SUBMISSION TO THE 1992/93 REVIEW OF THE AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

by
Prof R W R Rutland and others

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AGSO

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

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SUBMISSION TO 1992/93 REVIEW OF THE AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

NOVEMBER 1992

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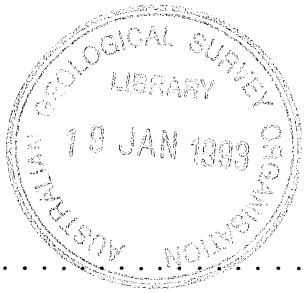

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EXECUTIVE SUMMARY

"The basic mission of any modern national geological survey is to ensure the availability of geoscience information and expertise that are required for the wide use of the nation's mineral, energy and water resources, for the health and safety of its people and for the protection of the environment". (R.A. Price) Episodes 15(2) June 1992 pp 98–100

This submission by the Australian Geological Survey Organisation (AGSO) to the Review announced by the Government on 13 August has been prepared by the Management of AGSO.

TERM OF REFERENCE – 1—COMPOSITION AND STRUCTURE

The geoscientific knowledge base is particularly important in Australia because it underpins Australia's most important export industries and because it supports resource, land and environmental management. It is required by a wide range of clients in government, industry and the public.

The programs of AGSO need to be structured to reflect this wide client base.

The main programs should continue to be those relating to the exploration for and management of Australia's mineral and petroleum resources. These are programs under the National Geoscience Mapping Accord and the Continental Margins Program which are organised into separate **Petroleum and Mineral Programs**. They contribute the basic geoscience information necessary for effective land management and the management of Australia's mineral and petroleum resources. They underpin petroleum and mineral exploration worth over $1 billion per year and the production of commodities worth $A30 billion per year. The contribution of these industry sectors to export earnings is now over 50% and growing, and is built upon the natural competitive advantage this country has — its huge onshore and offshore area of almost 20 million square kilometres, with a still largely undiscovered and untapped resource endowment. The improved geological information base acts to reduce perceived exploration risk, to improve the efficiency of exploration effort, and to encourage investment in Australia rather than overseas.

Another major thrust of an Australian Geological Survey should be a geoscience mapping program related to **Sustainable Land Use**. With agriculture still responsible for over 25% of our exports, an understanding of our groundwater resources and the surficial geology and weathering processes that provide the soils upon which it is based, is seen as critical to developing strategies to respond to land degradation.

An emerging geoscience priority relates to the use and development of the coastal zone. An **Environmental Change Program** is required to undertake and coordinate a strategic geoscience mapping program of the coastal zone and to assess natural variability and natural hazards and to provide the bases for management strategies.

AGSO should continue to provide an **Observatories Program** in the areas of earthquake seismology, nuclear monitoring and geomagnetism. All three areas have clearly identifiable priorities in relation to urban development, foreign policy and national mapping, respectively.

Finally, **International Program** delivery should be seen as a key element in helping to promote the internationalisation of Australia's exploration and exploration service

industries, as well as meeting the sustainable development priorities of our neighbours in the Asia-Pacific region. Funding should be provided through AIDAB, other development assistance agencies, industry or foreign governments.

The key mapping programs complement those of the States and will continue to be developed in collaboration with State Surveys and agencies. These are distinct from those of CSIRO which are focused on industry and lack a national survey or inventory capacity.

TERM OF REFERENCE–2—ADMINISTRATIVE ARRANGEMENTS

The preferred administrative arrangement is an independent statutory authority with strong links to the Bureau of Resource Sciences (BRS) and the Department of Primary Industries and Energy (DPIE).

The focus of DPIE has clearly shifted to policy advice, related program development and administration. The view has been put that AGSO's functions no longer fit into DPIE core business following the transfer of the petroleum and mineral industry technical advice functions to BRS. It might, therefore, be concluded that the status quo is no longer appropriate. Given the strategic program structure outlined in TOR–1 and comparing it with the tactical research functions of CSIRO, it might be concluded that incorporation of AGSO in CSIRO is also inappropriate.

The preferred location for AGSO is Canberra because of the importance of close ties with government clients, the established centre represented by AGSO for geoscience-related information, the effective utilisation of unique national facilities, and the inherent inefficiencies resulting from decentralisation of a small agency.

TERM OF REFERENCE–3—COORDINATING GEOSCIENTIFIC INFORMATION AND ADVICE

AGSO should have the primary responsibility for development, management and coordination of Australia's national geoscience databases and a role for provision of advice to government based on its expertise and specific knowledge of the limitations of the scientific evidence.

A Memorandum of Understanding should be developed between AGSO and BRS comparable to that between the US Geological Survey and the US Bureau of Mines.

TERM OF REFERENCE–4—APPROPRIATE FUNDING

The overwhelming public good nature of AGSO's core program (TOR–1) should be clearly recognised. It provides the basic geoscience information for all aspects of land and environmental management resource assessment, assessment of natural hazards as well as providing a framework for exploration. It should be emphasised that AGSO's petroleum and mineral province mapping programs are pre-competitive and rather than endowing specific companies with special benefits (for which they should pay) these programs ensure efficient and effective exploration by all companies in an internationally competitive framework. Program cost recovery occurs downstream, after discovery and development, through the taxation regime, and can be clearly demonstrated.

Present levels of appropriation funding are too low. Program delivery in AGSO is too extended; staff and facilities are not being efficiently used; the search for "soft money" to make up for the now significant attrition in appropriations funding is diverting staff effort and distorting priorities away from the long term program priorities.

Strategic programs in AGSO are inherently long term (3–5 years). Consequently, the funding cycle should also be 3 years, in line with that provided to CSIRO.

Cost recovery should be pursued in AGSO only to the extent that it demonstrates alignment with client needs, provides a supplement to appropriations to promote further program development, and underwrites international programs.

TERM OF REFERENCE–5—REPORTING AND ACCOUNTABILITY

The administrative arrangements suggested under TOR–2, namely statutory authority, carry with them appropriate and well tested systems for reporting and accountability. AGSO as a statutory authority would have a relatively small management board dedicated to overseeing the achievement of corporate goals and to which the Director is responsible.

A STRATEGY FOR THE AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION INTO THE TWENTY-FIRST CENTURY

''National geological surveys are in the geological information business. 'The basic mission of any modern national geological survey is to ensure the availability of the geoscience information and expertise that are required for the wise use of the nation's mineral, energy, and water resources, for the health and safety of its people, and for the protection of the environment''.

''Emerging global crises that are arising from the growth of human population, the per capita use of resources, and the resulting depletion of natural resources and deterioration of the environment for human habitation will present governments world-wide with urgent needs for geoscientific information and expertise about areas both within and beyond their national borders''. (Raymond A Price, *Episodes* 15 (2), June 1992, pp 98–100)

PREAMBLE

This submission comprises the formal submission from the Australian Geological Survey Organisation (AGSO) to the 1992/93 Review of AGSO chaired by Dr Max Richards. It provides AGSO's comments against the Review's Terms of Reference in this part (Part A), and background material on the evolution of AGSO and the issues confronting the Organisation and some material on current administrative arrangements in Part B. The evolution of the management and administration of BMR(AGSO) is given in the Appendix. Additional material items of particular interest to the Review can be provided on request.

INTRODUCTION

An improved understanding of the geological aspects of Australia's natural environment and resources is essential to any strategy aimed at sustainable development. More particularly, the development of the geoscientific knowledge base is important because

- it underpins Australia's most important export industries
- it supports resource, land and environmental management and provides a bridge of understanding between development and environmental concerns.

This knowledge can only be developed by regional studies in Australia and its offshore areas. The basic purpose of a national geological survey is therefore to develop and deliver strategic geoscientific programs in the national interest. These programs are focused on geoscientific mapping and database development.

1. TERM OF REFERENCE – 1

"To examine and report on the appropriate composition and structure of the Australian Geological Survey Organisation and its relationship to CSIRO research activities, and to the activities of State Geological Survey organisations".

1.1 RELATIONS TO STATE GEOLOGICAL SURVEYS AND CSIRO

The programs of all national geological survey organisations are developed in response to national priorities and responsibilities, but in countries operating under a federal system, key national mapping programs are developed in collaboration with state or provincial surveys. In Australia, the National Geoscience Mapping Accord has been developed on the basis of the complementarity of Commonwealth and State roles as identified in the Woods Review.

A particular feature of strategic mapping programs is that they are based on the collection, interpretation and evaluation of large quantities of observational data. The products are disseminated widely to government clients, industry and the public as a basis for decision making. In contrast, CSIRO has placed particular emphasis on technique development and research into the most effective applications of these techniques for industry.

CSIRO's geoscience activities have allocated larger resources to soil and water resources but, as mentioned above, those activities do not involve national survey or inventory capacity. On the other hand, the BMR regional mapping programs were largely related to petroleum and mineral resources. Only limited regional geoscientific mapping programs have been undertaken in relation to soil and water resources.

Effective links with CSIRO (as well as with key university groups) are being forged by mutual cooperation in Cooperative Research Centres.

1.2 APPROPRIATE COMPOSITION: THE SCOPE OF AGSO'S PROGRAMS

AGSO's programs are generally developed as a consequence of specific government decisions with ear-marked funding, often developed after a specific study. The programs outlined below reflect the findings of a wide range of studies. All of AGSO's programs are essentially "public good" programs undertaken in the national interest. Some support national "Economic Development" objectives while others support "National Welfare" objectives.

