to organise others on higher bands to run associated pieces of kit etc.

Technicians who are capable and anxious to demonstrate their competence can move up the bands. Once on Bands 3/4, it is perfectly possible for them to progress to Band 7. However, project leadership roles are performed by technician/researchers who are not necessarily on the highest bands.

Project leadership is expertise led and this provides important opportunities for technicians to build their skills. But there are difficulties associated with HST 11's attempts to grow into the commercial sector. Although the workforce is relatively young, new skills are required in order to win contracts. This is creating retraining demands, which HST 11 is having to learn how to manage.

### 2.11.4 Funding and cost recovery issues

HST 11 is bound by Treasury rules that determine it has to recover the full costs of its operations. These costs are linked to HST 11 charging and selling rates, which have to be acceptable to customers, including DEFRA and others in government such as the Food Standards Agency.

Budgeting and charging is organised at group level and is then devolved to teams, with both team and individual performance targets a part of the overall package. The key target is to remain in budget. Teams are accountable in that sense. HST 11's management information systems are sufficiently sensitive to manage these budgets, though it was admitted that the organisation is striving to streamline (reduce the burden) of reporting requirements and achieve consistency across all activities.

However, HST 11 has to compete in a widening market for such services and is learning to be flexible on prices. Work is increasingly examined on a case by case basis - should we be doing this and why?

Technician costs are charged to contracts. Technical support is included in all contracts and full cost recovery attempted. HST 11 charges the hours worked on the project and each technician is expected to recover their share of salary and overhead costs. Hours are divided into the cost base to get a selling rate.

HST 11's business planning process has a target to achieve a set of budgets for 1 April each year. These plans include reasoned judgments about the staff and other resources required to deliver projected work. The plans relate to science teams - the basic operating unit - with each team set research targets and allocations. Costing rates are set for each group on the basis of the mix of staff within each team.

The underlying principle is net running cost - i.e. balance the books. However, contracts are increasingly becoming short-term and their value is declining. This is impacting on HST11's planning process, which is becoming more difficult. One of HST 11's biggest worries is the lack of clear funding strategies from its key (i.e. Government) customers. The organisation craves some certainty, longer-term time frames for funding envelopes, and a clearer view of what its customers really want. The paradox is that when there is a sudden crisis (e.g. foot & mouth outbreak, in which HST 11 was heavily involved) there is a need to have the capacity to be responsive.

### 2.11.5 Flexibility, skills and retraining

HST 11 acknowledges it needs to be involved in training (it is an Investor in People), but there is a feeling that it has some structural difficulties. HST 11 looks to switch expertise as markets/contract opportunities change, but longer-term prediction of future needs and funding is difficult. The service groups play a key role in this respect, liaising with customers to identify gaps/new developments. For HST 11 managers, the strategic aim is to introduce greater flexibility into the labour force and to increase the level of cross-servicing (there is resonance here with faculty pooling/restructuring in HE).

Reviews of science are conducted periodically in order to retune HST 11's organisational structure. The skills HST 11 has at any one time may be different to those it needs to respond to new market opportunities. These pressures are putting a premium on retraining within the organisation, as well as serious examination of how people actually do their work.

Retraining costs equal downtime hours. HST 11 looks to build these into the overhead costs into contracts. Respondents estimated about 5% of time is devoted to training (induction etc.) and re-training. A figure of 5 days per person, per year, allocated to training was mentioned. Retraining is seen as part of the culture, contract-related activity that has to be done.

There are obstacles to retraining. First, training is the responsibility of individual groups, but group budgets are not always said to be sufficient to support the training required (HST 11's training manager also has a training budget to support training needs of non-group specific staff). Second, persuading staff to retrain is also far from easy, although staff generally appreciate HST 11's changing circumstances. Third, the motivation to switch roles is low: work objectives for appraisal are agreed at the start of the year and individuals will be monitored against these objectives. But this exercise is different from banding of jobs and the 'reward' element - or incentive - for reskilling is less clear.

Specialists in surveillance and pesticide work are stretched to absolute capacity because of competitive pressures in the market for this work. There is then simply no scope for HST 11 specialists involved to develop beyond their immediate skills. Scientific curiosity is driven out, processes are highly automated, but human input in the form of trained analysts is still mandatory.

There is a Union issue here. When people have retrained, the Union (IPMS - Institution of Professionals, Managers and Specialists) has had to fight hard to prevent their performance assessment from being penalised. There is also a conflict between civil service internal systems for quality and government pressures to adopt private sector compatible quality systems. This relates to the relevance and quality of the training being provided. Retraining takes place but its quality may be variable – and it is questioned whether it is really required in HST 11 settings.

## 2.12 HST12

### 2.12.1 Industrial perspective

This case study examines the role of highly skilled technicians in a company. It highlights the nature of the supporting role, which features technicians working interactively with the research activity and enjoying a parallel career path with the potential for high rewards.

HST 12, one of the company business units, is involved in a wide range of research activities from basic science to applied technology. This includes work in areas such as e-services, security, digital imaging, printing and imaging, Internet and mobile communications, computer systems and advanced data storage. HST 12 employs around 1000 staff – two-thirds in California - and has main laboratories in Palo Alto, Bristol, and smaller labs in Cambridge (Mass), France, Israel and Japan. It sees itself as one of the world's leading industrial research organisation. HST 12 states its mission as the transfer of useful technology into businesses and generating intellectual capital for business. HST 12 works across the whole company, being less concerned with product development than with longer-term research that is more than one year away from commercialisation. Some research is very long term, such as work on quantum cryptography, which is more than five years from commercial exploitation. HST 12 researchers 'read books, go to conferences, and browse the web.' The researchers in essence are the creative thinkers who are paid to create the future. HST 12 also sees one of its roles as building relationships between the research and business domains through effective knowledge management.

HST12 is organised into 4 centres, of which Research Operations contains the technical support team known as IT Labs. IT Labs has 25+ support technicians and is distinct from the centre called 'Company IT' which provides basic support such as data processing, web sites and networks. IT Labs provides HST12 researchers with more advanced technical support. This is focused on so-called 'bleading edge' and 'leading edge' research. The specialist technicians in IT Labs are expected to add value to the research, to work as part of teams. The technicians work in one of 5 main roles: Networks; Platforms; (internal) Customer Services; Global collaboration environment; and Applications and business - software development and tools. Typically work might involve the development of a customised operating system for one of the company's product divisions or the development of new database solutions for a team project. In each case the technicians support the work of researchers engaged in commercially focused research, at the same time delivering leading edge solutions. Technicians work closely with but are different from researchers. They work in teams but nonetheless have a great deal of individual freedom.

Recruitment of the technicians in question is aimed at finding the sort of person who could equally have been a product engineer. Of the team of 20, three-quarters are graduates, three have got an MSc and a couple have PhDs. The team includes a few less skilled who work on the maintenance. The skills backgrounds of technicians is broad and certainly not just covering IT. The PhDs in the team did research in particle physics and mining engineering. Some of the technicians are in their first jobs. It is expected they will develop experience and move on - either in the company or elsewhere. One of the main requirements is to build self-confidence and the ability to interact with customers i.e. other company divisions.

