

History of the British Geological Survey 1990-1997

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A history of the British Geological Survey 1990-1997

Introduction

Any attempt to write the history of the British Geological Survey for the period 1990 to 1997 at this time is fraught with potential difficulties, not least because a period of time is usually needed before the significance of a period can be truly assessed by those with 'no axe to grind'. Why then am I choosing to put out this account at this time. To do so does at least have the advantage that many of the issues in which I was directly involved are still fairly fresh in my memory. But first and foremost

I have been required to do it as part of 1997 Science Management and Audit (SMA) exercise and I thought that BGS staff generally might be interested in this short account, which is essentially the SMA report, with a few additions and personal observations.

It is important to stress that when I took over as Director of BGS in March 1990 I was able to build on the many achievements of past Directors and the firm base that they had provided. Geoff Larminie (1987-1990), Innes Lumsden (1985-1987), Malcolm Brown (1979-1985), Austin Woodland (1975-1979), Kingsley Dunham (1967-1975) and James Stubblefield (1960-1966) all contributed in their particular way to ensuring the well-being of the BGS^[1]. Nor was I acting alone. The Directorate were, and continued to be, very much part of the process of change, contributing their ideas and their energy in order to achieve the right changes. You will no doubt make your own judgement on that in the fullness of time, but at least this account will provide you with a better understanding of the climate of change in the period 1990-1997 and why things were done in the way that they were done.

1. [↑](#) It was a particular pleasure to be able to welcome all those past Directors to the official naming ceremony for the Kingsley Dunham Centre of the BGS at Keyworth in June 1990.

The period 1990-1997

The period under review (1990-1997) as part of the science and management audit (SMA) process, has been a time of change for the BGS as it has responded to new initiatives, new priorities, the changing needs of Government and a series of reviews. Some reviews have been helpful, others less so. But throughout, the BGS has remained scientifically very productive; in fact, it has produced more good science and more products for more customers than ever before. As the subsequent text and data will show, 1990 to 1997 has been a period of considerable achievement for the Survey. The BGS can take pride in this and from it derive confidence in the future of the organization. Any ephemeral uncertainties resulting from the restructuring in 1997 or the appointment of a new Director early in 1998 should not be allowed to overshadow the enormous achievements of the BGS over the past 7-8 years, nor the firm foundation that this will provide for the years to come.

Rather than starting this account at the date of the previous SMA in early 1991, it is perhaps appropriate to stress that the period of change for the BGS commenced in early 1990 when I took up the position of Director, when the recommendations of the Butler Review were implemented and when the new Core Programme commenced. In mid-1990, a review was initiated (using Price Waterhouse as external advisers) to consider new business opportunities against a background of decreasing support from Government contracts and some caveats attached to the new science budget funding given as part of the 1990-1991 PES settlement. At this time, one possible option was perhaps to decrease the size and scope of the BGS to encompass only the Core Programme, but I and senior management were (and still are) very much of the view that there are major benefits accruing to the BGS from commercial contracts, whether with the private or the public sector. Mr Robert Jackson, the Minister at that time, was also very much of this view. Equally importantly, following private discussions I had with the Minister in May 1990, he agreed that there would be no decrease in the science budget if we were to bring in more external funds. He publicly gave this assurance at the naming ceremony for the Kingsley Dunham Centre in June 1990. This then was the decision in late 1990: the BGS would respond to decreasing Government income by increasing its income from other sources, both in the United Kingdom and internationally. At the same time the Survey would drive down overheads to ensure that it was a cost-effective organization able to maximise the amount of money directed at the science. All this was to be done without compromising the excellence and impartiality of BGS science. To facilitate this process, a new

'market-facing' structure was put in place at the end of 1990, and a Core Programme with clear deliverables was defined. How then has this worked over the subsequent years and what have been the achievements?

Perhaps a notable achievement during this period has been to maintain staffing levels and improve productivity at a time when most other major geological surveys in the World have had their budgets severely cut and their programmes compromised. The United States Geological Survey (USGS), the Geological Survey of Canada (GSC), the French Survey (BRGM), the Australian Survey (AGSO), the German Survey (BGR) and many others have all been subjected to major cuts. That this has not happened to the BGS is not due to the existence of a more benign regime in the United Kingdom in the 1990s, for during this same period most Public Sector Research Establishments (PSREs) in the United Kingdom have been under severe attack from reviews, privatization and various other initiatives (see later). Rather, it has been due to a vigorous effort by the BGS to find new customers, exploit data in new and innovative ways, and take a more thorough business-like approach, combined with scientific excellence and a willingness to be at the vanguard of change.

All of this has resulted in Government being persuaded that there is a need to have a geological survey, functioning within the public sector, and that the BGS is best placed to deliver that essential function. This then has been the approach taken and the philosophy that has prevailed over the past eight years. Let us now look at specific issues, examples and outcomes.

Structure of the BGS Programme

One of the achievements of the BGS over the past seven years has been to develop a structure for its scientific programme composed of Core, Partnership and Contract Programmes (Figure 1) which enables the Survey to work with 'mixed economy' funding in a highly effective manner. Each of these programmes has its particular funding sources and its specific 'deliverables'. But at the same time these various elements are mutually supportive with, for example, expertise and knowledge developed in the Core Programme feeding into the Partnership and Contract programmes, and data and funding flowing from the Contract Programme back to the Core Programme. It is important to stress that there is no subsidy of the Contract Programme from the Core Programme. This tripartite structure has been highly effective over the past few years and has become recognised as a generic model which can be applied to other scientific organizations. In a House of Lords debate on science earlier this year the Earl of Clancarty said 'With my emphasis on pure research, I certainly do not wish to deny the use of the results of industry-financed or commissioned research. Rather, there is in a PSRE such as the BGS a fragile and subtle relationship between, on the one hand, the so-called 'core programme' and, on the other, commissioned research — what the BGS calls a "synergy". To tamper with one will radically alter the character of the other'. To that I say Amen!=== Scientific achievements ===

I have indicated that the BGS Core, Partnership and Contract programmes are mutually supportive. But it is also important to stress that the quality and importance of the science is not dependant on the manner in which that science is funded; contract or partnership science can be, and frequently is, of the same high quality as core science. Therefore, I shall highlight some of the BGS's scientific achievements without concern for whether they are part of the Core, Partnership or Contract programmes.