Strategic goals of the Department of Primary Industries and Energy (DPIE), the Department of Arts, Sport, the Environment and Territories (DASET), the Department of Foreign Affairs and Trade (DFAT), Department of Defence (DOD) and corresponding AGSO geoscientific program requirements are:

Progressive, adaptable and internationally competitive Australian primary energy industries (DPIE)

- develop the geoscience knowledge base for Australia to provide incentive for investment and to promote efficient and effective exploration and discovery
- participate in international programs which will assist Australian industry to compete effectively in expanding its activities in the Pacific region and globally

Sustainable development of the nation's primary and energy resources with appropriate returns to the community from their use (DPIE)

- develop the geoscience knowledge base to promote the sustainable supply of minerals, energy and water resources and sustainable yield from soil resources
- develop the geoscience knowledge base for environmental and land use decision, and for managing the impacts of environmental changes and natural hazards

Enhancing Australia's scientific, environmental and economic interests in the Antarctic and in preserving Australian sovereignty over the Australian Antarctic Territory (DASET)

- develop the geoscientific knowledge base of the AAT and its offshore areas to promote understanding of the Antarctic environment and of global change

Achieving ecologically sustainable use and long term conservation of the environment (DASET)

- develop geoscientific understanding of the environment, of natural change, and of environmental impacts to assist the development of strategies to mitigate these impacts and to rehabilitate damaged environments

Contribute to enhanced global security (DFAT), (DOD)

- detect and monitor underground nuclear explosions as part of a world-wide program to achieve a comprehensive nuclear test ban treaty

To realise the Government's priorities for the development of Australia's defence capabilities through the provision of logistics ..... (DOD)

- develop the geoscientific basis required for improving Australia's defence capabilities and for defence logistics

The programs to achieve these goals are focused on geoscientific mapping and associated research, and on the national coordination of geoscientific databases. They are aimed at a comprehensive three-dimensional geological understanding of the land mass and its offshore areas, together with an understanding of the geological evolution to the present state, and the rates of continuing natural change. Such understanding can serve all goals, but logistic, resource and time constraints lead to discrete programs which are focused on particular priorities and particular areas.

The principal existing strategic programs, the National Geoscience Mapping Accord and the Continental Margins Program, are clearly focused on providing critical geoscience information for management by Government of Australia's natural resources and land and environmental decision making. They also provide the scientific infrastructure for the minerals and petroleum industries. The submission argues that these programs need to be maintained, and funded by government, to achieve their objectives in the national interest. The petroleum industry provides almost 25% of Australia's energy needs. Oil is an essential liquid fuel which powers most of the nation's transport requirements. As stated in DPIE's Energy Research and Development Discussion paper (September, 1992).

> ''Australia faces the prospect of a growing net import bill for oil, unless this can be offset by improved exploration efficiency and effectiveness''.

The paper notes that export enhancement and an improved balance of payments position is a key challenge facing Australia, and that Australia, like the rest of the world,

will continue to be dependent on fossil fuels for the foreseeable future. In the medium term there will be no large scale economic substitutes for oil.

The Australian minerals industry has contributed substantially to the growth and structural development of the Australian economy over the past 100 years and over the last decade the industry has continued to grow. The volume of mine production doubled in the last ten years and in 1991/92 the mineral industry contributed more than 9% to Australia's gross domestic product. The minerals industry has been identified as one in which Australia has a competitive advantage and economic projections suggest that the mining sector will remain as the largest single contributor to Australia's export income for the foreseeable future.

The exploration and discovery of Australia's onshore mineral (and petroleum) resources for the past 3 decades have been underpinned by the national 1:250 000 geological map series and reconnaissance airborne geophysical mapping program undertaken by the BMR and State geological surveys in the 1950s, 1960s, and 1970s. This period saw the discovery of major new mineral deposits, including several of world class. The nominal gross value of the 98 mineral deposits discovered in Australia over the past 30 years has been estimated at approximately $A195 billion.

This submission argues for the development of similar strategic geoscientific programs in support of sustainable land use, focusing on the geoscientific basis for soil and water management. Many Australian soils are poor in both major and minor nutrients as a direct result of their geological history. Strategic geological mapping can categorise the areas for which sustainable agriculture is possible, and where production can be enhanced, and also the areas which should be restored to other uses. The Murray Basin Groundwater project, carried out in collaboration between AGSO and State agencies; and the Cape York Peninsula Land Use Strategy (CYPLUS), being carried out in collaboration between State and Commonwealth agencies, including AGSO, provide excellent examples of the potential value of such strategic programs.

AGSO considers therefore that its strategic regional programs need to be structured as follows:

Petroleum Program: National Geoscience Mapping Accord in Sedimentary Basins and Continental Margins Program

The key role of AGSO's Petroleum Program is, and should continue to be

> ''to provide the geoscientific framework for management by Government and outline the petroleum resource potential of Australia's sedimentary basins as a basis for more efficient and effective exploration by industry''.

The Program should thus provide, as far as possible, the basis for the **sustainable development** of the nation's endowment of economically exploitable petroleum resources in an environmentally sound way. The function of the Program is to provide geoscience information for resource assessment, policy-making and land management, and data and information which no single company could afford to collect by itself, but which acts to reduce perceived exploration risk and therefore to encourage efficient and competitive investment in exploration. The absence of such public data and information would certainly lead to a redirection of exploration investment out of Australia.

Minerals Program: National Geoscience Mapping Accord in Basement Provinces

The importance of a high quality geoscience knowledge base to underpin resource assessment and to provide a basis for sound environmental and land-use decisions into the next century has been recognised by the establishment in 1990 of the National

Geoscience Mapping Accord (NGMA). An additional objective is optimising the environment for and promoting more efficient and effective mineral exploration through the provision of modern geoscientific information in the form of datasets, maps, and exploration models of strategically important areas of Australia, thereby enhancing Australia's international competitiveness.

Sustainable Land Use Program: National Geoscience Mapping Accord, Soil, Groundwater Resources

These programs would focus on systematic mapping for soil and groundwater management. The program will provide the geoscientific basis for the sustainable management of Australia's soil, groundwater and coastal resources, including the assessment of the local and regional impacts of resource extraction and use.

The Standing Committee on Soil Conservation has identified 15 major land degradation processes. However, of those processes, soil acidification in crop-pasture systems, soil erosion and salinisation of agricultural and pastoral land (following devegetation of some sort from practices such as overgrazing and till clearing) are widely recognised as Australia's paramount land degradation problems.

There is an urgent national need for adequate resources to allow the most serious problems of land degradation to be mapped, research, managed and alleviated.

From the national perspective, a national groundwater (quantity and quality) program, coordinated by the Federal Government is an essential requirement if Australia is to understand, monitor and effectively manage the extremely valuable groundwater resources of Earth's driest continent.

Environmental Change Program: An Environmental Change Program is required to assess natural variability and to provide the basis for management strategies, especially in the coastal zone.

The coastal strip between Gladstone and Adelaide has Australia's highest population accumulation (75% of Australia's total population resides within 50 km of the coast) and is an area subjected to high developmental pressure from industrial, residential and recreational demands which impact on the fragile association of landforms, scenery, waterbodies and vegetation.

Increasingly, the coastal zone will come under pressure from pollution (e.g. sewage and industrial wastes) and resource usage (e.g. nearshore mining of industrial materials — sand, gravel, aggregate) to support onshore development in areas of high population density.

AGSO can contribute the geoscience information required by coordinating a Commonwealth–State initiative of strategic geoscience mapping and database development of the onshore and offshore components of the coastal zone.

It is also necessary to assess the consequences for Australia of global impacts, notably climate change and sea level change. The geosciences are crucial in their potential to provide an understanding of the natural changes on which the anthropogenic changes are superimposed, and which may dampen or accentuate the latter. Geoscience data is essential for the understanding and mitigation of natural geological hazards.

Observatories Program: National geological surveys world-wide have responsibility for geological/geophysical observatory functions. These include earthquake and magnetic observatories (the mapping of earthquake risk and of the magnetic field). The **Observatories Program**, therefore, also has an important dimension of international

obligations. In addition, Australia has committed itself to a major international role in nuclear monitoring and AGSO has close links with DFAT in this area.

International Program: There is an international dimension to all these programs. AGSO needs to be abreast of the most advanced geoscientific concepts world-wide in conducting its programs. It needs to contribute to international geoscientific programs where appropriate. It needs to support Australia's foreign policy objectives in Antarctica and through aid programs funded by AIDAB. The globalisation of technology and of the mineral and petroleum industries is leading to increasing opportunities for Australian industry overseas. AGSO needs to maintain the scientific infrastructure to provide a firm base in Australia and also to help identify opportunities overseas.

National geological surveys in most advanced nations (such as Canada, USA, UK, Germany and France) have active international programs focusing on strategic national objectives. In Australia's case, the Government is anxious to promote wide ranging economic linkages with countries in the Asia-Pacific region. Asia, in particular, is now a ''key focus''. It is therefore appropriate for AGSO to participate in overseas programs which promote the delivery of geoscientific services available from AGSO and provide commercial opportunities for Australian industry. AGSO should also actively participate in programs which further Australia's foreign policy, trade and development assistance objectives, as well as those which contribute directly to the delivery of AGSO's domestic program (e.g. observatories).

Such international activities would be operated out of the relevant program areas but coordinated by a small dedicated group.