There is no such thing as a company career structure. It is reported as a ‘Darwinian Environment’ of survival of the fittest. There is also a lack of monitoring of time. People do get slack time during which they are responsible for their own self-learning. HST12 provides consistent opportunities to access high quality training. At the start of the financial year each technician negotiates objectives for personal skills development with their line manager. Team leaders are responsible for a training development plan for each member. This will consider skills that need sharpening and those that are required from scratch, set against the broad business goals of the unit. Once agreed, the training is ‘booked’ with high quality trainers. Budgets can be considerable and £10,000 per year is not uncommon.

Personal development is seen to be the responsibility of a partnership between the employee and the manager. It is based on regular performance appraisal, with pay linked to performance. Importantly, performance criteria can reflect fully the technical nature of posts. This means technicians can be highly promoted without needing to take on administrative duties. Accordingly, pay can be considerable, potentially rising to £60,000-£70,000.

# 3 Stakeholders

## 3.1 Introduction

2. This section summarises stakeholder views in relation to recruitment, retention, roles, development and career progression of highly skilled technicians. Several stakeholders, notably the Royal Society, the Technologists Action Group and trades union representatives, have already placed comments on record. To place these views in a wider context we consulted three separate groups of stakeholders:

i. Funding bodies

Organisations in this group include the OST and the Research Councils, the Arts and Humanities Research Board (AHRB) and the Wellcome Trust. Although technicians are not necessarily a personnel policy issue for this group, they share a common interest in issues relating to the well-found laboratory.

ii. Technicians' representatives

To cover trades union perspectives, MSF was consulted as the principal Union representing higher education technicians in bargaining, employment and workplace matters.

We also consulted the Institute of Science Technology (IST). The IST is a quasi-professional group comprising (mainly) senior laboratory superintendents working in a range of scientific disciplines. It aims to develop the science and practice of laboratory science technology and to further the recognition of laboratory science as a profession.

iii. Professional and training organisations

A more disparate set of stakeholder interests are represented in this group. It includes the Royal Society, whose views are summarised in the 1998 Report *Technical and research support in the modern laboratory;* the Institution of Incorporated Engineers (IIE); and HESDA, the National Training Organisation for higher education. The Institution of Mechanical Engineers was invited to participate but intimated that issues concerning engineering staff on technical grades were outside its remit.

## 3.2 Recruitment and retention

### 3.2.1 Funding bodies

The Research Councils and AHRB do not record any evidence of problems with highly skilled technician recruitment - although there was some awareness of recruitment shortfall in a few highly specialised roles (for example animal house technicians). The Wellcome Trust reported that HEIs are finding it difficult to fill technical posts, although this applied more to the lower skills end of technical and research support than higher levels. It was suggested that in biological research fields there is less of a problem recruiting for technical support roles where applicants are seeking to find routes through to PhD study.

The Councils, AHRB and Wellcome Trust perceive their role in relation to the provision of funding for specific technical support posts linked to project requirements. Although both the Research Councils and AHRB have a responsibility for highly trained people, this responsibility is applied to those directly employed using project funding such as PGRAs and PDRAs. In general technical support roles are required at a low percentage FTE and the universities are seen as the bodies responsible for longer-term retention and career development of people in these roles.

However, it was acknowledged that there may be tensions between shorter-term funding horizons and longer-term retention issues. The advancement of state-of-the-art technical capabilities was seen as a very challenging area in this respect. The Research Councils expressed some concern for the future of the UK's well-established capacity for instrument innovation. Technology innovation was also identified as a critical consideration. It has been addressed in some fields at a national, managed level (for example, an Astronomy Technology Centre at Edinburgh). We understand also that programme or platform funding provided by several of the Research Councils provides some basis for building continuity in support for key technicians.

The Wellcome Trust's policies in relation to technical support highlight a specific concern with longer-term retention issues, especially for technical specialists at the cutting edge of their field. Generally, the Trust has allowed specialised technologists to be co-applicants on grant proposals, but not to apply for their own salary costs. The assumption has been that these costs are the responsibility of the employing institution. However, since October 2001 the Trust has varied these procedures to enable a case to be made for those with exceptionally strong track records (particularly in statistical or IT support areas). Funding support, normally for those working in research laboratories already in receipt of Wellcome funding, may be provided for a maximum of five years, contingent on the employing institution contributing 20 per cent of salary costs during this period and providing for the full cost for a further five years after.

### 3.2.2 Technicians' representatives

Responses from these groups indicate the general problem of differentiating issues relating to highly skilled staff from the general body of technical support staff. There is a perception that it is difficult to attract good quality applicants to technician posts. However, this view applies primarily to the recruitment of what might be termed 'traditional' technicians, those with primarily vocational qualifications and laboratory experience. Technicians in this mould were distinguished from graduate applicants, primarily in terms of aptitude and commitment to a technical career. It was suggested that while graduate recruitment to technical support posts was not necessarily problematic, the orientation, skills and awareness of good practice in laboratory procedures/techniques required new approaches to recruitment and retention. With few HEIs now recruiting young technical trainees, the emphasis needs to be on underpinning training and career structures. (We refer to this in Section 4.4.

### 3.2.3 Professional and training organisations

The Royal Society has noted that most university departments have 'difficulty in recruiting good entry level staff at current rates of pay (RS 1998 para. 2.5). However, it is less specific about supply issues in relation to the higher skills end of technical support, other than to record a close relationship of 'dynamic flux' between industry and universities that is dependent largely on the cycle of the economy. The perspective of HESDA is that the supply of highly skilled technicians is a complex issue. HESDA supports the view that there has been a general shift towards the recruitment of graduates in technical support roles and that the supply and demand dynamics of this group are different to more traditional technical staff recruitment patterns. Supply is therefore less of a problem than it might otherwise be simply because the employment of young trainees from vocational backgrounds is now a rarity.

These views concur with the comments from the representative of the IIE. While the engineering industry reports a severe shortage of skilled technical people, it appears that the most problematic area concerns the labour market for 16-18 year- olds, particularly those wishing to pursue Modern Apprenticeships. Evidence about the supply of experienced and higher skilled people is more ambiguous. Overskilling combined with some skills shortages is reported across several areas of the engineering industry. This represents something of a paradox, which may be explained in part by the interests of some organisations in promoting a skills agenda. It may also be stimulated by more widely shared fears of an imminent skill shortage rather than a current crisis.

## 3.3 Technical support roles

### 3.3.1 Funding bodies

Research Council perceptions of the roles performed by technical support staff do not appear to be well-defined. In general there is acknowledgment of a close interaction between methods and design, in that such interaction helps to develop research capabilities and that the involvement of highly skilled technicians in fundamental research is essential. It was suggested by one Research Council representative that PGRAs get used to being their own laboratory technicians and expect to carry forward such roles. The assumption appears to be that PGRAs and PDRAs will spend part of their time on such work. This has implications for their own career development and for those in technical support roles. The assumption is that PDRA involvement is neither detrimental nor wholly inappropriate since a desirable objective is to combine science backgrounds with technical skills. On the other hand, there may be merits in developing specialist technical support people capable of running major facilities. For example, genomics facilities are currently managed by PDRAs. A better alternative may be to use skilled experimental officers in such roles.