Geological mapping is the most traditional role of a geological survey, but in fact geological mapping now constitutes no more than about 25 per cent of the total BGS programme. Neither is the approach used for the mapping programme 'traditional'; rather, it is highly innovative. Mapping is the activity which underpins most other parts of the programme to a greater or lesser degree, and therefore the health and productivity of the mapping programme is critical. By any measure, the

core mapping programme has been highly successful. The Survey is now halfway through the 15-year mapping programme and is right on target, despite an overall decrease in the core science budget for the onshore geological mapping programme (at 1997/98 prices it is now only £3.6 million per annum compared to £4.4 million at the start of the programme).

An even more graphical measure of this success is the number of products produced during this time. Specifically, in the six financial years since the last SMA the BGS has so far published 115 printed maps at the 1:50k scale (with more to be published in the remainder of this financial year), compared to 55 maps published in the previous six years. I believe that I have probably 'signed off' more maps in the past eight years than were signed off in the previous 20 years. This is not my achievement; it is the achievement of all BGS staff. This substantial increase in productivity followed the complete conversion of the BGS map production system to digital methods in the latter half of 1992/93. But because of the necessary 'bedding-down' process associated with moving to a completely new methodology, the full benefit of this investment in digital map production was not seen in printed map output until 1993/94 and beyond (Figure 2); in the past four years 110 maps have been published compared to only 78 in the previous eight years! The BGS's digital cartographic techniques, developed to service the mapping programme, are now the most innovative of any survey in the World.

Similarly, in the six years before the last SMA a total of 38 publications were produced, all of them memoirs. Since that SMA, not only will 44 memoirs have been published by the end of this financial year, but at the same time a huge variety of additional, innovative publications have been added to the BGS portfolio. Notable examples include eight Offshore Regional Reports, nine Lithostratigraphic Atlases, new products such as Hydrogeological Monographs, a new UK Atlas Series and an acclaimed and growing range of Popular Publications designed to bring the earth sciences to the wider public; five books, 13 guides, and three posters have been published since 1993/94. Here, I must acknowledge the outstanding job that the editors and the publications staff have done in producing this staggering range and quantity of publications.

Of course, BGS science is not just about producing standard publications; it is also about scientific creativity. During the past six years there has been a great diversity of creative scientific developments in terms of understanding urban geoscience, the palaeogeography of the Westphalian, the Iapetus Suture Zone, the geological applications of remote sensing in the UK, fracturing, and in many other areas.

In the area of geochemical mapping, the programme is on schedule despite a declining budget: it is producing outstanding products that are widely acclaimed as the best of their type in the World. In the past six years 35 000 square kilometres have been geochemically mapped in the regional mapping programme, compared to 28 000 square kilometres in the previous six years. Concurrent with this increase in the area covered by regional mapping, an additional 800 square kilometres of urban area have been the subject of more detailed geochemical mapping; this urban mapping is equivalent to regional mapping over an extra 4000 square kilometres. The BGS's methodologies are now taken as the standard techniques for regional geochemical mapping and are being applied in many parts of the World.

Related studies in geochemical exploration and metallogeny have similarly been acclaimed by industry and the scientific community. Innovative studies of the Cheshire Basin provide new insights into basin evolution, fluid flow and metallogenesis to name just a few of the areas of exciting science undertaken as part of, or related to the core programme.

In the area of geophysics, innovative techniques have been applied to existing data sets, producing maps and models that have been highly valued by the petroleum industry in particular. One of the

disappointments of the past eight years has been that no new high-resolution data have been collected to modern standards due to a lack of funding. There is an urgent need for a new airborne geophysical survey of the United Kingdom. A recently established Partnership Project will allow this programme to commence in 1998, in co-operation with industry, but the lack of support from some government departments for this 'public good' initiative is to be regretted. Despite limited core funding, seismology and geomagnetism have been very successful in attracting a considerable amount of external funding to maintain their monitoring activities. Exciting developments in this area have been in the seismic anisotropy and the environmental monitoring fields.

Offshore geological mapping was a major activity of the BGS in the past, but with the conclusion of Department of Trade and Industry (DTI) funding for this programme it was necessary to seek other sources. In some ways this was inevitable in that DTI considered it had done the job expected of it. Nevertheless it is a disappointment that DTI could not be persuaded to fund work in the areas remaining to be mapped to the west of the UK. The marine group has been very successful in obtaining support from a consortium of oil companies to undertake a geological survey of the Rockall continental margin. Not only does the Survey now have a new understanding of the evolution of this margin but for the first time it has also been successful in imaging the geology below the basalts. This is an important geological and technical breakthrough which is highly significant for oil exploration in the Atlantic Western Frontier region.

Undoubtedly one of the single most important responsive tasks of the BGS in recent years has been to contribute to the investigations at the Sellafield site for the proposed rock characterization facility (RCF). This work has been funded by UK NIREX and for this reason some have questioned the BGS's involvement, taking the view that it compromises the BGS's impartiality. The reality is that the BGS has maintained its impartiality, providing frank opinions directly to UK NIREX throughout the investigations. At the same time, the BGS has carried out some outstanding science in terms of analysing fractures, elucidating the diagenetic history, understanding the Quaternary geology, constraining the hydrogeological models and developing new and innovative ways of characterizing the core.

The uncertainties surrounding UK NIREX as a result of the outcome of the Public Inquiry and the absence of a government statement on the proposed way forward in this area is a concern; the fluid processes and nuclear waste expertise in the BGS will be lost without a funded work programme to retain the skill base. This has been brought to the attention of the Office of Science and Technology (OST) and others but as yet there has been no positive response. I have also raised the issue in a submission to the House of Lords Select Committee review of nuclear waste. In addition, the BGS is diversifying the areas in which fluid process skills can be deployed. One of the exciting areas where this is being done is in the area of subsurface disposal of CO₂. This work, in which the Survey has been leading a consortium of European organizations, has generated a considerable amount of interest. Similarly, through its work on artificial storage and recharge in aquifers, the BGS has shown how this method could be applied to contribute to overcoming some of England's current water supply problems. Field trials involving water companies are now being planned and the BGS is confident the technique will be successful.