In summary, therefore, AGSO envisages that its future programs in the national interest should consist of six main elements:

Petroleum
Minerals
Sustainable Land Use
Environmental Change
Geophysical Observatories
International

The new generation mapping envisaged in these programs is highly dependent on the acquisition of major continent-wide geophysical data sets — geophysical "surveys" in a narrow sense. National geophysical data sets are an important part of that geoscience knowledge base. Over the past decades they have played an essential role in the significant advances made in understanding the structure and composition of the Australian continent and its margins. Ongoing development of these data sets will continue to sustain Australia's mineral and petroleum exploration potential and the industry's competitive position in the global market place. The information is also required for resource assessment, and to provide a basis for sound environmental and land-use decisions. The mapping, however, is multidisciplinary research involving a wide range of specialist disciplines and the application of new concepts. It integrates a wide range of information to provide a four-dimensional description and understanding of the geological structure and history. A team approach is required.

In order to carry out these strategic geoscientific programs, major geophysical and ship survey capabilities are required.

AGSO also has a pivotal role in the coordination of geoscientific information on the national scale. New technologies for information management, including information storage, retrieval, processing and analysis, have greatly increased the potential value of the national geoscientific knowledge base. There is an increasing need for coordi-

nation of information, particularly through the adoption of common standards. It is therefore proposed to give increased emphasis to **Geoscientific Information Management.**

These programs need to be supported, as at present, by **Cartographic, Library, Marketing and Publication Services** and by **Engineering Services** and **Information Systems expertise.**

The opportunity clearly exists to broaden AGSO's existing strategic programs and database coordination to cover the whole range of geoscientific resource and environmental information on the regional and continental scales.

1.3 STRUCTURE OF THE ORGANISATION

The structure of the organisation must facilitate the management strategies for developing and delivering high quality strategic geoscientific programs in the national interest. AGSO requires an environment in which its people can pursue corporate goals efficiently and effectively.

Key elements are:

- effective priority setting mechanisms acceptable to users of geoscientific information and to staff
- professional excellence and creativity in a multidisciplinary scientific staff and various support groups dedicated to cooperation in achieving national goals
- the structure should permit flexibility in staff deployment between programs, and should provide rewarding career development opportunities
- effective utilisation of unique national facilities
- the structure should permit the use of airborne, seismic, geochronological, GIS and other facilities across a range of programs
- leadership in the coordination of the national geoscientific knowledge base and the adoption of national standards for mapping and accessing information
- effective communication with client groups and cooperating organisations, and responsiveness to client needs
- effective resource management which permits flexibility while promoting efficiency and preserving accountability to government

The management structure has evolved over recent years in order to meet these requirements. In response to the recommendations of the Woods Review, a close alignment has been achieved between the structure and program goals. A review of recent management changes is provided in the Appendix. Following the establishment of AGSO and BRS some further changes in structure are required. One of the main reasons for the present division into two groups was to ensure integration of the research and resource assessment functions and it is considered that this division is no longer appropriate. Instead, it is proposed to re-organise the programs so as to more closely reflect particular program goals in relation to client needs.

The precise organisational structure depends to a very large degree on the level of resources devoted to each program element, research services required by each program and administrative arrangements (e.g. Statutory Authority). For these reasons it is premature to consider an organisational structure beyond that of the key program elements.

2. TERM OF REFERENCE - 2

"On the basis of the response to T.O.R. 1, to advise on the administrative arrangements and geographic location of the geological survey organisation, including whether it should be established as a separate Institute within CSIRO, remain with DPIE, or some other arrangement".

2.1 KEY FACTORS

In establishing the current review, Government recognised "the need to maintain an integrated and coherent national geological survey organisation with a clear identity." (Minister for Resources, 13 August 1992)

Key factors relevant to administrative arrangements and geographic location of AGSO have been identified in our response to T.O.R. 1 and also in our responses to T.O.R.s 3, 4 and 5.

The most important are:

- Programs are undertaken in response to national priorities and must have a national focus.
- Programs are essentially for the "public good". They serve interests of several departments and close liaison with those departments is desirable.
- The organisation is an essential element in attracting exploration investment to Australia and needs to maintain its present strong and independent international visibility.
- The national geological survey functions require secure long term funding on a rolling basis of at least 3 years.
- There needs to be direct accountability to Government for the discharge of the national geological survey functions.
- Geological survey functions have a distinctive character and geological surveys need to foster a distinctive scientific culture which is different from that of other scientific organisations.
- A major function is the coordination and management of the national geoscience information system.
- The national geological survey functions are complementary to those of state geological surveys.
- The national geological survey has a unique body of expertise and operates unique national facilities which need to be deployed through all areas under Australian jurisdiction.
- The national geological survey has the expertise to play a lead role in significant international development programs thereby providing offshore opportunities for Australian industry in the private, public and academic sectors.

2.2 ADMINISTRATIVE ARRANGEMENTS

In the light of the above key factors, a number of administrative arrangement options are discussed below, viz

(1) the status quo
(2) a separate Institute within CSIRO
(3) a Statutory Authority within DPIE
(4) a Statutory Authority within DITAC

There is a presumption in favour of a statutory authority arrangement for scientific research in Australian government administrative arrangements and in international practice. For AGSO such an arrangement could be its establishment as an independent body within the DPIE or DITAC portfolios, or it could be achieved with AGSO as a separate Institute within the existing statutory authority of CSIRO. The establishment of a statutory authority would require an identified mechanism to allow input to policy issues.

2.2.1 The status quo

The present arrangement has been preferred since 1946 because of close linkages between the policy department responsible for petroleum and mineral resources and the research and resource assessment functions of a national geological survey organisation. The Woods Review of 1988 endorsed this view and recommended close integration of the resource assessment and research functions of BMR.

The current separation of BRS and AGSO is based on the view that appropriate linkages between the research and resource assessment functions can be achieved by formal management agreement between the two organisations. The view has been put that AGSO's functions do not fall within the core business of DPIE (policy advice and program development, administration and improvement) and therefore that alternative arrangements are now appropriate for AGSO.

Under the present arrangements there are inevitably risks to budget in terms of the reallocation of resources away from strategic scientific research in order to meet the more immediate demands of policy development and implementation.

2.2.2 A separate Institute within CSIRO

The principal advantages of this option are:

- potentially closer links with other areas of CSIRO
- potentially more efficient use of common facilities and services

The principal disadvantages would be:

- the potential loss of a clear national and international identity which facilitates communication with clients and stakeholders
- the loss of separate appropriation and separate accountability to Government
- movement away from national interest programs to programs more driven by shorter term sectoral interests to the detriment of the strategic long-term programs such as the NGMA and CMP

It has been argued that the scientific cultures of CSIRO and AGSO are quite different and that since AGSO's programs have been, and should be, in direct response to government requirement there is little advantage to be gained from bringing it under the corporate CSIRO umbrella. Previous reviews (ASTEC, 1978; Woods,1988) which

have considered this option have rejected it, but there has been a suggestion that if a geological survey organisation were being formed *de novo* it would merge with parts of CSIRO to form a new statutory authority.

2.2.3 A Statutory Authority within DPIE

The principal advantages of this option are that

- it would maintain close links with the principal client department
- it facilitates close liaison between AGSO and BRS

The disadvantages are that

- it might inhibit the development of the broader national role of AGSO and its relation to other client departments.

2.2.4 A Statutory Authority within DITAC

The principal advantages of this option are that

- it would establish AGSO as one of a family of scientific organisations in the Science portfolio
- it would facilitate consideration of AGSO funding in the broader context of national funding for scientific research
- it would facilitate interaction with several client departments from a "neutral" base.

The principal disadvantages are that

- it would weaken the present close links with the principal client department
- it would require greater effort to maintain close liaison between AGSO and BRS

2.2.5 Concluding Discussion

Overall, there is a clear balance of argument in favour of an independent statutory authority arrangement for AGSO as such an arrangement will best serve the range of key factors which have been identified above.

This arrangement would allow the functions of a national geological survey to be best defined, funded, and carried out, with full accountability to Government. Any formal requirements to provide services to Government departments or agencies could be built in to the enabling legislation.

The Australian Nuclear Science and Technology Organisation (ANSTO) provides a useful model, noting particularly ANSTO's view that a key factor in its success is its size. "ANSTO is small enough to enable the establishment of a corporate culture and an organisational philosophy which has allowed change to occur rapidly, effectively and quietly (although not painlessly)". The same is true of AGSO. Like ANSTO, AGSO as a statutory authority should have a relatively small management board dedicated to overseeing the achievement of corporate goals. Each program should have an Advisory Committee with strong client representation from government, industry and the public, as appropriate, and these Advisory Committees should report to the Board through the Executive Director.

2.3 LOCATION OF AGSO

It has been recognised by Government that there is a need to maintain an integrated and coherent national geological survey organisation with a clear identity. This would be facilitated if AGSO continues to be integrated in a single location. However, it is recognised that there are some arguments in favour of a measure of re-location to other states in Australia.

The principal arguments for the organisation to remain centrally located in Canberra are that the co-location of the various programs

- assists AGSO in developing a national perspective across the whole range of geoscience relating to resources and the environment
- facilitates the development of a National Geoscience Information system and a Centre of Excellence as a single point of contact for national geoscience information
- facilitates close liaison with client departments and agencies in providing information and advice
- ensures the effective utilisation of a range of unique national facilities
- provides clear complementarity to State geological surveys, located in each of the State capitals
- best meets the needs of existing staff
- is more cost effective in terms of capital works, running costs and established arrangements.