The Wellcome Trust reinforced these uncertainties, suggesting a growing trend for PDRAs and grantholders to take on some of the work that might once have been performed by technical support staff. Indeed, the Trust expressed some concern at the (related) tendency for grantholders to recruit PGRAs for essentially technical roles, particularly where they register for a PhD. Although this may confer status on the HEI unit, the fear is that the status of the work involved may not in itself be at a suitable level for high quality doctoral research.

The AHRB reflects the general uncertainty about the pace and direction of change in relation to academic and technical support roles. It was reported that anecdotal evidence, rather than a strong evidence base, tends to support conclusions in this area. However, our understanding is that the AHRB perceives issues about technical support roles to be closely related to widely shared concerns about research career paths in the arts and humanities. These pathways are closer to the social science model than to natural or physical sciences. Inevitably therefore understanding technical support roles touches on what PDRAs are being expected to know and do, including technical skills and practice. A specific concern in this respect relates to IT support. It was noted that an increasing proportion of research grant applications in arts and humanities seek support for using IT in high order applications. However, in several cases the necessary support skills have to be sourced through collaborative arrangements with departments in other disciplines. At one level such cross-disciplinary collaboration is positive; at another, it risks portraying the arts and humanities as inadequately resourced for cutting edge, technically supported, research.

### 3.3.2 Technicians' representatives

Stakeholders' concerns focused on erosion of the platform of less skilled roles performed by those in technical and research support. There is a shared perception that the trend at the higher skills end (in certain fields) is towards closer integration between academic and technical roles. However, the recruitment of PGRAs to perform essentially technical support roles is identified as a cause for concern, for two reasons. First, there is a perception that although these staff will possess the necessary scientific theory, they lack grounded laboratory experience and a feel for the underlying principles and practical aspects of laboratory work. It was also suggested that this was resulting in declining laboratory standards of practice as poor habits creep into and then lodge in operating practices.

Second, the roles now being developed in technical and research support undermine even further the career structures enshrined in the Blue Book. It is no longer possible to establish from the guidelines work of equal value, nor the skills and abilities required. This problem has led to institutional by-passing of the Blue Book criteria, often in response to grading appeals, or to place new appointments on grades that are no longer appropriate to the role being performed. Too often the approach is budget led rather than skills led.

### 3.3.3 Professional and training organisations

The Royal Society report has indicated that changes in the role of technical support staff has been driven by a combination of funding pressures and by changes in the internal dynamic of research itself. The drive by university departments to make savings has resulted in attempts to reduce technical support salary costs and to reorganise existing sources of funding and develop new ones. Meanwhile, outsourcing of technical support services, increased automation and computerisation have impacted further on the organisation and nature of technical support roles. For example, the report notes reductions in workbench time, especially in chemistry; an increase in the need to know the 'mechanics' of equipment; a developing requirement for knowledge of computer software and electronics; a shift to data analysis and interpretation; and, a reduction in requirements for manual sampling and data processing (see Royal Society report 1998 paras2.3 and 2.4).

HESDA perspectives confirm this broad picture. In particular it was suggested that roles had changed radically during the last five to ten years. The perception is that technicians are now taking on roles that previously were the preserve of academics, including much more contact with students for demonstration and supervision purposes. Changes in roles were also noted by engineering industry representatives. The IIE emphasised that engineering technicians may be less focused than in previous years on building equipment, but they need to understand the reasons why things go wrong, how to correct them and to develop a feel for data analysis (especially whether results are likely to be right or wrong). It was emphasised that they collaborate closely with engineers in setting and running equipment, obtaining results and, at the higher skill end, taking a more proactive role in developing the work.

## 3.4 Development and career progression

### 3.4.1 Funding bodies

The Research Councils generally consider universities to be the bodies responsible for technicians' training. However, several examples of Council involvement in training were highlighted. For example, PPARC supports a course at Birmingham for advanced technicians seeking to develop skills relevant to space research instrumentation. This course is aimed primarily at fresh physics graduates. We understand too that EPSRC would also be willing to contribute towards training if the costs can be justified. The link with career development issues was also acknowledged. Not all PGRAs on project grants will become academics responsible for their own research. Alongside future academics will be a parallel stream who are highly skilled but seeking sequential employment and development opportunities. One approach may be to build a more explicit Experimental Officer career track, with open-ended employment contracts for those who at present have no obvious career path. It was acknowledged that those in these roles provide key support for laboratories and Principal Investigators. Job insecurity related to funding blips is a disincentive to enter these roles. However, potential problems in developing such initiatives were also identified.

The Research Councils and Wellcome acknowledge the growing costs of skill loss when experienced staff leave. Replacement costs are also increasing as the learning curve for new skills' acquisition lengthens. Wellcome identified problems further back in the skills production line, particularly those stemming from a general decline in core skills in physics, chemistry and mathematics. The Trust's representative was clear that the issue of technical support impinges on the quality of research and that the Trust had responded explicitly to this challenge by opening up funding opportunities for highly skilled technicians. The perception is that the Trust can no longer be focused purely on equipment but must also invest in the skills necessary to deploy it. It recognises that fast changing skills can rapidly become obsolete.

### 3.4.2 Technicians' representatives

There is some criticism of what is seen as a lack of appropriate staff training for HE technicians. This criticism relates in particular to the lack of opportunities for technicians to upgrade their skills whilst maintaining contact with the workbench as a basis for achieving career development. Although Blue Book structures have been opened up, promotion possibilities were too heavily weighted towards managerial roles. It was also suggested that existing skills are not being passed on to new or existing staff. Institutional responses, particularly in relation to the management of reskilling requirements, were identified as problematic. This was associated with a trend towards creeping casualisation and a resultant undermining of technical standards and training rigour. A widening ‘skills gap’ was identified requiring policy attention, with a view to providing a full infrastructure for technicians’ careers and training, perhaps incorporating accredited qualifications.

### 3.4.3 Professional and training organisations

The Royal Society identified several problems in relation to training and career development. It reported claims that technical staff recruited in recent years were less well trained than in the past; a demand for training schemes to enable continual updating of technical skills and expertise; and extensive concerns for career progress associated with overly rigid grading structures, lack of promotion opportunities and job insecurity.

HESDA perceptions reinforce these views. HESDA was one of the original partners to an informal action group from within HE formed to tackle technical skills deficiencies. Although a mixed group, it is united in the view that the sector has a problem with the acquisition of new, cutting edge skills, as well as dropping older skills no longer required. HESDA advocates skills development organised collaboratively, perhaps on a regional basis or through centres of technical excellence.

Engineering representatives recognise the problem of career progression for those in technical roles. We were alerted to several organisations that have turned corporate attention to the linkages between skills development and career progression. For example, our understanding is that BAe has developed three career pathways, one of which facilitates technical specialists rising in rank up to and including board appointment. It is increasingly recognised that the retention of highly skilled technical specialists is linked to the identification of clearly delineated career development structures that link training with promotion opportunities.

# 4 Literature review

## 4.1 Background

3. Our search of on-line bibliographic databases found several thousand journal articles in the last two decades that refer to technicians. Further checks using key-word combinations revealed that very few of these were of direct relevance to the present study. A detailed review confirmed that literature on technicians' work and roles is extremely sparse and dominated by empirical studies of workers in US industrial and research settings. Technicians constitute a neglected area in the sociology of science and work organisation. Because they work in organisations that tend to be dominated by other occupational groups, especially professionals such as doctors, scientists and engineers, technicians constitute an almost 'invisible' part of the workforce (**Shapin 1989**).