Another area of continuing uncertainty is in the area of databasing. The setting up of the National Geoscience Information System (NGIS) in 1990, brought with it the expectation (or hope?) that BGS would become a one-stopshop for UK geoscience data. This has not happened for various reasons. The coal data presently resides with the Coal Authority; there at least there is agreement that ultimately that data will come to BGS. In the case of offshore data there is likely to be an improvement in the situation with access to offshore seismic data, but for all other data there is still a highly restrictive policy. My view is clear on this; BGS is not just any other geological organization, it is the national survey and should have access to all offshore geological data, as soon as practicable

as part of its core programme. I also believe that the offshore data must ultimately become the responsibility of the BGS. This does not mean that BGS necessarily has to provide the core store or the storemen but it does mean that to ensure long-term curation of the offshore data set and its compatibility with other national geoscience datasets, BGS must take over responsibility from DTI in a reasonable time frame. In the interim, we must work towards data compatibility, something that was not assisted by the last 'market testing' exercise, which probably also resulted in considerable extra costs to the taxpayer.

Despite these setbacks there have been important new developments in the absolutely critical area of databasing, in terms of compilation and co-ordination of new and existing data sets. The borehole database and its underpinning 'system' is one example of a very important initiative. The successful introduction of fully distributed computing to the BGS, the widespread use of the Internet for obtaining and disseminating information and the development of MINGOL, IFPU, GHASP, ALGI and other user-friendly, problem-oriented, knowledge-based systems are examples of important scientific and commercial initiatives. One difficult task has been balancing the particular needs and aspirations of scientists, Groups and Divisions with the corporate need to ensure maximum cost-effectiveness and operational compatibility throughout the BGS, particularly in terms of data quality, data holdings, database systems, hardware and software. A series of initiatives are now in place to address this complex operational problem, coupling the BGS distributed computing system with strengthened corporate co-ordination to achieve the necessary balance. Just where the balance lies is an extraordinary emotive issue, but I hope that through constructive dialogue the correct balance can be achieved.

These then are but a few of the examples of excellent science carried out in the past six years; science that is highly relevant to Britain, both in terms of wealth creation and in maintaining the quality of life.

In addition to its UK focus, the BGS is also contributing to global geoscience in a major way. Examples of vital international activities undertaken by the BGS include data-basing, such as in global seismology and geomagnetism, the compilation of World mineral statistics and the development of standard approaches to geochemical mapping. At the more fundamental level, activities such as those on the climatic record of the Sahel region, or research on fluid inclusions, have been seen as highly significant internationally. The majority of the international work undertaken by the BGS is funded through United Kingdom and international aid agencies, or through foreign governments. This work produces a vast amount of information, much of it highly relevant to the alleviation of poverty and to improving the environment in developing countries. Some of this work is by its nature confidential and cannot be published; much of it is 'grey literature' because the 'sponsor' wants to receive a report but will not pay the extra cost of getting to the publication stage. This is unfortunate, and as a result less of the BGS's international work is being published in international literature than I would wish. But this is a reflection on the limitations on funds in the BGS and its clients, not on the people doing the work or the quality of that work. Nevertheless, the BGS has been extraordinarily successful in winning international contracts and its international profile has never been higher. Major activities in areas as widespread as Montserrat, Angola, East Africa and Papua New Guinea, are of great importance to these countries, and are also producing excellent science.

A measure of the high international regard in which the BGS is held is the extent to which its staff, at all levels, are asked to be keynote speakers at major international meetings, edit or contribute to definitive volumes or lead major national or international research projects. Perhaps I can be forgiven on such occasions for blowing a rather loud trumpet on behalf of the BGS, but I believe two comments made to me recently encapsulate the way the BGS is now regarded. The first is from a senior United Kingdom academic who, after a recent visit to the BGS, commented that "the BGS

profile has been raised onto a whole new level in the last few years". The second, from a senior member of a major overseas Survey, was that "the BGS is now the leading Survey in the World; it is showing the way". Praise indeed!

Similar sentiments have been expressed to me by many other people and by the independent international peer reviewers who recently assessed the BGS as part of the Programme Review Groups (PRGs). I suspect that because of a penchant for modesty and understatement and an overwhelming penchant for cynicism there is a certain reluctance by BGS staff to overtly recognise just what the BGS has achieved in recent years or just how highly regarded it is outside the United Kingdom. Therefore, let me, on behalf of the BGS, be immodest and state that I firmly believe that, scientifically, the 1990s have been extraordinarily productive for the BGS and that it is now one of the leading (if not the leading) geological surveys in the World. I believe that the PRGs and the SMA will support this view.

The organization and management of science in the BGS

There is no such thing as an ideal way of organizing science. By its very nature, science will always need to cross organizational boundaries and cut organizational corners. It must also be recognized that the organizational and management arrangements are there to serve the science and not vice versa. At the same time, systems must be in place that ensure the public receive value from public money spent, that quality is maintained, and that cost-effective and relevant science is undertaken. These checks and balances are ensured in part through the SMA process, but more importantly on an ongoing basis they are guaranteed by the BGS (Programme) Board and by internal systems that the BGS has itself put in place.

This was an outcome of the so-called Price Waterhouse review and often the structure is seen as an artifact of Price Waterhouse. The reality is, of course, that Price Waterhouse was the vehicle by which I and senior management was able to introduce a new structure and bring about change. Be that as it may, in January 1991, the BGS implemented a new organizational arrangement, consisting initially of four Programme Divisions and four Corporate Divisions (Figure 3). The Programme Divisions were 'market facing' (water, minerals etc.) and science based. There were inevitably some compromises and some fuzzy boundaries, but these Divisions were successful in that they were productive scientifically and balanced their budgets. Some Corporate Divisions were successful, others less so. After three years, it was apparent that the arrangements put in place for marketing should be looked at again. They had been successful to the extent that they had raised the profile of marketing throughout the organization and had been important in developing the first corporate business plans, but overall it was felt that marketing undertaken by staff within the Programme Divisions could be more cost-effective than operating a fully staffed Marketing Division.

Therefore in 1994, the Corporate Marketing Division was abolished. The functions of public relations (including popular publications and the public understanding of science) were deemed to be (and continue to be) very successful; they were absorbed by the Corporate Coordination Division. The marketing co-ordination role was taken over by International Division.