The principal argument against co-location in Canberra is that the organisation's visibility and contact with industry clients would be facilitated if offices were established in various states. This, however, would militate against the advantages of centralisation identified above and would tend to dissipate the national effort as complementary to that of the States. AGSO has concluded that it would be counterproductive to establish offices in the State capitals.

There is, however, a case for closer integration with State Geological Surveys in the pursuit of field programs under the National Geoscience Mapping Accord. There is also a case for State geological survey personnel to obtain greater benefit from national facilities in Canberra.

A special argument can perhaps be made for AGSO's Continental Margins Program (CMP) to relocate to a suitable location on the coast such as Fremantle. This program is concerned with offshore areas under Commonwealth jurisdiction and there are no complementary State programs like those onshore. However the current integration of AGSO's two petroleum programs (offshore and onshore) would be seriously undermined unless relocation involved both. In such a case, there would be substantial additional costs and significant staff losses involved and coordination of the offshore and onshore petroleum programs, which have become increasingly interdependent, and their contact with BRS and their shared databases would be more difficult. Use of common facilities and specialist groups (e.g. laboratories and specialist expertise such as geochemistry and palaeontology) would be hampered. Contact with other elements of the industry involved in these Programs research would not be assisted.

There may be a case for establishing an office in Townsville which could focus on environmental geoscience and coastal zone studies. In its present location AGSO is centrally located to the major zone of degraded agricultural land in southeastern Australia which will require increased research effort.

On balance it seems clear that the central location of AGSO in Canberra should be maintained but that further consideration could be given to the relative costs and benefits of decentralising aspects of AGSO's program.

3. TERM OF REFERENCE – 3

"To examine and report on the mechanisms for coordinating geoscientific and resource information from AGSO and CSIRO in providing advice to client departments".

3.1 THE PROVISION OF GEOSCIENTIFIC INFORMATION AND ADVICE

Strategic basic research is usually defined as being "directed into specified broad areas in the expectation of useful discoveries" and providing "the broad base of knowledge necessary for the solution of recognised practical problems". Programs have to be carefully designed by the scientists concerned with the recognised practical problems in mind. It is therefore important that the scientists maintain close contact with their clients whether they be in the exploration industry or in other government agencies or departments. Conversely, it is not possible for clients to make the best use of scientific information without close contact with the scientists concerned. The scientists will often have insights into the possible applications of the strategic knowledge base for singular purposes, which will not be readily apparent from published syntheses.

It is also important that the scientists be involved in consultations with clients on the utilisation of the information which they produce. This is particularly important when the decisions which need to be made cannot be made solely on the scientific evidence but involve elements of social and political judgment. In such cases it is important that decision-makers fully understand the limitations of the scientific evidence.

3.2 COORDINATION OF GEOSCIENTIFIC INFORMATION AND PROGRAMS

A primary function of a national geological survey is that of technical competency, policy leadership and development and management of Australia's national geoscience databases. Databases include reference collections. AGSO is the repository for geoscience data and develops publicly available Australian geoscience databases.

State agencies have no responsibility for geoscience information beyond their borders whilst geoscientific issues transcend their borders. AGSO has a role in the national interest to participate in and facilitate programs that address issues transcending state boundaries. The Murray-Darling Groundwater Study is a case in point.

AGSO also has a prime responsibility to undertake programs that facilitate collection of national data sets and production of maps to common standards. The NGMA achieves this through a cooperative program of geoscience mapping with the states. AGSO also represents the national interest with respect to geoscience data and programs through fora such as the Coordinating Committee on Science and Technology, the Chief Government Geologists Committee of ANZMEC and their associated working groups and through sponsorship of databases such as AESIS.

3.3 RELATION TO THE BUREAU OF RESOURCE SCIENCES

The Bureau of Resource Sciences will provide "the Government with scientific and technical assessments, analysis and information to support the formulation of policies relevant to Australia's agriculture, forestry and fishing industries, as well as the petroleum, minerals and energy sectors". It will focus on the objective of making "better use of scientific research and analysis in the development of policy". (Ministers' state-

ment, 21 October 1992). It has been proposed that an explicit management system be put in place to link the AGSO scientific mapping activities with the resource assessment responsibilities of BRS. The key objectives must be to achieve the highest quality of output with maximum efficiency, avoiding duplication of effort.

The new arrangement has some analogy with arrangements in Canada and the USA. In the USA for example, the USBM has responsibility for appraisal of mineral reserves in economic deposits, and for appraisal of mineral supply, but the responsibility for assessment of resources on a national and global scale, as well as for the development of computerised databases and an integrated information system, rests with the USGS.

It seems clear that, to achieve the objectives, close cooperation will be required between BRS and AGSO in resource assessment, and that AGSO must have substantial responsibility for the assessment of resource potential in particular. Assessments of resource potential are a natural product of the studies of mineral and petroleum provinces under the NGMA and CMP. More generally, AGSO's whole range of strategic programs remain an important source of information and advice to a number of government agencies and departments.

4. TERM OF REFERENCE – 4

"To advise on the most appropriate funding arrangements for AGSO, taking into account the June 1992 report of the Joint Committee of Public Accounts".

4.1 THE PUBLIC GOOD NATURE OF GEOLOGICAL SURVEY ACTIVITIES

The programs of the geological survey organisation are essentially public good. They provide the national scientific infrastructure for

- public good activities that cannot be provided by any private group, including international obligations
- resource and environmental management by government in the interest of sustainable development
- increased efficiency and international competitiveness of Australian industry

A range of arguments has been advanced why geological survey programs for all these purposes should be funded essentially by government appropriation.

- Priorities for strategic programs need to be determined by the longer term national interest. In particular, mineral and petroleum resources are national assets which need to be inventoried, managed and developed in the national interest.
- Outputs from the programs have a wide range of uses by government, industry and the public.
- The public benefits are very large in relation to the public investment.
- Benefits from the programs are spread over several decades and the private beneficiaries cannot be determined in advance.
- Any nation which does not provide the scientific infrastructure for exploration is seriously disadvantaged in attracting investment and in international competitiveness.
- In order to preserve the incentive value of the programs, funding should be from the results of successful exploration rather than as a pre-exploration cost to industry.

- Government resource assessment programs are highly dependent on information freely provided by industry and this is encouraged by the provision of the scientific infrastructure at low direct cost.

4.2 FUNDING LEVELS AND ARRANGEMENTS

In recent years, demands on the Australian Geological Survey Organisation have increased, costs have increased in real terms, but available resources have been reduced. Recent budget cuts have resulted in only three of a desirable program of six research cruises a year for the *Rig Seismic* being funded from Government appropriation, so that there is potentially serious under-utilisation of the investment in the vessel, its equipment, and the scientific and technical expertise.

In the case of the National Geoscience Mapping Accord, budget cuts are also curtailing the critical levels of activity that had been achieved. It is also recognised that the initial levels of activity are inadequate to reach the goals of the program within the proposed framework of twenty years.

Support for the existing National Geoscience Mapping Accord Program should be increased so that its goal of producing a new generation of geoscientific mapping of Australia's principal mineral and petroleum resources can be achieved by 2010; and support for the existing Continental Margins Program should be restored to a level which will permit cost effective utilisation of the RV *Rig Seismic*.

Strategic geoscience programs need to be planned and executed effectively and efficiently on the basis of secure funding for individual programs on a rolling basis of at least three years. The national assets of human resources and national facilities must be built within a management framework which also guarantees a base level of funding for the fully effective utilisation of these assets.

In recent years AGSO has actively sought supplementary funding from other sources to enhance its program activities. AGSO should continue to do this to enhance and accelerate the delivery of program outcomes. But the pressure for additional funding should not be such as to divert AGSO from its proper program goals. It should be noted in this context that industry levy funds are not available from the petroleum and mineral sector as they are in the agricultural sector. Furthermore, the more direct research in support of industry, which lends itself to cost recovery, is the research into exploration techniques which is undertaken by CSIRO. AGSO has also sought funding, mainly through AIDAB, for overseas projects in support of government objectives. In particular, this has permitted increased utilisation of the *Rig Seismic*.

AGSO has also made strong efforts to increase the level of cost recovery from sale of products by careful differentiation of its products so that higher recovery is made where there is a significant element of private appropriation of benefit in addition to the basic public good purpose. Recent experience has shown that this approach cannot be taken further without compromising achievement of the basic objectives of the programs. At least some States, for example, believe that the purposes of the joint National Geoscience Mapping Accord are best served by pricing all products at the cost of supply.

AGSO believes that

- appropriations should guarantee an effective base level of funding
- cost recovery strategies which do not prejudice program goals should continue to be pursued
- there should be no formal cost recovery target

- net financial benefits obtained from cost recovery should be used exclusively for the enhancement and acceleration of the core program activities.

All of the recommendations of Report 318 of the Joint Committee of Public Accounts (pp 296–304) would improve the funding arrangements for AGSO. ''The Committee recommended that the resource base for BMR(AGSO) should be enhanced for a variety of program activities, that funding appropriated for research programs should not be aggregated as part of running costs, that BMR(AGSO) should be exempt from the application of the efficiency dividend and that overall funding should be approved by Government on a triennial basis in the same way as that approved for other government funded research agencies''.

5. TERM OF REFERENCE – 5

"To examine arrangements for reporting and accountability to Government to ensure the continuing relevance and high quality of AGSO activities."