This neglect of the technical stratum is something of a paradox, for two reasons. First, in the British context at least there is a long history of debate stretching back to the nineteenth century about the technical development of industry and the quantum of requisite skills necessary for international economic success. The Second World War highlighted the essential contribution of science and technology in both educational and economic policy terms. Thereafter a series of official inquiries and policy instruments pointed out the deficiencies of provision for technical and technological education and training in both schools and universities (**McCullogh 1989; Fox and Guagnini 1993; Sanderson 1994**). Despite the resurgence of interest in technical education after the 1944 Education Act the reality for much of the period since has been a dual system of stratification that has emphasised professional and craft streams of training at the expense of technical (**Venables 1955** *Technical Education* is the standard work).

The second, closely related, reason reflects confusion about the differences between scientists, technicians and technologists. Again, these are deep-rooted problems. They were reflected in the protracted struggles after WW2 to develop British postgraduate technological education comparable to the provision offered by the Massachusetts Institute of Technology. It was symptomatic of the problem that when Lord Hailsham assumed responsibility for science and technology in 1959 (as Minister for Science) he had to have the term 'technology' explained by his principal official (cited in **Walsh 1998: 176**). Precise definition of what constitutes technical roles appears to have been lost in the same fog of confusion. But the paradox is that over time technicians and the roles they perform have become an increasingly important, if imperfectly understood, part of the industrial and scientific process.

Despite their invisibility in the literature, technicians' work expanded considerably during the second half of the twentieth century. The term 'technician' as denoting an intermediate grade of worker only came into general usage (imported from America) during and after the 1940s. Thereafter technicians became an increasingly important component of industrial and scientific production, the paths by which technicians' occupations evolved varying considerably (for an analysis of these paths see **Whalley and Barley**

**1997**). Towards the end of the 20th century a number of researchers, particularly in the US, began to argue that shifts in the post-industrial or service economy could not be understood without a proper appreciation of the input of technicians (**Barley and Bechky 1994: 87**). This was reinforced during the 1990s by Bureau of Labor Statistics data indicating that professional and technical jobs were increasing faster than all others, and forecasting that these workers would represent 18 per cent of the labour force by 2005. Employment data for the UK and Canada suggested similar growth patterns (**Barley and Orr 1997: 3-4**).

The advent of technical roles in higher education research needs to be viewed against this general background. It is only in recent years that social scientists have begun to investigate the social origins, development and roles of the diverse occupational groups that comprise technicians. Because of its relative sparseness the following review examines the literature thematically, concentrating on those studies most relevant to the issues raised in our empirical study of highly skilled technicians in English higher education institutions.

### 4.2 Technicians in UK policy studies

The only recent UK policy study to be published has been **The Royal Society Report (1998)** *Technical and research support in the modern laboratory*. It argued that technical and research support staff play an important part in research teams but have attracted little attention in discussion of research policy. The study focused on 'traditional' technicians; scientific support staff (including experimental, technical and scientific officers); and PGRAs. It noted (but did not comment further) that aspects of technical support are provided by 'other' staff and in some circumstances by postdoctoral research associates.

The report noted that changes in technical support roles during the last two decades reflect four broad factors: (i) pressure on funding for the science research base; (ii) a shift towards short-term project funding; (iii) pressures from the RAE and a rapid growth in student numbers; (iv) changes in the internal dynamic of the research process e.g. increasing sophistication of experimental techniques and equipment. In the face of these changes, a decline in the number of 'core' technical support staff and a culture of short-term contracts, the report noted its concern for the continuity of five support skills:

- Specialist design and manual skills to build research equipment not commercially available
- Advanced technical skills required to operate and maintain large complex pieces of equipment
- Knowledge of local set up
- Ability to evaluate products and services (intelligent customer)
- Effective lab management and safety.

The report suggested that HEIs and the Research Councils had responded to these trends by seeking additional funds from new sources to support technical support functions; controlling costs more rigorously; restructuring departments to seek economies of scale; centralising facilities; assigning technicians to major research groups rather than specific projects or individual researchers; and outsourcing a wide variety of services. Specific recommendations were:

- 'There must be no further reduction in technical and research support'
- Funding Councils and charitable bodies should consider how core technical and research support staff can be protected
- Commends MRC responsive mode of longer-term funding to provide greater stability for core technical and support staff
- Investigation of implications of RAE to stability of funding for technical and support staff
- A more integrated approach to career prospects and training of all technical and research support staff including revision of Blue Book, new approaches to technical training and introduction of university training courses.

Technicians have figured less prominently in other recent UK policy documents. The Dearing Report included a number of references to changing roles of administrative and support staff including those in technical support roles (see **NCIHE 1997** especially Report 4). Although a diverse group in terms of the type of work performed, the report concluded that they were playing an increasingly central role in HE, driven by the growth of IT, changes in the delivery of HE and the development of an enterprise culture. However, the report noted that technical and support staff had experienced a less dramatic change in their role due to the impact of IT and other technological advances than other administrative staff. Two reasons were identified. First, technicians were already embracing new technological sources as an integral part of their daily work. Second, they were less affected by increasing numbers of IT users. The report explained that this was primarily because technicians tend to be attached to specific departments rather than providing a core university wide function and this had the effect of limiting the numbers of staff and students they were required to support.

Dearing also noted that technicians' opportunities for career progression were limited. The primary reason cited by technicians and support staff was lack of resource. The report quoted one technician who explained: 'Technicians are…funded from within the department, so there's no real incentive for the head of department really…to upgrade you because it's just less money for them' (**NCIHE 1997** Report 4, para 5.39). This problem received indirect corroboration in the Bett Report. In pre-1992 institutions a substantial proportion of technical staff were found to be at the top of their pay scales, yet for the period 1981-1998 the average earnings of this group had increased 21 per cent less than all non-manual employees (Bett 1999 paras 51 and 155). Bett went on to recommend that for technical and other lower grades the aim should be to redress large disparities with market rates for equivalent jobs (**Bett Report 1999 R29**).

### 4.3 The social organisation of technicians' work

Apart from an ongoing study of medical and pharmaceutical technicians in research and pathology laboratories (funded by the Wellcome Trust, see **Russell, Tansey and Lear 2000**) the major source of insight and conceptualisation of technical work within science as a social institution is provided by the American studies of Barley and colleagues. The core of this work emerged from a series of studies sponsored by the Program on Technology and Work at Cornell's School of Industrial and Labor Relations during the late 1980s and early 1990s. Occupational groups investigated include emergency medical technicians, science technicians, medical technologists, radiological technologists, microcomputer support specialists, engineering technicians and programmers. Accounts of these studies have appeared in several sources, but perhaps the most useful compendium of these is **Barley and Orr (1997)** *Between Craft and Science*. Focusing on technicians in action the various chapters provide empirically based insights into the changing nature of technicians' roles, the culture of technical work and its recent development.

These works draw attention to wider problems about technical work, notably its anomalous nature located in the interstices of science and craft, blue-collar and white-collar. Indeed, the title to the introductory chapter – '*The neglected workforce*' – conveys the essence of the problem in relation to understanding technicians' work. The studies also illustrate the diversity of roles that are sometimes included in the titles technician and technical.