In early 1997 a new structure was implemented. In some ways this structure was 'imposed' upon the BGS as a result of the Senior Management Review (SMR), because there was an absolute requirement on the BGS to decrease the number of Grade 5 (Assistant Director) positions and an expectation that the BGS would also decrease the number of Grade 6 (Group Manager) positions. This loss of divisions, groups and senior positions was inevitably a difficult measure, leaving some people feeling bruised and unhappy and some areas of science suddenly forced into closer cooperation with perhaps unfamiliar areas. Because it was in part a 'numbers game' there was a

degree of arbitrariness about the process, but at the same time it did provide the opportunity to decrease management costs and put proportionately more funding into science. It also provided the opportunity to address other issues that needed fixing. For example, co-ordination of databasing had not worked as well as it should over the preceding six years. There was an increasing tendency for divisions to compete in unhelpful ways and for walls to build up between divisions and groups. In some areas the nature of the science had changed and there was a need for some groups to be brought more closely together. Additionally, the BGS was not being as effective as it should have been in marketing some areas where there was a need to bring together the complete spectrum of BGS skills, rather than just those skills residing in one Group or Division. Also in 1995 and again in 1996, the Group Managers lobbied strongly for a restructuring. Even after it was pointed out than any restructuring would result in a loss of some Grade 6 positions, they were still emphatic that they wanted a restructuring in order to decrease competition. I think the wringing of hands over competition has been slightly overdone, for that spirit of competition has in the past helped us to be successful. However by 1996 it was clear that improvements could be made though the problem was not the oft-cited bogey of the 'internal market', which is no more than a charging mechanism. Rather it was an inevitable tendency on the part of people to build up walls around their territory to ensure that the laudable aim of funding all their staff could be met. I saw it as part of my job to knock holes in some of the walls in order to foster co-operation and a greater degree of multidisciplinary. The new structure would have been introduced in 1996 but the Prior Options Review intervened and it was not finally introduced until 1997.

So, in essence, the 1997 reorganization decreased the number of Divisions and Groups (and therefore management costs), established new interfaces to stimulate new areas of science, and strengthened co-ordination in areas such as Geographic Information Systems (GIS), databasing and sector marketing. The benefits of Group and Divisional identity, and the stimulus of doing more and better science while meeting financial targets, were retained.

The development of annual and longer-term Programme and Business Plans has become an important feature of forward planning since the last SMA. The first of these was produced for the 1991-92 financial year as part of the Price Waterhouse Review. It has become critical to the well-being of the BGS, with scientific and financial targets being defined alongside budgets, earnings and costs since that time. For the past six years the BGS has met and in some cases exceeded its financial targets at a time when many other scientific institutions in the United Kingdom have been in serious financial difficulties. The BGS's philosophy has been that a business-like approach is entirely compatible with good science. If financial success is to be taken as the hallmark of organizational and management success then the BGS has been successful. This in itself would not of course be enough if the Survey had not been scientifically successful. But, as pointed out earlier, and as the record will show, financial success has been accompanied by, indeed has sprung from, scientific success.

Underpinning all of this is the quality and the dedication of BGS staff. There have been many changes in the BGS and some people have felt threatened by this. Some have left or taken early retirement; some have stayed and perhaps grumbled. But the overwhelming majority of staff have reacted in an extraordinarily positive manner to the many changes that have had to be faced and the new demands placed upon them. I suspect that few would wish to go back to the days when Government was the sole source of (inadequate) funding. Members of staff have been required to be more flexible. The BGS has endeavoured to help them achieve this by greatly enhancing training opportunities in the BGS for all staff at all levels. The Survey has recently been accredited under the 'Investors in People' programme: an indication that the BGS has achieved a high level of professionalism in the training area. Indeed, so much so that the BGS now offers training to many external organizations and businesses, both in the UK and internationally. This is a far cry from

eight years ago when there was little training beyond a few courses for scientists, and reflects with great credit on the BGS Training Section.

Communications with staff have been strengthened; there are now at least two BGS general meetings a year at each of the major offices, and many staff circulars, notices, newsletters and e-mails in between those meetings. There are also many more meetings of senior members of staff and they in turn are expected to 'cascade' information down to their staff. Formal and informal meetings are held with Union Side, and the BGS cafeteria plus various social events all help. In common with the Assistant Directors, I visit staff in their offices, in laboratories and in the field. But having said all this, it is inevitable that staff will say "communications need to be improved"! Yes, of course they can be, but the fact is that senior staff and managers could spend all of their time 'communicating' (leaving no time to do anything else) and some staff would still feel that communications were not good enough! Nevertheless, the BGS will continue to look for ways to further improve communication at all levels within the organization.

In reviews such as this it is right and proper that the focus will be on the science. At the same time, it would be remiss not to comment on the administrative staff who, largely unsung and often unappreciated by scientists, do an extraordinarily good job in the BGS. They have borne much of the extra load, resulting from the devolving of responsibilities from Swindon to the BGS. They have responded to the need to acquire new skills. Last, but by no means least the marked decrease in overheads that the BGS has achieved in recent years has in no small measure been a consequence of their efforts. Despite all of this they have continued to provide the high level of service that has helped to ensure the continued smooth running of the BGS.

One final 'administrative' issue that requires airing is the question of remuneration. For the most part the BGS does not have a problem with retaining people and from this it could be construed that they are paid at market rates or that even if they are paid below market rates there are compensations: for scientists, the opportunity to do good science; for other staff, a congenial working environment. However, the recent introduction (by the NERC) of a new pay system is changing that balance. Junior staff in particular now face the prospect of perhaps never earning an adequate salary and I am receiving more and more written and verbal reports which indicate an increasing level of dissatisfaction, not only with their current salaries but also with their future salary prospects. If allowed to continue this will have a serious impact on the BGS's ability to attract and retain high-quality staff. There are moves afoot within the NERC to change the current salary system!

In conclusion, over the past six years there have been many gains for the BGS, not least being the fact that it has survived and prospered in a less-than-benign climate for public sector science. I believe it is now seen as one of the leading geological surveys in the World and as one of the most successful PSREs in Britain.== Implementation of the 1991 SMA recommendations ==

The 1991 SMA produced a large number of useful observations and recommendations. Progress in implementing those recommendations was formally reviewed in August 1994. In essence, the BGS has implemented all those recommendations that are within its gift. The biggest obstacle to full implementation, inevitably, has been the lack of science budget funding. Over the past six years, a combination of lack of full indexation, coupled with salary increases has effectively meant financial cuts to the Core Programme. The affect of this on the science has been minimized by reducing overheads; in addition, improved productivity has also helped to keep programmes on schedule. However, it has to be recognized that this process cannot continue indefinitely. The core budget must be restored to its 1990 level in real terms if the Core Programme is to stay on target.