5.1 ARRANGEMENTS FOR REPORTING AND ACCOUNTABILITY

Under T.O.R. 2 arrangements are outlined which would be appropriate for the management of AGSO as a statutory authority. We believe that a Board would provide enhanced reporting and accountability to Government. The Board would be assisted in ensuring the continuing relevance and high quality of AGSO activities by the Advisory Committees to each of the major programs. Such arrangements are proving effective for ANSTO.

"The third and last duty of the sovereign or commonwealth is that of erecting and maintaining those public institutions and those public works, which, though they may be in the highest degree advantageous to a great society, are, however, of such a nature that the profit could never repay the expense to any individual or small number of individuals, and which it therefore cannot be expected that any individual or small number of individuals should erect or maintain...". (p 210–211)

"When the institutions or public works which are beneficial to the whole society either cannot be maintained altogether, or are not maintained altogether by the contribution of such particular members of the society as are most immediately benefited by them, the deficiency must in most cases be made up by the general contribution of the whole society". (p 298)

Adam Smith, (1776),
An Inquiry into the Nature and Causes of the Wealth of Nations
Volume II, London, Dent, 1910

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PART C: APPENDICES

GENERAL INFORMATION RELATED TO THE REVIEW OF THE AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

This section is intended to provide the Review with background material on the evolution of AGSO and the issues confronting the Organisation of relevant points to the terms of reference of the review.

In constructing the Submission, AGSO has taken a broad view of the Review's Terms of Reference while acknowledging their principal focus on organisational structure, coordination with other agencies, funding arrangements and accountability to government. The Submission has been prepared following discussion with AGSO's Heads of Program, including the then Heads of the Petroleum and Mineral Resource Assessment Branches, the AGSO Executive and the AGSO Advisory Council.

Overall, the Submission is based on AGSO's perception and experience of four key factors:

- client need, including the public, the exploration industry and government
- international comparisons with other countries' national geological survey activities
- client responses to existing programs
- opportunities for geoscientific research with clear benefit to Australia

BACKGROUND

Before commenting in detail on matters directly relevant to the Terms of Reference, it is important to establish the context of Australian geoscientific research. From the point of view of AGSO, the following are the critical trends affecting geoscientific activity in Australia.

- the minerals and petroleum industries remain of critical importance to Australia's development and economic future. Minerals and energy accounted for 41% of Australia's total exports in 1991–1992 and production has since increased in several commodities. Arguably the mining industry (including metal smelting and refining) is the largest primary sector contributor to Australia's Gross Domestic Product (9% in 1991–92); the resources sector overall has increased its contribution to Australia's exports from 26.7% of total exports in 1969–70 (the base year) to 41% in 1991–92. Royalties received from the petroleum and mineral industries remain major sources of revenue, particularly for State Governments ($812 597 000 in 1989–90)
- Australia remains relatively under-explored on an international scale. In the petroleum field, for example, the state of Australia's petroleum exploration in terms of wells drilled per square kilometre has been compared to that of the United States in the middle of the last century. In the minerals field an equivalent comparison with the United States might be that while Australia has only just completed its geological maps at the scale of 1:250 000 the USA has a well established program of mapping at 1:24 000

- the minerals and energy industries are becoming increasingly internationalised and increasingly mobile. The opening up of the Eastern Block countries and improved access to the South American continent has increased competition between nations for a share of exploration industry capital. Australia cannot afford to neglect the basic geoscience that underpins exploration activity
- technological advances in exploration and extraction technology have opened up new prospects but increased the financial risk to exploration companies
- government policies world-wide are seeking to apply market mechanisms to the operation of geological surveys and other activities previously regarded as "public good" and are seeking to reduce their involvement in "market place" decisions about exploration and extraction
- although still unacknowledged in some circles, environmental geoscience has a significant role to play in activities to promote and ensure ecologically sustainable development

Each of these trends has an important impact on the national geological survey and an assessment of that survey's composition and structure must take into account these, and other trends, if the organisation is to be able to meet the challenge the trends embody.

THE NEED FOR A GEOLOGICAL SURVEY

The Australian Government has recognised the need to maintain an integrated and coherent national geological survey organisation with a clear identity and that the national Geological Survey Organisation is an important strategic asset as Australia approaches the 21st Century (Statement by the Minister for Resources on 13 August 1992). The Government has also recognised "the vital role of its own research organisations as part of an effective science and technology infrastructure (Statement by the Minister for Science and Technology, Developing Australian Ideas, August 1992, p 28) This submission will not expand substantially on the need for a Survey but will provide some brief explanation of what geological surveys do and why that is appropriate.

It is now widely recognised that an improved understanding of the geological aspects of Australia's natural environment and resources is essential to any strategy aimed at sustainable development. More particularly, the development of the geoscientific knowledge base is important because

- it underpins Australia's most important export industries
- it supports resource, land and environmental management and provides a bridge of understanding between development and environmental concerns.

Geological surveys deal with geoscientific data and concepts and provide geoscientific advice. The collection of data in map or digital form is the foundation of all survey work. On this foundation geological surveys develop concepts to describe and elucidate geological events which are essential to interpretation of the data. Such concepts guide mineral and petroleum exploration and investment, land use decision making and advice to government on the appropriate control and regulation of the minerals and energy industries.

This knowledge can, of course, only be developed by regional studies in Australia and its offshore areas. Consequently, while Australia contributes only about 2% to scientific research world-wide, it must undertake virtually 100% of the scientific research into its own natural environment and resources.

To undertake these functions, a national geological survey in Australia needs to

- collect data using remote sensing equipment and by verification in the field
- analyse the data to re-present it in accessible form
- develop concepts which allow the analysis to be interpreted and applied for different purposes
- disseminate the analyses and data collected so as to meet national objectives
- coordinate its activities with other geological surveys in Australia and overseas
- maintain the scientific skills of its staff to ensure that the survey's products reflect the standards required by its clients.

The basic purpose of a national geological survey is therefore to develop and deliver strategic geoscientific programs in the national interest. These programs are focused on geoscientific mapping and database development.

This submission argues that in economic terms the programs of geological survey organisations are essentially public good. However, since AGSO selectively releases some information which is not always '' non-excludable'', AGSO data are more accurately described as quasi-public good. These programs provide the national scientific infrastructure for

- activities that cannot be provided by any private group, including international obligations on behalf of Australia
- resource and environmental management by government in the interests of sustainable development and inter-generational equity
- increased efficiency and international competitiveness of Australian industry
- reducing the risk to industry in making investments and to the nation in securing the capacity for continued use of our resources.

INTERNATIONAL COMPARISONS

Almost every nation has established a national geological survey to undertake the functions described above. The resources allocated to different surveys and their organisational structure and functions depend largely on the nation's gross national product, the importance of the minerals and energy industries to national income, and on national political and administrative arrangements. AGSO has, however, undertaken a questionnaire survey of national geological surveys in nine other countries comparable to Australia. The findings of this survey on key features of the geological surveys are summarised below.

COMPARISON WITH INTERNATIONAL GEOLOGICAL SURVEYS

The geological survey organisations surveyed were GSC (Canada), SGN (France), BGR (Germany), GSI (Italy), IGNS (New Zealand), RSAGS (South Africa), SGU (Sweden), BGS (United Kingdom) and the USGS (United States of America). Other organisations invited to contribute but which failed to respond in time were from Greece, Japan and Poland.

Canada and South Africa are most like Australia being major mineral exporting countries of large area and small population. The US is also a major mineral and petroleum producer. Canada and the US are like Australia in having federal systems in which the national geological survey is complemented by state or provincial geological surveys. The other countries are smaller in area and are essentially mineral and

petroleum importers. Their national surveys therefore serve a different balance of national needs.

Although data was collected to permit comparisons between different surveys on a range of economic and resourcing data, it was clear that without exhaustive research such comparisons have limitations. Accurate comparisons would require compensation, for example, for the following factors

- differences in role and function
- proportion of resources devoted to contracting out of services
- standardisation of definitions of the value of particular sectors of the economy
- compensation for the existence of state surveys and their various roles and responsibilities
- estimations of exchange rates at particular times
- comparison of data from one country from one year against information from another country from another year.

STATISTICAL COMPARISONS

It is possible however to draw some tentative and partly subjective conclusions on broad comparisons based on the survey data and organisational knowledge of the circumstances of each survey. In brief these are

- Of countries with a significant minerals and petroleum sector relative to Gross National Product, Australia's financial support for its survey is about average
- Australia tends to have a lower expenditure per staff member than most other surveys, probably because it tends to undertake more work in-house
- Australia is below average in expenditure on survey activity relative to the area for which it claims sovereignty
- Australia allocates fewer staff to survey activity than other countries relative to the importance of the industry sector to its national economy.

ROLE OF THE NATIONAL SURVEY ORGANISATION

Focus of research

Respondents were asked to indicate to what extent their research was directed to each of the following categories

- applied (specific problem solving)
- national interest (baseline geoscientific data)
- pure science (pushing back the frontiers of science).

This language may have got in the way of meaning as some respondents felt that applied and national interest were the same. However, there is a strong indication that research undertaken by the overseas geological surveys is about equally directed towards applied (industry) research and national interest with less than 5% directed towards pure science.

As a general rule projects may be commissioned from outside or determined by internal priorities but they must be directed towards a desired socio-economic (government and/or industry) outcome.

Research Activities

Regional geological mapping is carried out by all respondents to the survey, except Germany where regional mapping is carried out by the provincial (Lander) geological surveys. Regional geophysical mapping is carried out by all except France. Deep drilling in support of geoscience is undertaken by the USA, Germany and France.