Reinforcing this point, the literature search revealed several studies of technicians that locates them as factory based shopfloor workers. For example, **Bonazzi 1998** studied supervisory and technician roles in the Fiat plant of Mirafiori. **Orr** (1996) studied copier service technicians. These are very different occupational groups, different again from highly skilled technicians in HE. However, one argument is that although superficially different, they share a common problem of troubleshooting complex machinery in situations that can often be urgent (**Pentland 1997**: 114). Another argument is that the studies have an intrinsic empirical value. Several have been instrumental in breaking new conceptual and theoretical ground, particularly in signposting connections between organisational theory and the study of work. Whilst not directly relevant to the present focus we refer below to some of the concepts that have proved helpful in developing our own understanding of technicians' roles in HE.

### 4.4 Technicians' knowledge

The literature suggests that the knowledge base required of highly skilled technicians is increasing. Technicians are not just 'junior professionals'. They work at, and often manage, the interface that links symbols, information and theory with the empirical world. Although it is evident that technicians require contextual knowledge and skills it would be a mistake to assume that the academic's knowledge subsumes the technician's. According to one study, such a view would misrepresent the distribution of scientific skill within science's labour process (**Barley and Bechky 1994**). Indeed, it can be argued that technicians' work resembles the professional-academic because it is esoteric to the extent that few outsiders could claim similar skills or knowledge. The skills required are also relatively analytic and may require specialised education (**Barley 1996: 413**).

However, studies have revealed that technicians' knowledge and skills need to be understood with reference to important distinctions between formal and contextual knowledge. Experience and on-the-job learning characterises technicians' contextual understanding. Such knowledge is accumulated in ways that is neither reflected in, nor tested by, more formal training and educational programmes. Typically therefore contextual knowledge is an amalgam of formal and informal knowledge (**Barley and Bechky 1994**). Interest in the qualifications and training of technicians in science education (in UK schools and colleges) has been shown by the Association for Science Education (ASE) (**Gadd 1999**). Noting that the skills and personal qualities of science technicians have lacked recognition, the ASE, with two other organisations – Vocational Qualifications in Science, Engineering and Technology (VQSET), and the Science, Technology and Mathematics Council National Training Organisation – has spearheaded the development of a framework for the professional recognition and development of lab technicians. NVQ Levels 1-3 and a Modern Apprenticeship for Laboratory Technicians Working in Education are being developed. ASE claims that technicians themselves have been at the heart of the qualification developments. The relevance of this framework to the development of highly skilled technicians in HE is not clear. Such technicians are probably operating more at levels 4 and above rather than Levels 1-3. It is not clear how far those operating at these higher skill levels have bought into the whole competency NVQ paradigm. Moreover, training at modern apprenticeship level can only be considered as a starting point in attaining the highly skilled roles that are the focus of the present study.

Ethnographic research reveals that technicians create their own informal ‘communities of practice’ that may prove most effective as learning communities regardless of the formal organisational context in which the work takes place **(Orr 1996)**. The literature establishes that it is not unusual for high skill technicians to have few or no formal qualifications in their particular specialist field. However, predicted shortfalls in technical labour power and suggested remedies for improved education and training too frequently ignore these findings. The particular ways in which technicians acquire knowledge and build their expertise can easily create tensions with professional educators’ tendency to elevate theoretical over contextual knowledge (**Barley 1993; Zabusky 1997; Henning 1998;** for a study of different types of skill formation see **Whitley 1995**). Training programmes dedicated to developing technicians’ skills can nevertheless show excellent results. For example, in a comparison of measurement precision between research technicians and radiologists in vertebral morphometry, completion of an on-line training programme was seen to promote good interobserver measurement precision, even where those participating in the study had no prior experience of the techniques (**Gardner et al 2001**).

That technicians’ knowledge and the nature of the skills they bring to the work process is sometimes misunderstood is possibly one aspect of deeper legacies of meaning and status attached to notions of professional-technical work (**Whalley and Barley 1997**). One study of such distinctions investigated how the term ‘technician’ was used to explain different perceptions held by farmers and conservationists in relation to their understandings of nature. While conservationists construct farmers as ‘technicians’ largely ignorant of nature’s workings, farmers see themselves as ‘natural conservationists’ (**Burgess, Clark and Harrison 2000**). Similar overtones of professional versus technician identities were revealed in a study of how the work of engineering technicians is affected using the orders written by engineers (**Winsor 2000**).

Several studies of technicians’ work in disparate specialisms draw attention to the impact of advancements in knowledge on prevailing modes of work organisation. For example, in a study of dairy science **Misztal and Lawlor (1999)** argue that the increase in volume and complexity of genetic information, coupled with new technology, implicates *both* technicians and scientists in the research, design, supervision and maintenance of the entire system of evaluation, decision making and distribution. In paramedical work, improved techniques allow technicians to do work previously performed by more highly qualified professionals (**Schoenfeld 1999**). In some sub-fields of medical research it is even argued that batch science machines may serve as programmable laboratory technicians in a ‘servile’ role replacing hundreds of humans in pursuit of answers to ‘big’ problems (**Layne and Beugelsdijk 1998**). Failure to understand the changing knowledge base required of technicians has a number of implications. First, it raises questions about the rationale for linking learning opportunities with applications in the scientific inquiry process. For example, one study has concluded that experiential education strategies are likely to strengthen school science performance and create an increased pool of scientific and technical workers (**Tuss 1996**). Second, it highlights the challenges that organisations are likely to face given the changing nature of technicians' work. It is important to understand what technicians do and what they (need to) know if organisational arrangements are to be fit for purpose (**Barley 1996**).

### 4.5 Technicians' roles: a paradigm shift?

The configuration of technicians' knowledge is linked to how their work is conceptualised. **Barley (1996)** suggests the technician's task is primarily to link the empirical world to the symbols, information or theory used by professional occupational groups. How the social role of the technician is articulated depends on the organisations in which they work and the particular division of labour involved. In general, however, these roles conform to one of two different conceptualisations:

*Technicians as 'buffers'*, applies when the technician is substantially involved in the work process. In effect the technician's role is to 'buffer' other occupations from the empirical phenomena on which they are dependent for their theories, designs, plans, diagnoses etc. In this role the technician provides the output that in turn serves as the input for the work of other occupations, especially those described as professionals. **Barley and Bechky (1994)** identify research laboratory technicians as prototypical 'buffer' technicians.

*Technicians as 'brokers'*, applies when the work of the technician is less directly relevant to other occupational groups. Instead they are responsible for creating the general conditions necessary for other work to proceed. Typically the technician oversees aspects of the technical infrastructure upon which the core production system rests. **Zabusky (1997)** identifies IT support workers as prototypical 'broker' technicians.

Although these conceptualisations are helpful to understanding the place of technicians in the division of labour (and why in general technicians tend to be accorded low status), they do not explain wider changes in the organisation of technicians' roles. Paramount amongst these has been the shift towards team working, characterised by the growth of self-managed, semi-autonomous groups whose work or outputs contribute to the wider activities of larger systems. Several studies have noted that teams of technicians provide exemplars of precisely this development. Understanding the behaviour of teams (inside as well as outside the laboratory) also highlights a further shift in the division of labour, from hierarchical to horizontal forms of work organisation.