Audits and reviews

Any review or audit can be useful in that it makes us take stock of ourselves, justify our existence and measure our performance against others. In fact, based on the large number of geological surveys and other organizations that have visited the BGS in recent years to see how the BGS operates, coupled with the number of times members of BGS senior staff have been asked to undertake reviews of surveys in other countries, it is not unreasonable to say that many other surveys now see the BGS as the benchmark against which they must measure their performance. In a recent review of geological surveys by the World Bank, Fozzard states "The BGS is a sophisticated geological survey institute which operates on the cutting edge of technology". Given this high standing it comes as something of a surprise to other surveys to find that the BGS is so frequently reviewed. There is no question that the BGS has been excessively reviewed in recent years and it is testament to the dedication and confidence of BGS staff that morale has not suffered. Let me briefly examine the various reviews that have been undertaken in the past seven years, and in the last three in particular.

Business Development Review (1990-91)

This review, which arose as a result of the Butler Review in the mid-1980s was undertaken with the help of Price Waterhouse. It involved a very major input from BGS staff. The review was not particularly helpful in defining business opportunities, but was helpful in changing the culture of the organization to one that is responsive to customers and more market-oriented. As the 'New Director' I found this review particularly helpful.=== The BGS (Programme) Board (ongoing) ===

More than any other NERC Centre/Survey, the BGS is under constant review from its Board. This is a rigorous, critical and entirely helpful process which ensures that the BGS remains on target and relevant, that it provides value for money, and that it retains excellence in science. The BGS (Programme) Board formally meets four times a year, but there are many other individual and group meetings during the course of the year. In 1996 the Board held an in-depth review of the Core Programme. This review chaired by Richard Hardman of Amerada Hess, reported favourably on the progress of the programme. It has been suggested in the past that the BGS Board is not sufficiently independent to carry out the audit and review process. I entirely reject this view. The Board is composed of senior members of the profession who, as non-executive Directors, bring both objectivity and knowledge to their assessment of cost effectiveness, the meeting of deliverables, and quality and relevance of BGS science. The BGS (Programme) Board has been a critical element in the success that the Survey has enjoyed in recent years and the new BGS Management Statement will further enhance the role of the Board. A close and constructive relationship between the Director of the BGS and the Chairman of the BGS Board is also critically important, and here I must thank the current Chairman, Dr Eric Hassall, and his predecessor Mr Gwilym Roberts for their support and help over the past eight years.

The Earth Science and Technology Board (ongoing)

The Earth Science and Technology Board (ESTB), and its predecessor the Earth Science Committee, has in the past had an ill-defined review role for the BGS vis a vis the BGS Board. For the most part this has entailed reporting on the BGS core programme. Of itself this is not arduous, but it does provide another level of scrutiny. The positive feature is that it places the BGS Core Programme within a broader earth science setting. Nevertheless, there remains a need for greater clarity concerning the role of the ESTB vis a vis the BGS (Programme) Board. Tensions do arise from time to time within the ESTB for a variety of apparent reasons but with the underlying reason perhaps being funding. This is understandable in that the academic earth science community feels it does not

receive adequate funding for its research. BGS is under similar if not greater financial pressure but as the BGS budget is the largest single item in the science budget related to the earth sciences it is perhaps inevitably looked at from time to time as a source of funding by some parts of the earth science community! The budget of BGS is essential if the core programme is to be undertaken but such tensions do inhibit full co-operation on occasions which is unfortunate. Clearer definition of roles and budgets would actually help co-operation.

Multi-Departmental Scrutiny of PSREs (1994)

Over the past three years the BGS was subjected to a series of external reviews commencing with the so-called Efficiency Scrutiny, undertaken by a team drawn from various Government departments. This was in theory a 'light' and speedy review of all PSREs. Its mandate was to consider privatization as an option, identify areas for rationalization and consider ownership arrangements. In the event, this scrutiny did not recommend any changes to the BGS and therefore was regarded as a failure! But in line with the dogma of the time, it led inexorably to the Prior Options Review (POR).=== Prior Options Review (1996-97) ===

The 1996-97 POR was the most rigorous, and potentially the most threatening, review of the BGS (and other PSREs) in that the Government of the day was clearly of a mind to transfer as many science functions as possible to the private sector, as part of its aim to minimize public spending. It was a very time-consuming exercise for the BGS in terms of preparation of documents and various related tasks. All members of staff were involved to varying degrees and this did have a positive benefit in terms of defining the BGS ethos, developing the way forward and making everybody feel part of the process. The BGS took the exercise very seriously; it also viewed it positively, to the extent that there are always some benefits from reviews. The document "Future Options for the British Geological Survey" was a valuable outcome of the POR and served to convince the Review Team and Government that there was indeed a need for a national geological survey function, that the BGS should meet that function and that it should be publicly funded. However, I believe the POR was a very expensive and somewhat disruptive way of reaching this conclusion. Additionally it delayed the introduction of a number of necessary changes.=== Senior Management Review (1996) ===

The purpose of the SMR was to decrease management costs, itself a laudable aim and an issue which the Survey keeps under constant review. But the reality was that the exercise became largely a 'numbers game' for the review team, without examining the need for the functions etcetera. The outcome of the SMR was a requirement placed on the BGS to further decrease the number of senior management positions and this has now been done through the 1997 restructuring though not without pain to staff and to me! I did seriously contemplate leaving the implementation of the SMR until after my departure. This might not have been possible from the point of view of OST but more to the point it would have placed a planning blight on BGS for an extended period and more unfortunately would have been an awful legacy for my successor. For those who have not experienced it, whilst empire building and expansion can be difficult, 'delaying' at senior levels is an even more difficult and thankless task!

Review of Financial Management in the BGS (1997)

One of the ironies is that as a result of being both well organized and successful, the BGS is subjected to more review and scrutiny than most other UK PSREs. The Review of Financial Management is a case in point where the BGS was one of only four organizations in the Research Councils selected for this comprehensive review (involving 94 very specific and detailed questions to be addressed). Again there were benefits from this process but, as with the other reviews, it did require a significant amount of BGS staff time.

Programme Review Groups (1997—)

PRGs have recently been established by the NERC in conformity with the structure of other Centres/Surveys. Given that BGS has a Board I must say that I was lukewarm to this arrangement. Nevertheless I must say that despite my reservations it has proved valuable. The PRG structure now in place appears to be satisfactory in that it is part of the process of review by the BGS Board. The recently completed Quinquennial PRG has been an exhaustive but positive exercise which I believe will be very useful to the BGS. Members of the PRGs have been extraordinarily generous with their time and this has undoubtedly contributed to the success of the enterprise. The cost to the BGS has been considerable, but it has been outweighed by the benefits. I am, however, rather concerned that the ESTB now appears set to further review the Review. This cannot be sensible.