Regional groundwater mapping is undertaken by all except France and South Africa. In France, the SGN has a network of drillholes which allows for monitoring of groundwater level and quality but this does not constitute regional mapping *per se*. Regional regolith/soil mapping only occurs in Australia, Germany, Italy and Sweden although most surveys see soil, regolith and land use mapping as a developing area of activity.

Regional topographic surveying is carried out by 3 of the 9 respondents: Italy, New Zealand and the USA.

Assessments, either of potential or actual resources or both, of groundwater, minerals and energy resources for Government and industry decision making appear to be carried out by all respondents except AGSO (Australia) and SGN (France). The assessment functions in AGSO have been transferred to the Bureau of Resource Sciences while in SGN, a recent review determined that, as from 30 June 1992, the systematic inventory of French mineral resources would cease as it was largely complete.

Three of the nine respondents actively explore for mineral and/or energy resources: France, Germany and the United Kingdom. These activities are undertaken offshore, largely in developing countries.

None of the respondents carries out offshore bathymetric surveying, although all surveys undertake marine geoscientific research (e.g., seismic surveying, sampling, coring) of some sort.

Public education activities (questions from the public, etc) are carried out by all respondents except Germany and Italy.

All respondents have a responsibility to coordinate national geoscientific database activities as well as environmental hazard (for example, earthquake) monitoring and assessment.

All respondents have a responsibility to manage national mineral and fossil collections. Some, however, do not have any role in the maintenance of biostratigraphic indexes (e.g., France).

All respondents carry out geoscientific development assistance projects in other countries except Italy and Sweden. All respondents contribute to various international geoscientific programs where it directly relates to their national mandate.

Other functions which were not mentioned in the questionnaire, but for which national surveys have responsibility include

- application of nuclear sciences to industrial and environmental studies: New Zealand, Germany, France
- coastal zone studies: AGSO (Australia) and the United Kingdom
- commercial laboratory/analytical services: France, South Africa
- earth science parts of the Museum of Natural History: South Africa
- engineering geology work for housing, dams, tunnels, bridges, etc: South Africa

- hazardous waste sites, including nuclear and toxic waste repositories: the United Kingdom, France and Germany
- National Core Library: South Africa
- National Earth Science Library: South Africa
- seismology and geomagnetism: AGSO (Australia), the United Kingdom, New Zealand, South Africa.

REPORTING AND ACCOUNTABILITY

All respondents are part of their national governments; however, the South African survey is very keen to move away from the government umbrella. The New Zealand organisation has moved into a Crown Research Institute, which has meant that almost all research must be treated as if externally funded. SGN (France) is currently setting up subsidiary companies to handle all its non-public service activities.

BGR (Germany), GSI (Italy), IGNS (New Zealand) and SGU (Sweden) operate as independent organisations, while the others are part of larger Government organisations. The primary focus of these larger organisations is generally minerals and energy or natural resource management. SGN (France) is part of a larger national geoscience organisation BRGM, which has large overseas programs including supporting overseas exploration effort by French companies.

GSI (Italy), IGNS (New Zealand) and the BGS (United Kingdom) report to a Board/Committee appointed by the Minister. AGSO (Australia), SGN (France), BGR (Germany), the RSAGS (South Africa) and SGU (Sweden) are responsible to a Ministry or Department of State. The USGS (United States of America) is responsible to a Presidential appointee. Details are as follows

- Italy: the Minister's Committee
- New Zealand: shareholding ministers through appointed Board of Directors
- United Kingdom: program through BGS Program Board appointed by Minister; administration through appointed Director of Earth Sciences, NERC
- Australia: Secretary, DPIE; government appointment
- France: Ministry of Industry
- Germany: Ministry of Economics
- South Africa: Deputy Director General, Department of Mineral and Energy Affairs
- Sweden: Minister for Industry
- United States of America: Assistant Secretary for the Interior for Water and Science; presidential appointee.

In all cases the head of the survey is responsible for the development of the program; however, approval often lies further up the line

- Italy: the Minister's Committee
- New Zealand: Board of Directors
- United Kingdom: BGS Program Board
- Australia: Advisory Council; Minister

- France: Ministry of Industry
- Germany: Ministry of Economics
- South Africa: Chief Director, RSAGS
- Sweden: Minister for Industry
- United States of America: Congress; the President.

It is interesting to note that the accountability and reporting lines for AGSO are different from the approval process for its work program. In AGSO's case, the Secretary or his nominee is a member of the Advisory Council, which endorses the program before it is sent to the Minister for approval.

All except AGSO (Australia) and the RSAGS (Republic of South Africa) report independently. An interesting variation is that SGN (France) reports annually through the BRGM annual report and biennially in a report of its own.

All agencies involve their stakeholders quite considerably in the development of their work programs. There is specific mention of other national government agencies in most survey responses but particularly by Germany, the United Kingdom, the United States of America and France. SGU (Sweden) has consultative councils with different sectors, IGNS (New Zealand) has cooperation with other Crown Research Institutes. SGN (France) has an Inter-Ministry Steering Committee.

All organisations, except GSI (Italy), mentioned that they had recently undertaken, or were currently under, review. The French are currently reviewing their public service (national interest, public benefit) activities. In South Africa, several reports have been completed but little has changed. In the United Kingdom, the Butler Review of six years ago confirmed the need for the BGS and provided the basis for what is now core program.

In Germany, the Ministry of Economics charged the President of BGR with an internal review. In Sweden, SGU undertook an extensive review on its own initiative. In New Zealand, there seems to have been almost continual evaluation activity over the last few years — *Government Science in IGNS* New Zealand (1991); *Research in Geosciences* (1992), report not yet available; *Long Term Science Priorities in IGNS* (1992).

RESOURCES

Funding Sources

The majority of funding for geological surveys still comes from Government. Australia is about average but there are several countries, particularly France, the United Kingdom and Germany which are sourcing their resources from outside the Government appropriation process, although largely from other Government bodies, much as AGSO does with DFAT and the Murray Darling Basin Commission.

RSAGS (Republic of South Africa) is in a similar position now to that of AGSO several years ago. It is not allowed to retain profits and all government work is expected to be resourced from its appropriation.

The surveys further down the path of quasi-commercialisation — SGU (Sweden), USGS (United States of America), BGS (United Kingdom) and IGNS (New Zealand) — are largely funded from government appropriations for their public good core programs but are expected to fund all other operations from other sources (i.e. the clients of those operations which may include government departments). In the United King-

dom, BGS is also expected to feed profits back into the core program, but its operations outside core programs are broadly of a kind that are not undertaken by AGSO at present but by State Geological Surveys, other State instrumentalities or CSIRO.

Funding Guarantees

The average length of time for which a project is funded is around 2 years; only the USGS (United States of America), AGSO (Australia) and IGNS (New Zealand) are funded annually. SGU (Sweden) is funded for 5 years while SGN (France), BGR (Germany) and GSI (Italy) are funded for 3.

Of the organisations surveyed, the average length of time for which they are funded for core program is around 3 years; however the majority only receives funding for one year. SGU (Sweden) is funded for 3 years, BGR (Germany) for 5 and the BGS (United Kingdom) for 10.

Staffing

Most surveys have the vast majority of their staff on permanent tenure. BGS (United Kingdom) seems to encourage the most ''flexible'' staffing arrangements with 25 % of its staff being non-permanent, followed by BGR (Germany) and the USGS (United States of America) with 15%. The rest, including Australia, are at 10% except Sweden with 5%.

Capital equipment

There is a wide variation in the policy on capital equipment funding and it depends on the definition applied

- AGSO owns its own geophysical survey plane, land seismic equipment and chartes a multi-purpose vessel
- the USGS (United States of America) classes anything valued at over $5,000 as capital equipment; it owns all its equipment, (US$256.8M) except planes for which it contracts out
- SGU (Sweden) owns a research vessel and drilling machinery but contracts flying time for airborne surveying
- GSI (Italy) and RSAGS (South Africa) have not identified holdings of capital equipment
- SGN (France) has a small drilling rig, but most major equipment is obtained under contract. BRGM however has major facilities for its international programs and also collaborates in a range of CNRS laboratories. France also operates a number of geoscience research vessels.
- BGS (United Kingdom) owns drilling equipment and major laboratory equipment, but contracts boats and planes
- IGNS (New Zealand) has no boats or planes, but has a range of drilling rigs and processing and analytical equipment
- BGR (Germany) has a helicopter for geophysical surveying, but contracts in its boat and drilling rigs.

CHARGING FOR PRODUCTS AND SERVICES

Products and Services

Most respondents are increasingly charging for everything they do and produce except for policy advice, the library (for which AGSO imposes some charges on external users) and information services. However, with these last two services, most surveys charge for reproduction or dissemination costs. The charge for raw data is generally only based on the cost of reproduction and dissemination.

Other products and services which were not mentioned in the questionnaire include

- laboratory/analytical work under contract for industry and other agencies for which they charge commercial rates: France and South Africa
- equipment manufacture: South Africa
- software products: France and the United Kingdom
- training courses: the United Kingdom and France.

Cost Recovery

No organisation is expected to earn a proportion of its core funding from cost recovery, except AGSO, which has $589 000 deducted upfront then one third of all cost recovery over that figure deducted, and IGNS (New Zealand). Most organisations are allowed, rather than expected, to supplement their annual Government appropriations by earning funds through contracts for work outside their core program. RSAGS (South Africa) is unable to keep any of its profits so there is no incentive for it to look for external work.