For example, in a study of the economic logic of organising field technicians, **Batt (2001)** has drawn attention to the importance of understanding how teams contribute to production efficiencies, the extent to which they alter the broader organisational structure, and the impact of the specific industrial and technological context. Batt draws attention to the distinction between direct and indirect tasks performed by technicians and their managers. Indirect tasks include co-ordination (including the allocation of labour and internal-external co-ordination) that are very time consuming, but are essential to maintenance of the technical infrastructure. In vertical hierarchies these tasks will typically be performed by managers. But as Batt argues, this is anomalous where technicians work according to the logic of occupational or horizontal communities. Self-managed teams are likely to be much more efficient for two reasons: first, third-party transaction costs are eliminated; second, the level of technical expertise among technicians is invariably higher than among supervisors. The assumption is that removal of supervisors improves technical efficiency and reduces indirect costs. Further, organising into self-managed teams should change the production system through better alignment between the organisational structure and technicians' occupational skills and practices (**Batt 2001: 6**).

The emphasis on self-managed teams and organisational structure draws attention to similar questions in relation to the roles of highly skilled technicians in higher education research. In particular it highlights possible role and task differences due to discipline and funding disparities. It also raises important questions about the cause of any shift towards a more collaborative organisational model, its relationship to the apparent decline in the numbers of technicians, and whether there are any advantages to be derived from involving technicians in the whole research process.

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## 5 Statistical Annex

### 5.1.1 Changes in numbers of technicians at successive Research Assessment Exercise (RAE) census returns

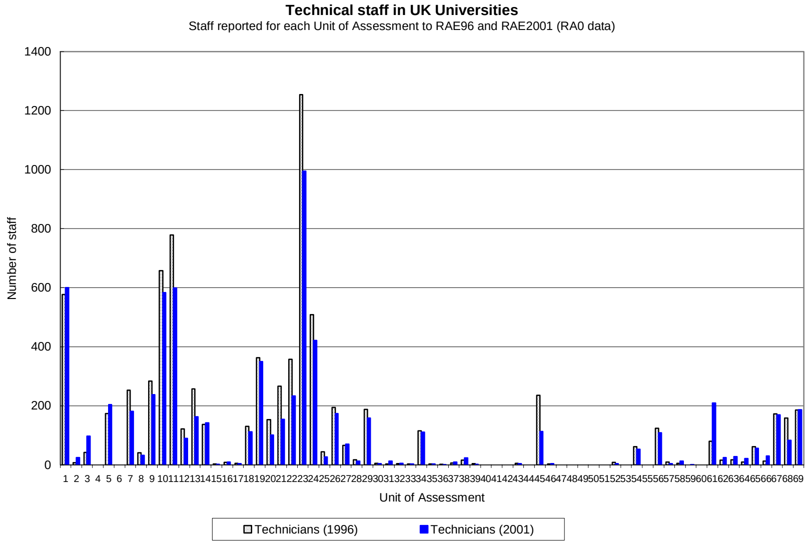
| SUoA code (note 1) | SUoA name | Technicians reported to RAE96 | Technicians reported to RAE2001 | Difference | Percentage change |
|---|---|---|---|---|---|
| 1 | Clinical | 2241.5 | 1997.9 | -243.6 | -10.9 |
| 2 | Pre-clinical | 917.6 | 757.2 | -160.4 | -17.5 |
| 3 | Biological sciences | 577.2 | 450.7 | -126.5 | -21.9 |
| 4 | Environment | 581.1 | 463.3 | -117.8 | -20.3 |
| 5 | Mathematics | 16.0 | 15.9 | -0.1 | -0.9 |
| 6 | Physical sciences | 1630.3 | 1356.5 | -273.7 | -16.8 |
| 7 | Engineering | 1889.8 | 1466.0 | -423.8 | -22.4 |
| 8 | Social science | 117.8 | 143.7 | 26.0 | 22.1 |
| 9 | Business | 23.7 | 30.9 | 7.2 | 30.3 |
| 10 | Language and culture | 24.6 | 37.5 | 12.9 | 52.7 |
| 11 | Humanities | 70.7 | 56.8 | -13.9 | -19.6 |
| 12 | Visual & performing art | 122.7 | 281.6 | 158.9 | 129.6 |
| | **Overall** | **8212.8** | **7057.9** | **-1154.8** | **-14.1** |
| SUoA 1-7 | Broad-based 'science' | 7853.4 | 6507.4 | -1346.0 | -17.1 |
| SUoA 8-12 | Broad-based 'arts' | 359.4 | 550.5 | 191.1 | 53.2 |

4. These data group the units of assessment (UoAs) by major subject areas (cognate groups of similar UoAs or Super-UoAs - SUoAs), making it easier to distinguish patterns of change.

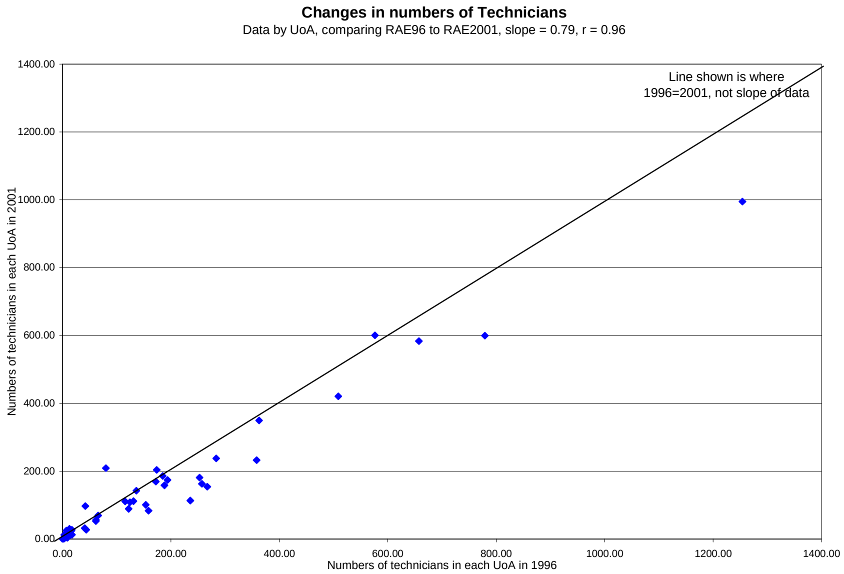
Technician numbers at RAE2001 have clearly fallen since RAE96, confirming the general trend identified in all the case studies. Since some minimum numbers will be required to support ongoing teaching it might be assumed that the cuts will have fallen disproportionately among research technicians, but this may not be the case. The shift of research technicians onto 'soft money' will have maintained their numbers in the research active institutions, and changes in teaching practice have reduced the volume of laboratory-taught classes although student numbers have risen.

There is a clear difference between the sciences and arts, not only with the overall aggregate numbers but also the fact that there has been a rise in technical staff numbers among arts subjects. Why this has occurred is not immediately clear but part of the explanation has to lie with the increasing demand for IT support staff in many areas, which are included in the figures. These are skilled staff, but the skills are generic rather than specific to the university or research environment. There is no reason to believe that the increase in IT staff in the arts is not reflected equally or even possibly to a greater extent in the sciences and therefore is masking a greater decline in the numbers of traditional technical posts directly associated with specific subject methodologies.