Review of BGS—Institute of Hydrology links (1997)

Whilst constituting a review of only a small part of the total BGS programme, this most recent review (which arises from the Prior Options report) has not been welcomed by staff. It brings yet more uncertainty to members of staff who have been reviewed several times in the recent past. The holding of this review separate from the PRG and the SMA is not helpful in terms of staff morale or forward planning. I believe that the outcome must be for BGS to retain the Hydrogeology Group for it is an integral part of our science. Indeed if it loses the Group it would have to 'grow it' again leading inevitably to duplication.== Responding to a new political scene ==

A change of government, particularly one as dramatic as that which happened in 1997, always presents a challenge to a public sector organization such as the BGS. There is no expectations that a new government means new money. Nevertheless, areas where there could be new opportunities in the longer term as a result of the change of government policy include nuclear waste, land use, the environment (especially the urban environment), international aid, water and perhaps the Law of the Sea. Good links have been established with ministers and opportunities have been taken to provide written and oral evidence to a range of government committees. These initiatives have had very positive outcomes, particularly in terms of the endorsement of BGS positions. They have further raised the political profile of the Survey which has never been higher. I am very optimistic that Government—BGS links will strengthen in the coming months. I am also gratified at the strong support that BGS receives from Members of Parliament.

Proposals for a greater degree of independence for Scotland and Wales also present an opportunity for the BGS to strengthen the range of activities undertaken in these parts of the United Kingdom (Figure 4). However, this must be done in a way which safeguards the integrity of the BGS as a scientific organization and maintains the geoscience standards for the UK as a whole, whilst responding to national aspirations. The current arrangements for the Geological Survey of Northern Ireland may provide a model for Scotland and Wales. The recent concordant between NERC and the Scottish Office make it clear that there will continue to be a single national geological survey and this is the way it should be.

Some challenges for the future

The BGS has shown itself well able to respond to the changing needs of the Research Council, the Government and the community at large. But it cannot just be responsive; it must also be proactive and look for emerging areas of geoscience and new opportunities. The BGS is not a blue-skies research organization. At the same time, it must be alert to new and unexpected discoveries in basic science arising from its applied work. But the BGS cannot plan its future on serendipitous events and discoveries; it must plan on the basis of long-term Government priorities such as wealth creation

and the quality of life, or the increasing stress placed on 'sustainability'. These priorities provide the basis for the NERC mission and the BGS mission must in turn be set within this NERC framework.

Within the NERC strategy for the earth sciences, the focus of the BGS will continue to be on:
advancing geoscientific knowledge of the United Kingdom landmass and its adjacent continental shelf, by means of systematic surveying and data collection, long-term monitoring and high-quality research;

- providing comprehensive, objective, impartial and up-to-date geoscientific information, advice and services which meet the needs of customers in the industrial, engineering, government and scientific communities and the public at large;
- contributing to the economic competitiveness of the United Kingdom, the effectiveness of public services and the formulation of policy, including international policy, and the quality of life;
- enhancing the United Kingdom science base by providing knowledge, information, education and training in the geosciences, and by promoting the public understanding of the relevance of geoscience to resource and environment issues; and
- contributing to the resolution of important global issues.

To achieve these aims the Survey must continue to acquire and maintain up-to-date knowledge of the United Kingdom landmass and its adjacent continental shelf, by means of systematic geological, geophysical, geochemical, hydrogeological and geotechnical surveys. It must publish the results of these surveys and interpretations of the data collected. In addition, the Survey must continue to maintain geoscience monitoring networks and prepare regular monitoring reports. It must undertake high-quality research to underpin these strategic activities and it should also continue to undertake activities overseas that build upon its UK-based expertise.

This mission will inevitably (and appropriately) be pursued not only through core funding (from the Science Budget) but also through partnerships and through contracts. In other words, the three-fold programme structure should be retained. But the UK and international future of the BGS, like its past, must be based on values such as excellence in science; high-quality staff; impartiality; credibility and authority; relevance and fitness-for-purpose; public benefit; and value for money.===
Core, Partnership and Contract Programmes ===

Whilst the Core Programme now constitutes less than half of the total BGS programme, it is absolutely critical that it is maintained and enhanced in the future. This will require that science budget funding is restored to the 1990 level. The Core provides the base for all other activities. It is also the only way that geoscience information and data sets can be compiled to uniform national (and international) standards. It will be a major challenge to ensure that the Core Programme is maintained against apparently more urgent (or popular) issues. Additionally, whilst there is seen to be benefit in the separation of customer and contractor, the BGS (and the NERC) must not resile from the principle that, given the nature of the Core Programme, only the BGS can guarantee the quality and long-term maintenance of uniform geoscience data sets collected to national and international standards. In other words, the BGS must continue to carry out the Core Programme. For its part the NERC must resist the siren calls of (apparently) cheaper science. After all, cheap science is like cheap brain surgery — not something you really want!

The future of the BGS is not in becoming 'just another consulting organization'. Its contract activities must be based not only on commercial values but also on the synergy between the various elements of the total BGS programme. This in turn means that the overall programme cannot become dominated by the commercial contracts. Therefore one of the challenges of the future is undoubtedly to maintain the right balance between the Core and the Contract Programmes. There is scope for

growth in the Partnership Programme, but this too must be done carefully; there must be real benefits, both to the public and to the science, if public funding is involved. Critically, co-funded work must not become a form of cheap consulting. Some areas of the BGS's programme are and will continue to be more involved in industry partnerships than others. This is no bad thing in that it is a reflection of particular needs and opportunities within individual market sectors.

Is there scope for so-called spin-off companies to handle some aspects of BGS work? Perhaps, but it must be done carefully. For example, it would be disastrous to spin-off all the commercial work that BGS does into a private company. It has been tried by other Surveys and did not work, for once cut off from its core, the 'commercial' work withers. However, if done for a specific activity, particularly one that might distort the nature of BGS, for example a specific overseas project for a limited time but involving a large number of people, it might be an example of a discrete activity that could be handled through a spin-off company. Exploitation of a particular piece of hardware or a very specific technique might be another example. But I stress my belief that care needs to be taken.

However, a further challenge for the future must be to have well-defined core elements, with clear core deliverables, for all Divisions, and well-defined deliverables for the Partnership Programme. Along with this, it will be important to ensure that the organizational framework is appropriate for the science.