All other organisations are expected to at least recover total costs for non-core program activities. SGN (France) is also expected to demonstrate that its core funding does not give it any commercial advantage over private sector competitors for commercial contracts. The BGS (United Kingdom) is expected to feed profits back into the core program.

Returns to the Nation vs Cost Recovery

In the context of moves to a user pays philosophy in government it is difficult to maintain a balance between cost recovery and returns to the nation through long-term research. Most respondents believe that the role of the survey is to fulfil the core program as best they can given their Government appropriations; only AGSO (Australia) and IGNS (New Zealand) are given a cost recovery target. The implicit hidden objective is also to tender successfully for any available commercial projects which can maintain the expertise and reputation of the organisation

- BGS (United Kingdom) sees cost recovery as a way of feeding money back into its core program
- USGS (United States of America) picks up a little extra for its core program by charging for the reproduction and dissemination of products as does SGN (France). France also competes commercially
- RSAGS (South Africa) does whatever the Government pays for but would like to operate in a totally free market (privatisation)
- SGN (France) is trying to regain its public service activities by looking for cost recovery from all client Government departments

- SGU (Sweden) sees cost recovery not as a conflict but as a way to enhance the scientific capability of its organisation
- BGR (Germany) and GSI (Italy) only work towards returns to the nation.

ORGANISATIONAL STRUCTURE

Structural Criteria

Most organisations are structured around a range of different criteria; however, discipline remains the major determinant, followed by client needs and geographical regions. Sweden has discipline oriented groups in charge of Government financed core programs and client financed commissions with multi-disciplinary project teams for non-core programs.

Geographical Location

All organisations have a recognised head office; most have regional offices although extensive regionalisation appears to occur more commonly where there are States, Territories or Provinces which also have geological surveys

- BGR (Germany) has provincial geological surveys but has 18% of its staff in one regional office in Berlin (this may be a function of pre-reunification boundaries rather than a decentralised approach)
- the USGS (United States of America) cooperates with 49 state geological surveys, but has 55% of its staff based in 3 main locations which correspond to major geological provices; each coordinates national programs for a significant proportion of the 49 states of the USA. It also has staff in 268 other locations in the USA and around the world.
- France and the United Kingdom have no provincial suveys; they have 22 (9% of staff) and 9 (42% of staff) regional offices respectively
- Sweden has no provincial surveys but SGN has 10% of its staff outposted in 2 branch offices; a third is being developed in a strong mining region
- IGNS (New Zealand) only has staff outposted (20%) to reflect the importance of geothermal and volcanic research
- Italy has no provincial surveys and GSI's staff are based in one location
- 10% of RSAGS (South Africa) staff are permanently assigned to branch offices, but staff have generous travel provisions to encourage a regional presence.

National Mapping Programs

Canada and the USA, like Australia, have national mapping programs in cooperation with the State or Provincial Surveys. In Canada and the USA these programs are largely funded by special Federal Government appropriations. In the USA, the National Geologic Mapping Act 1992 "... establishes a National Cooperative Mapping Program administered by the USGS, to promote the development and use of geologic maps"; and it authorises the expenditure of an additional US$184 million over four years.

FUTURE OUTLOOK

Respondents to the survey saw the following as features of geological survey activity that were expected to increase in importance

- Joint ventures nationally and internationally: United Kingdom, France and New Zealand
- Environmental and land use work, soils, pollution, groundwater protection: United Kingdom, Germany, United States of America, South Africa, New Zealand and France
- Coastal zone studies: United Kingdom
- Nuclear waste disposal: United Kingdom
- Geological hazards: Italy
- Remote sensing: France.

Major Issues

Major issues identified by the surveys included

- Applying research to socio-economic development: New Zealand
- Multi-disciplinary mapping: United Kingdom and Sweden
- Mapping standards: Italy
- Privatisation and cost recovery: United Kingdom and South Africa
- Industry support for science: South Africa
- Funding availability: United States of America
- Technological change: United States of America
- Changing perceptions of national needs: United States of America
- National database access and development: New Zealand.

Surveys were asked where they would like to allocate additional resources

- Increase public good program: France
- Increase environmental monitoring: France and Italy
- Hardware and software improvement: Italy
- Extend marine surveying into bedrock studies: Sweden
- Establish a geological museum: Sweden
- Coastal geology: United Kingdom
- Petroleum geology: United Kingdom
- Hydrogeology: United Kingdom
- Geochemistry and health: United Kingdom
- Water quality: United Kingdom
- Strengthen research base in core program: Germany and United States of America

- Accelerate what we do now: South Africa.

If resources were lost, surveys would

- Set priorities more carefully: France and Italy
- Avoid contracting expensive equipment: France
- Retreat to core program: New Zealand
- Decrease accuracy: Sweden
- Delay project completions: Sweden
- Cut functions: United Kingdom
- Realign and reshuffle focal activities: Germany
- Look for improvements to efficiency: United States of America
- Slow down publications: South Africa
- Reduce involvement in international programs: South Africa.

Copies of the questionnaire used for the survey and the responses received can be provided as required.

RETURNS ON INVESTMENT

It is clear that most nations have seen and continue to see investment in a national geological survey as providing an adequate return to the community on its investment, and that the goods they produce "produce substantial spillover benefits and would be grossly underproduced by the market system" (Jackson et al., 1980). The returns which nations expect from investment in geological survey activity fall into three broad categories.

1. Returns to the private sector. Geological survey work benefits the private sector through providing pre-commercial data and maps for the minerals and petroleum industries and base data for elements of the private sector dealing with building development, agriculture, forestry and so on. In these instances, the work of a geological survey tends to reduce the risk involved in exploration investment for the exploration industry and provides guidance on soil type, movement and stability for the agriculture and building sectors. The purpose behind such investment, however, is not to improve the profitability of private investment but to facilitate effective investment on behalf of the general community by providing a service which the private sector could not provide for itself.

2. Returns direct to government. As a result of geological survey mapping and associated activity, government can obtain advice on a range of geoscientific matters including information on mineral, petroleum and soil resources managed by government on behalf of the wider community, and gain insight into the best means of regulating commercial activity, particularly in the petroleum and minerals industries.

3. Returns to the community as a whole (i.e. pure public good). The activities of a geological survey which are generally classed as "pure public good" include benefits from long term scientific research, services that help mitigate potential disasters, such as earthquake and nuclear monitoring, and the services which are generally accepted by national governments as national obligations. The latter includes, in Australia's case, geoscientific activities in the Antarctic, administration

of the magnetic observatories to provide magnetic declinations for national and international mapping purposes and navigation, aid programs with a geoscientific element, assistance with the United Nations Convention on the Law of the Sea and the broader international obligations reflecting Australia's membership of the international community.

Information on the benefits to government and to the community as a whole are difficult to quantify although, in the case of community benefits, geoscientific programs administered by AGSO in this category are all subject to specific Cabinet direction, ministerial approval or funded by another department of state (as in the case of the nuclear monitoring program and overseas aid).

AGSO does not closely monitor the successful use of its strategic survey data by industry to locate and exploit mineral and petroleum resources as its liaison with industry is primarily directed towards determining priorities for future research. Material which summarises BMR contributions to the discovery of petroleum and mineral deposits was, however, prepared in 1982 and 1967 in response to questions on notice. This material is at Attachment A.

Notable among this record of achievement is the discovery of the Olympic Dam uranium/copper/gold deposit where the ore body was located by CRA primarily using AGSO acquired geophysical data. The recent review of the Continental Margins Program, with the assistance of Coopers and Lybrand, identified a total program cost of $22,149,332 in 1991/92, against which the exploration industry had committed expenditure for petroleum search in the areas subject to CMP evaluation of over $120 million since 1987 and has proposed additional work of over $250 million, contingent on the findings from the initial committed work. These last figures, of course, include only exploration expenditure; discovery of economically extractable petroleum reserves will entail an investment several orders of magnitude larger.

Just as important to the benefits arising from geoscientific strategic research in Australia are the potential costs of reduced research. Such costs include

- declining attractiveness of Australia to explorationists and movement of exploration capital to areas where strategic survey material is available. Almost every country in the world undertakes such activity to encourage the mineral and petroleum industries and to reduce the risks of exploration
- reduced capacity of government to control exploration activity to maximise benefits to Australia
- reduced capacity in government to direct exploration activity to locate strategic minerals at times of national crisis — as, for example, in the search for uranium after 1945
- declining efficiency of exploration as exploration decisions are taken without regional survey data, or where companies duplicate regional surveys of the same areas
- neglect of international obligations and loss of the benefits arising from such international cooperation in, for example, aid programs and monitoring of nuclear explosions
- reduced exploration and extraction activity and declining returns to the community in terms of economic activity and employment generated, taxes paid and export revenue earned

EVOLUTION OF BMR/AGSO

The discovery of gold in Australia was the mainspring of colonial government action resulting in the formation of the state and territory geological surveys, as it had only slowly been realised that geological survey was the key to the discovery and development of mineral wealth — including water — and in control of the physical environment. The need for a federal geological survey had been discussed at a senior level since the 1920s, but until the advent of World War II demonstrated the urgent need for reliable supplies of strategic minerals, the creation of a national geological survey was deferred, primarily to avoid offending state sensibilities.