### 5.1.2 Changes in technician number in each Unit of Assessment



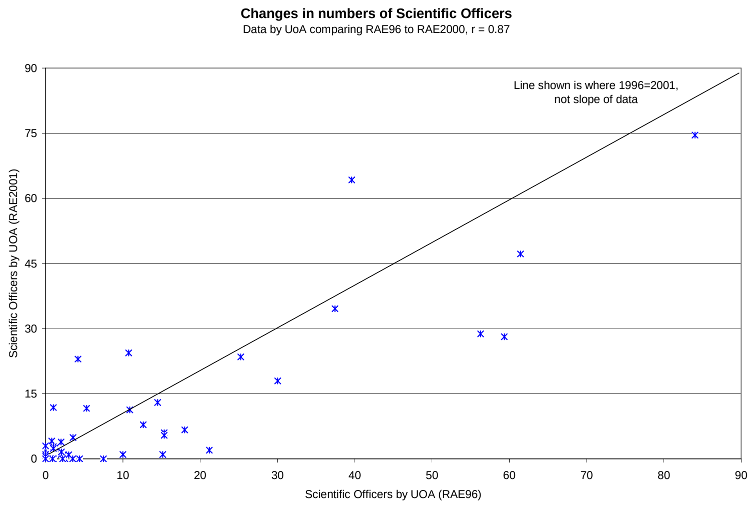

This histogram confirms at a more detailed level the trend seen in the table. Numbers of technicians have fallen most in the science subjects and where technical staff were more frequent, while numbers have increased in the arts areas.



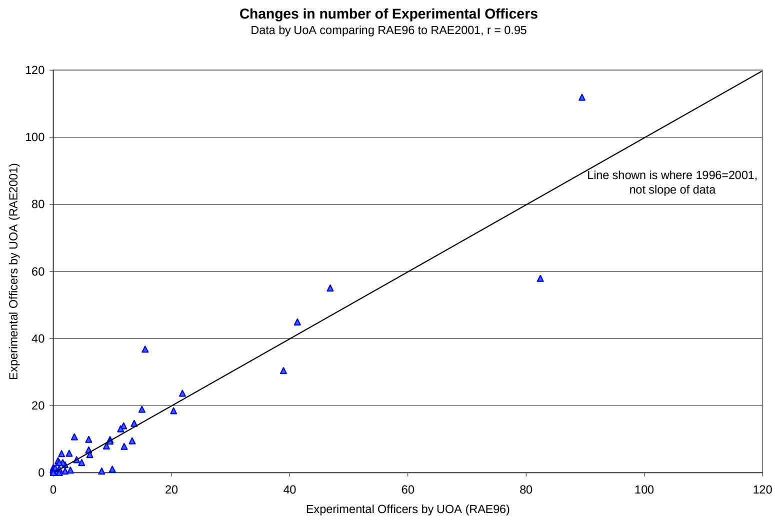
In this plot, all points below the line (which measures where 1996=2001) indicate UoAs in which technician numbers have decreased. Overall, the slope of 0.79 is a reflection of the relative proportions of technical staff now compared with 1996.

### 5.1.3 Changes in numbers of other research support staff

Numbers of Scientific and Experimental Officers are also reported to the RAE, although these are an order of magnitude less common than technicians. Small absolute changes therefore cause large apparent fluctuations.




While there are changes in the distribution of Scientific Officers between the RAEs, the overall trend is of stability. Some UoAs are up and others are down, suggesting reallocation of research activity. This may also reflect changing practice or differences between universities.



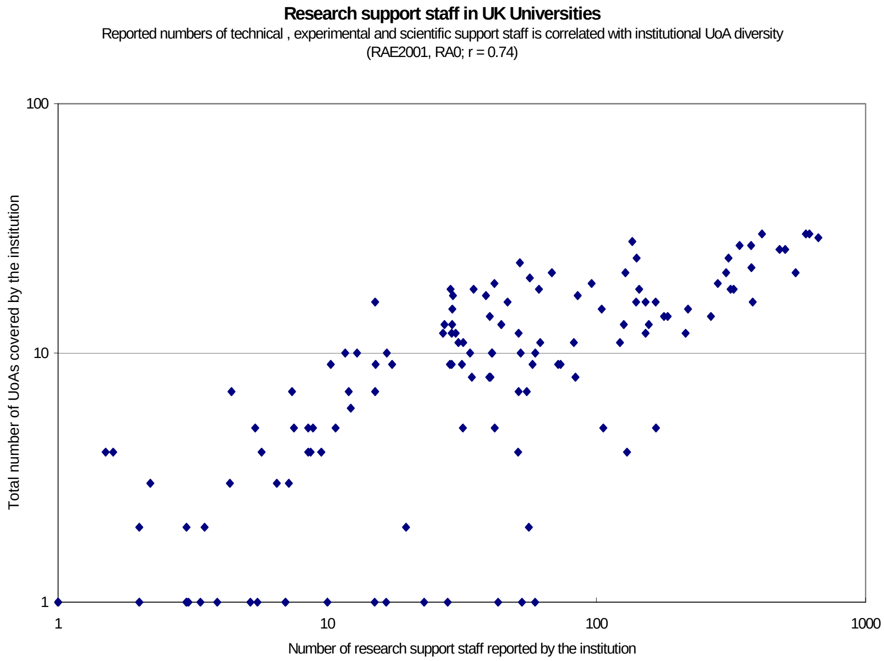

There is a slight decline in the numbers of Experimental Officers between RAEs but this is not on the same scale as for technicians nor is it uniform across UoAs.

Overall, therefore, the change in technician numbers does seem to be distinct from a general change in support staff. This reinforces the impression gained form the case studies, but the data do not suggest that these other grades are being used in any general or consistent way to regrade specialised technicians.

Data on Research Assistants might throw some light on the growth of RA numbers as a substitute for highly skilled research technicians, but the total RA population is so much larger that the likely staff shifts would be diluted beyond ready statistical recall.

### 5.1.4 Support staff and institutional diversity

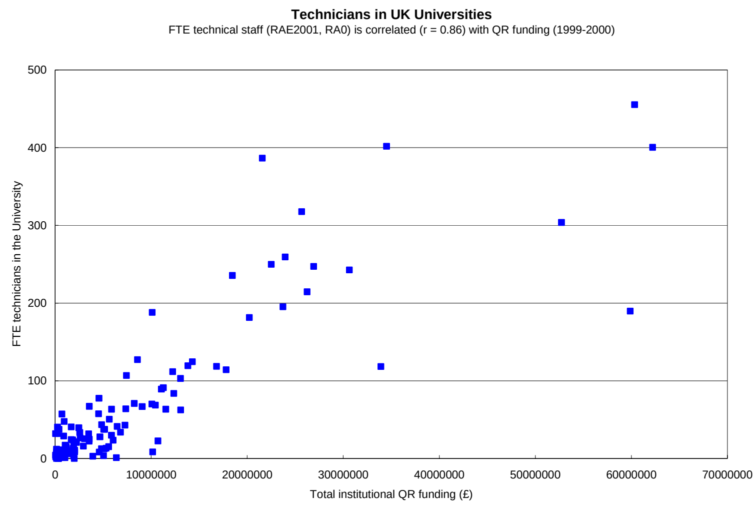
The data confirm that total numbers of support staff at RAE2001 are broadly in line with institutional diversity. That is, there are more technical staff in those institutions that submit in a greater number of UoAs to the RAE. This can partly be explained by the tendency of smaller more specialised HE institutions i.e. those covering fewer UoAs, to be arts based. By contrast, HEIs with higher levels of technical support tend to be more