What then are future scientific challenges to which the BGS can make a particular contribution?=== Nuclear waste ===

Undoubtedly one of the key issues ahead for geoscience in Britain and throughout the World is to select the best location for and to identify the best way to dispose of nuclear waste. Up to this time, the BGS along with a large number of other organizations has been funded by UK NIREX to undertake investigations at Sellafield. The outcome of the recent public inquiry highlighted the scientific, social and organizational difficulties in that approach. A case has now been put to the OST for funding the BGS, or a specific group within the BGS, to undertake some 'public good' investigations into radwaste issues outwith the current UK NIREX funding arrangements. Such an approach could be of great benefit to Government in providing an authoritative and impartial body able to provide the public with the scientific reassurance that it needs. Getting Government to agree to fund this approach will be one of the challenges for the BGS, but the greatest challenge will be to find the best site for disposing of the UK's radwaste that is acceptable to the community at large. This will require the combined input of not only the wide range of skills in the BGS but, of course, many others besides. I believe that the time has now come for the position of BGS to be reassessed. It is not just another contractor, as the national survey it has a critical role to play in the forthcoming debate and amongst other things should be seen as providing expert advice to Government.=== Water ===

Water shortages are becoming an increasingly common feature of life in Britain and elsewhere. The abstraction of groundwater and the use of aquifers for artificial storage are just two of the areas where the BGS will increasingly have to make a contribution. These topics must be pursued from a geological base and the BGS has much to contribute, based on its existing knowledge of regional aquifer systems in Britain. The BGS would not be able to meet this challenge if the Hydrogeology Group were to be removed from the BGS. Indeed, if this were to happen the BGS would undoubtedly have to rebuild these essential hydrogeological skills elsewhere within the Survey. The water industry does not so far have a good record of supporting groundwater research. The only way to change this is by convincing them of the relevance of BGS research in this area.

Energy and minerals

In the oil and gas sector, the BGS already makes a valuable contribution to exploration and production. But it can probably make an even-greater contribution than it presently does, and one of the future challenges will be to strengthen links with the oil industry. More than this, if present outsourcing trends continue, then the BGS will have an ever-increasing role to play in areas such as palaeontology, stratigraphy and sedimentology, as these core skills diminish in the hydrocarbons industry. The related skills of field work and core description will increasingly be focused within the BGS. The BGS will need to have the capacity to transfer such skills to industry (and academia in some cases); otherwise, they might be lost. I see considerable growth potential in the hydrocarbons area.

In the minerals area, there is a particular need to seek a balance between the needs of industry and those of the community for mineral commodities, whilst at the same time addressing concerns regarding the impact of mineral exploitation on the environment. Here, the BGS can contribute in the future by collecting relevant data, by assessing resources and most importantly, by contributing impartial and objective advice to inform all sides of the debate, particularly at the planning stage. Full life-cycle analysis of mineral commodities will become an increasingly important area of work for the Survey. The recent coal debate shows the importance of BGS retaining expertise in this area.

Land use

Mineral issues also have a major impact upon land use, but questions relating to natural and man-made hazards (landslides; subsidence), waste disposal, pollution, and urban expansion are all important for land-use planning. One of the particular opportunities, both in the United Kingdom and internationally, will be to bring geoscience knowledge and expertise to bear on some of the apparently intractable environmental issues related to problems such as waste disposal or transportation. The BGS has much to contribute in these areas in the future, but it must also have effective systems for collecting 3D geoscience data in urban areas, modelling that data and making more accurate predictions and risk assessments. This will require some concentration and integration of BGS skills relevant to understanding the urban environment and a more interdisciplinary approach to these issues in the future.

Geology and human health

The interplay between geology, geochemistry and the health of humans and animals is being increasingly recognised. The geochemical survey programme undertaken by the BGS coupled with epidemiological studies could lead to major advances. Like all areas which cross major discipline boundaries it is difficult to obtain funding for this work, which in turn makes it difficult to assemble the appropriate interdisciplinary teams. But despite these difficulties this area will be both scientifically rewarding and important for the public. The BGS must build up its expertise in this field.

Coastal and marine studies

The magnitude of the BGS marine programme has decreased in recent years. Whilst there was perhaps a certain inevitability about this given the fact that the Department of Energy/Department of Trade and Industry marine programme was regarded by the Department as 'completed', there is a need for new areas to be investigated, particularly given the fact that the United Kingdom has recently acceded to the United Nations Convention on the Law of the Sea. Britain's outer margin, and that of its possessions, also needs to be delineated. Perhaps even more important than this is the

need for a greatly expanded coastal programme, to address coastal pollution, erosion, siltation, sea-level change, urban expansion, coastal stability and coastal flooding, to name but a few of the issues.

Information

The capacity to readily provide geoscience information in a cost-effective user-friendly way will be of critical importance to the future of the BGS. It must ultimately be able to provide this information in a three-dimensional, GIS format; it must also be able to provide time series data; and it must have the capacity to develop complete integration of all its data sets. Whilst the BGS has made many advances in these areas in the past, there is still much to do. The BGS must better co-ordinate its databasing activities in the future to meet all these needs, whilst at the same time ensuring that data quality and relevance is maintained by the groups collecting the data. The bringing together of the BGS's expertise in GIS and remote sensing within one group should provide some particularly important opportunities in this area. If coupled with an involvement in major initiatives in spectral geology (ARIES, HYPEX), it could change the face of geological mapping and modelling in some areas of the World. Greater use of the Internet (and Intranet) will provide exciting new opportunities in science and marketing.

International activities

The BGS has a high reputation for its international work, but there is fierce competition for international contracts and one of the challenges will be to maintain the BGS's market share in the future. The maintenance of a first-class United Kingdom Core Programme will be vital to this goal, but it cannot rest solely on this. The BGS must also raise its international profile in the future beyond writing excellent, unpublished reports. Specifically, it needs to contribute more to the international peer-reviewed literature. Whilst this will not always be possible because of the confidential nature of some of the work, publication will, in many cases, benefit the country for whom the work is being done as well as contributing to the understanding of World geology. BGS (International) has a crucial role to play in the future of the whole of the BGS.