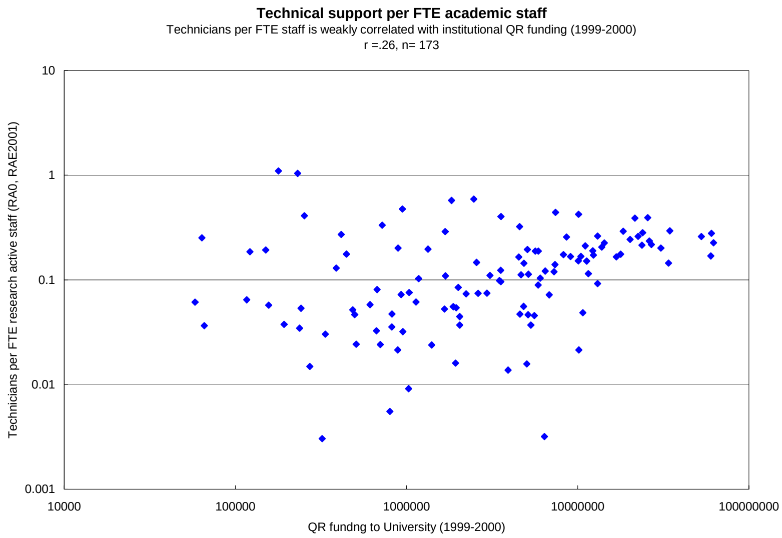

science based and in general older institutions with greater disciplinary diversity.

Specialist technology-based institutions are usually found only among the public-sector research establishments, not funded by the HE Funding Councils. There are, however, some land-based colleges that have a relatively high technician complement for their level of research activity.

### 5.1.5 Technical support in relation to research funding

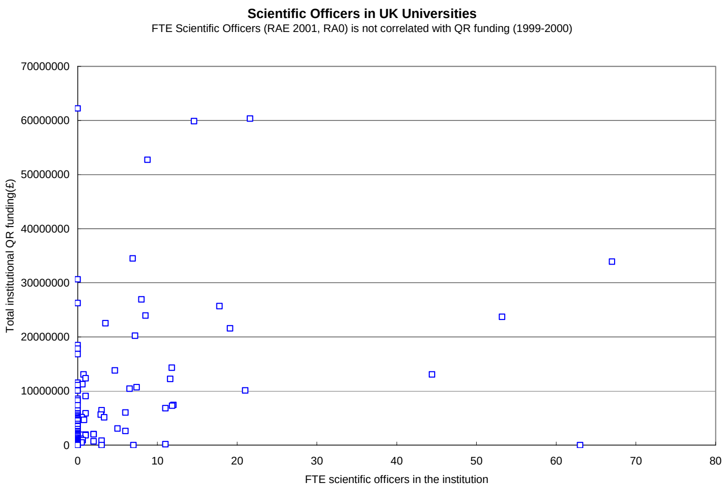



It is not surprising that there are more technicians where there is more QR core research funding. These data are significant, however, because they contrast with the data on Scientific and Experimental Officers. For those grades any anticipated correlation is absent.



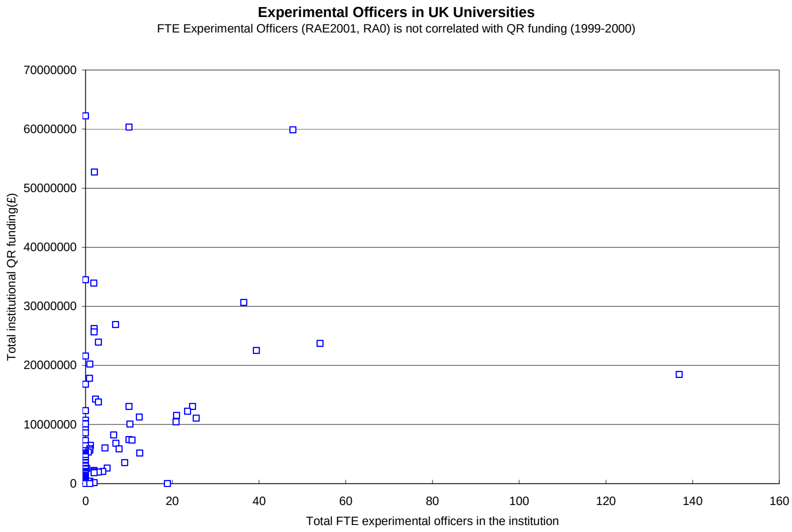

Rather than looking at the abundance of technicians in relation to funding, this graph shows the relative level of technical support in relation to research funding. The correlation is not visually striking but it is statistically significant. That is to say, there are more technicians per FTE research active academic staff in those institutions with absolutely more core research funding. There is, however, a scatter of smaller, specialist institutions that have relatively high levels of technical support. The relative levels of technical staff may reflect the concentration of science activity in larger institutions.

### 5.1.6 Other research support staff and research funding




It is evident that there is no relationship between the distribution of staff at Scientific Officer grade and the level of institutional research funding. In some institutions there are relatively large numbers of such staff but QR is relatively small, while elsewhere the grade seems to be rarely used yet QR is high. The data could indicate whether these Scientific Officers tend to be clumped in particular UoAs but as the data are sparse we would simply draw attention to the lack of any clear institutional or systematic policy in regard to grade usage.

As for Scientific Officer numbers, there is no systematic pattern in the use of the Experimental Officer grade. One institution appears to have an exceptional number of such staff but we have not ascertained as to whether there is any specific policy behind this or whether this is a statistical outlier.



## 6 Abbreviations

| | |
|---|---|
| **AHRB** | Arts and Humanities Research Board |
| **ASE** | Association for Science Education |
| **CERN** | European Particle Physics Laboratory, in Geneva |
| **EO** | Experimental Officer |
| **FTE** | Full-time equivalent |
| **HE** | Higher education |
| **HEFCE** | Higher Education Funding Council for England |
| **HEI** | Higher education institution |
| **HERA** | Higher Education Role Analysis |
| **HESA** | Higher Education Statistics Agency |
| **HESDA** | Higher Education Staff Development Agency |
| **IIE** | Institution of Incorporated Engineers |
| **IRC** | Interdisciplinary Research Centre |
| **IST** | Institute of Science Technology |
| **JIF** | Joint Infrastructure Fund |
| **PDRA** | Post-doctoral research associate |
| **PGR** | Postgraduate research (student) |
| **PGRA** | Postgraduate research assistant |
| **QR** | Quality-related research funds |
| **RAE** | Research Assessment Exercise |
| **SO** | Scientific Officer |
| **SRIF** | Science Research Investment Fund |
| **ULF** | Union Learning Fund |
| **UoA** | Unit of Assessment (in the Research Assessment Exercise) |