Any consideration of future international opportunities must also address the European Union dimension. When I was first offered the position of Director of the Survey I was in Strasbourg; 1989 was an exciting time to be there. The European Parliament was meeting, elections were due and there was a feeling of Europe coming together. I felt it would be exciting to be part of that new Europe. As it happened over the next few years domestic politics in the UK prevented some of that promise being realized, at least as far as the UK was concerned. But I made a very conscious effort to ensure that BGS was very much more engaged with Europe through visits and through various European survey organizations such as FOREGS (and its predecessor WEGS) and most recently, though EuroGeoSurveys. In recent years the BGS has played a very major role in developing EuroGeoSurveys. It has done this because, whilst it recognizes that there are some dangers in having to compete with other European surveys, there are potentially enormous benefits in co-operating with them. In particular, by working together through EuroGeoSurveys, the future directions (and legislation) of the European Commission can be influenced. The future challenge in this area is collectively to exert more influence in Brussels, so that earth science issues become more central to European Union concerns regarding environmental, resource and other issues. EuroGeoSurveys must also continue to work for harmonization of Europe-wide geoscience datasets.

Regional geophysical surveys

The last airborne regional geophysical survey of the United Kingdom was completed almost 30 years ago. Despite great efforts by the BGS to obtain funding for a new high-resolution geophysical survey of Britain undertaken to modern standards, there has been great reluctance on the part of the NERC

and government departments to provide financial support for such a survey. Indeed, in some instances there has been scepticism regarding the value of such a survey, despite the fact that overseas experience has made their value clear. In some instances there has been animosity to the possibility of such a survey taking place. The BGS has recently decided to forego 1996-97 capital expenditure in order to carry out a pilot airborne radiometric and magnetic survey over part of central England. This survey, which will be done as a Partnership Project with industry, is a small step in the right direction. The challenge will be to carry out a high resolution airborne geophysical survey of the whole of Britain. This would improve understanding of the bedrock and surficial geology of Britain more than any other programme in the past 30 years, and may also be of great benefit to environmental issues.

Employing the best staff

Ultimately an organization such as the BGS stands or falls on the quality of its staff. It must therefore be able to attract and retain outstanding people. As pointed out earlier, money is not the prime motivator for most people in the BGS, but the Survey must develop a better system for rewarding good people. Salary is part of this, but the opportunity to do research and to publish the results, and the chance to acquire new skills, must also be part of the total package in the future.

Research

The point has been made previously that the BGS is not a blue-skies research organization, but at the same time it must retain its research skills in order to support the BGS's programme. Basic research is presently underway in areas such as fluid inclusions, palaeohydrology and seismic anisotropy, but it is also being vigorously pursued, albeit less visibly perhaps, in many other parts of the BGS. Indeed a 1:50 000 map can be (and often is) the culminating product of a first-class research project. The limited number of Individual Merit Promotions (IMP) in the BGS is not an indication of the amount of research underway in the BGS. Rather, it is a consequence of the funding regime and the inability of the BGS to be able to provide guaranteed core funding to support the work of an IMP. But undoubtedly there would be benefit in further raising the research profile of the BGS, both to address its own priorities and also to enable it to more effectively contribute to the NERC's thematic and non-thematic earth science programmes. The challenge for the future will be to obtain the funding to enable the BGS to do this.

As part of its strategy to strengthen its research profile, the BGS must become more engaged with universities. The BGS presently spends approximately £100k each year directly supporting university research that will contribute to the BGS Core Programme. This has been very valuable but there is more to be done. The current pre-occupation of the research councils with the mantra of 'competition' inhibits full co-operation between the universities and the BGS. This issue needs to be addressed if effective links are to be developed. Links do exist at the present time, many of them at the individual scientist level. Institutional links such as formally endorsed joint appointments and joint research projects certainly exist, but there is perhaps a need to go beyond this. At the present time, the concept of a cooperative research centre approach in the environmental sciences is being actively explored with universities and I am optimistic that this will be successful. The lack of funding for this sort of co-operation will, however, continue to be a major inhibition. This is an issue that the NERC needs to address if there is going to be real cooperation throughout the scientific community.

Conclusions

I believe that a very great deal has been achieved by the BGS over the past eight years. Those

achievements provide a solid basis for the future. Given the organization's track record, I am confident that BGS staff will rise to all the challenges ahead.

Revision and reorientation of the Core Programme, major investments in equipment and training, the employment of more young staff, restructuring, a more open approach to people and ideas, strengthened external linkages, and greater responsiveness to customers; these are all notable features of the BGS in recent times and they must continue to be so in the future. There are also external issues beyond the control of the Survey which must nevertheless be addressed if the future of the BGS is to be secured. The orgy of reviews that the BGS has seen in recent years must not be repeated. The new arrangements for the BGS Board must be allowed to work; specifically, the pre-eminence of the BGS Board in BGS affairs *vis a vis* the ESTB must be clearly acknowledged. The BGS has undergone many structural changes in the past years and the present structure must now be left in place for some time in order to give the BGS the stability it needs. Radwaste is such an important issue that the BGS expertise in this area must be retained irrespective of the current uncertainties regarding the UK radwaste programme. There must be a will to turn the BGS into the one-stop-shop National Geoscience Information Centre for all geoscience data, and this will require the full co-operation of the DTI, the Department for the Environment, Transport and the Regions (DETR), the Health and Safety Executive (HSE), and the Coal Authority (CA). The research councils must reexamine their strategy towards funding, placing greater emphasis on co-operation rather than seeing competition and customer—contractor relationships as the only ways of achieving outstanding science. The NERC recognises all that has been achieved by the BGS in recent years, but also acknowledge that the science budget of the BGS has decreased to such an extent that it will jeopardise the future success of both the core and responsive programmes; the BGS science budget should be restored to its 1990 level in real terms.

Let me conclude on a more personal note. Had it not been for the requirement of the SMA this account of the last eight years would not have been written. It is a personal view but for that I make no apologies. Others will have ample opportunity in the future to give an impersonal, perhaps more objective view, but I do not believe that it will be a more knowledgeable view! The past eight years have gone more quickly than any other period of my life. It has been a great privilege and an enormous pleasure to be the nineteenth Director of the British Geological Survey. That pleasure has been enhanced by two things: one is that I do feel that many things have been accomplished (and threats averted). The second is the quality of the people in the organization and the generous support that they have given. Perhaps I can be forgiven for mentioning the particular help that I have received from the members of the Directorate and the Central Directorate Support Group. The close and friendly relationships that I have had with the BGS Board and with NERC senior executives has also been a great help to me. Finally, being Director of the BGS is a fulfilling and all-consuming task which I have always relished but it does exact a cost on family life; therefore let me acknowledge the wonderful help and support of my wife Norma and my sons John and Julian over the past eight years.

Dr Peter J Cook CBE

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