The recognition that there were special national priorities and the need for coordination of the activity of state surveys led to the formation in 1946 of the Bureau of Mineral Resources, Geology and Geophysics (BMR). The then BMR had as its main objective the systematic geological and geophysical mapping of the continent as a basis for informed mineral search. This program required uniform data presentation and led to agreements between the Commonwealth and states on geological map layout, symbols and colour scheme, and the formulation of an Australian code of stratigraphic nomenclature.

The establishment of BMR, combined with the expansion of state geological surveys in the 1950s and 1960s led to rapid development of the geoscience knowledge base in Australia. The systematic geological mapping which subsequently developed from the national initiative resulted in the first 1:253 440 (1 inch equals 4 miles) scale geological sheet being released in 1951. Since then the combined BMR and state and territory geological survey mapping activities have resulted in the standard metric scale (1:250 000) sheet geological series being 94% complete by 1988.

When the Australian Science and Technology Council reviewed the role of BMR in 1978, it concluded, however, that "Future discoveries of subsurface deposits will need increasingly to rely on sophisticated research utilising advance geophysical, geochemical and geological concepts and techniques, and the future BMR will be required to contribute to strategic research programs". This emphasis on the development of geoscience knowledge as involving an aggregation of observations, concepts and interpretation encouraged BMR to concentrate to a greater extent on the development of concepts and interpretations. BMR was asked to discontinue its involvement in systematic 1:250 000 mapping programs on the assumption that the responsibility could be discharged adequately by State Geological Surveys. This emphasis was changed following the Woods' Review in 1988 which recognised the need for a new generation of geoscientific mapping based on multidisciplinary studies. Mr Woods' report recommended:

- the redefinition to the Bureau's role and functions and the development of a National Geoscience Mapping Accord
- closer liaison and cooperation with the states and territories, CSIRO, industry and universities
- closer alignment of the Bureau's programs and priorities with the needs of industry and the examination of options for the extension of cost recovery
- the disposal of drilling rigs and the contracting out of onshore seismic and airborne data acquisition and processing
- divisional restructuring of the Bureau, and the transfer of certain statistical functions within the portfolio
- the use of external management consultants or a departmental task force to implement the Review recommendations.

The Government accepted Mr Woods' recommendations with few modifications. The most significant modifications were, following a review of the cost effectiveness of some of Mr Woods' suggestions for contracting out, to maintain a BMR seismic and airborne data acquisition and processing capacity and some variation to his organisational structure proposals.

There is no doubt that the Woods' Review recommendations have been well received by industry and are effective from the Government's viewpoint. The growth of demand for environmental geoscience services and increasing acknowledgement in government of the contribution which geoscience can make to ecologically sustainable development have been features of AGSO's program development since the Woods' Review.

AGSO's programs have generally developed as a consequence of specific government decisions with ear-marked funding. In recent times a number of reports (e.g. from ASTEC, from ESD Working Groups, and from the Industries Commission) have dealt with issues of Sustainable Development and the needs for improved scientific knowledge in addressing these issues. There has also been a report (*Towards 2005*) by the Australian Geoscience Council on the need for geoscience research into the next century.

The AGSO program objectives outlined below reflect the findings of this wide range of studies. All of the programs are essentially "public good" programs undertaken in the national interest. Some support national "Economic Development" objectives while others support "National Welfare" objectives.

Strategic goals of the Department of Primary Industries and Energy (DPIE), the Department of Arts, Sport, the Environment and Territories (DASET), the Department of Foreign Affairs and Trade (DFAT), Department of Defence (DOD) and corresponding AGSO geoscientific program requirements are:

Progressive, adaptable and internationally competitive Australian primary energy industries (DPIE)

- develop the geoscience knowledge base for Australia to provide incentive for investment and to promote efficient and effective exploration and discovery
- participate in international programs which will assist Australian industry to compete effectively in expanding its activities in the Pacific region and globally

Sustainable development of the nation's primary and energy resources with appropriate returns to the community from their use (DPIE)

- develop the geoscience knowledge base to promote the sustainable supply of minerals, energy and water resources and sustainable yield from soil resources
- develop the geoscience knowledge base for environmental and land use decision, and for managing the impacts of environmental changes and natural hazards

Enhancing Australia's scientific, environmental and economic interests in the Antarctic and in preserving Australian sovereignty over the Australian Antarctic Territory (DASET)

- develop the geoscientific knowledge base of the AAT and its offshore areas to promote understanding of the Antarctic environment and of global change

Achieving ecologically sustainable use and long term conservation of the environment (DASET)

- develop geoscientific understanding of the environment, of natural change, and of environmental impacts to assist the development of strategies to mitigate these impacts and to rehabilitate damaged environments.

Contribute to enhanced global security (DFAT), (DOD)

- detect and monitor underground nuclear explosions as part of a world-wide program to achieve a comprehensive nuclear test ban treaty

To realise the Government's priorities for the development of Australia's defence capabilities through the provision of logistics ..... (DOD)

- develop the geoscientific basis required for improving Australia's defence capabilities and for defence logistics.

The programs to achieve these goals are focused on geoscientific mapping and associated research, and on the national coordination of geoscientific databases. They are aimed at a comprehensive three-dimensional geological understanding of the land mass and its offshore areas, together with an understanding of the geological evolution to the present state, and the rates of continuing natural change. Such understanding can serve all goals, but logistic, resource and time constraints lead to discrete programs which are focused on particular priorities and particular areas.

The principal existing strategic programs, the National Geoscience Mapping Accord and the Continental Margins Program, which comprise approximately 78% of AGSO's appropriation are clearly focused on providing critical geoscience information for management by Government of Australia's natural resources and land and environmental decision making. They also provide the scientific infrastructure for the minerals and petroleum industries. This submission argues that these programs need to be maintained, and funded by government, to achieve their objectives in the national interest.

CURRENT ADMINISTRATIVE ARRANGEMENTS

AGSO currently operates as one of seven groups within the Department of Primary Industries and Energy, responsible through an Executive Director to the Secretary of the Department. In this arrangement the organisation enjoys equivalent status and line of command to other Bureaux within the portfolio and the policy groups. AGSO, however, employs approximately 30.5% of departmental staff and accounts for 32.3% of its annual appropriation.

AGSO is also unique in that it has a formal Advisory Council to provide advice on program direction and to review its activities. The Council was established in 1985 and its Terms of Reference strengthened following the Woods' Review. Its current Terms of Reference are to provide advice to the Minister for Resources and the Executive Director of AGSO on:

- the objectives and priorities of AGSO's research programs
- the initiation, performance and termination of aspects of the program
- industrial and economic policies which impinge on AGSO's activities
- community interests in relation to AGSO activities.

The Advisory Council's contribution to AGSO's activities has been extremely important and it has taken a particularly active role in AGSO's planning cycle, in reviewing

program performance and in providing advice and insights direct to programs. This last function has been performed under "godparent" arrangements whereby individual members of the Advisory Council spend a day with a nominated program, providing advice and input and reporting back to other Advisory Council members at the formal meetings. The Council has also been useful in providing informal contact with industry and community sources and there is clearly a capacity to strengthen its role in AGSO activities.

Day to day activities of the Organisation are carried out at the corporate level by the AGSO Executive. The Executive comprises the Executive Director and the two Associate Directors assisted by the Heads of the Corporate Relations, Information and Planning Branch and the Business Management Branch. Associate Directors have particular responsibility for overseeing the development of the two main groups of programs established in BMR following the Woods' Review. This responsibility included coordination of research and resource assessment functions in each group prior to the establishment of BRS.

In keeping with portfolio practice, budgeting and financial management for AGSO are devolved. Program Heads are responsible to the Executive for the delivery of annual programs set out in the Annual Program Document. Each program retains a Resource Coordinator and is responsible for management of its own staff and financial resources. Further details of these arrangements are provided in the Appendix.

Coordination of National Geoscience

In a federal government system, such as those of Australia, Canada and the USA, the programs of the national geological survey organisation are developed in response to national priorities; but, in all three of the countries mentioned, the key national mapping programs have also been executed in collaboration with state or provincial surveys. In Australia, the National Geoscience Mapping Accord has been developed on the basis of the complementarity of Commonwealth and State roles as identified in the Woods Review.

A particular feature of strategic mapping programs performed by Australian or state geological surveys is that they are based on the collection, interpretation and evaluation of large quantities of observational data. In contrast, CSIRO has placed particular emphasis on technique development and research into the most effective applications of these techniques for industry. A recent review paper prepared for the Primary Industries and Energy Resource Council noted that CSIRO's research effort in relation to soil and water resources was greater than that relating to mineral and energy resource exploration and development. On the other hand, the BMR regional mapping programs were devoted largely to petroleum and mineral resources. Only limited regional geoscientific mapping programs have been undertaken in relation to soil and water resources. The paper noted the need "...to develop an Australia-wide strategy which would integrate programs of data collection, collation and evaluation, soil classification, data base development and research into new methods for land resource assessment...". The paper also noted that "...mechanisms are not readily available to ensure that the advances in concepts and techniques development in the CSIRO research are fully utilised in national mapping programs".

AGSO enjoys formal and informal coordination arrangements with state Geological Surveys, the CSIRO, universities and the Cooperative Research Centres working on earth science matters. Formal arrangements include

Conference of Chief Government Geologists

The Conference of Chief Government Geologists (CCGG) meets annually and includes representatives from each State and Territory survey and from New Zealand. Two representatives are provided from AGSO and the chairmanship of the Conference is held by the State hosting the meeting.

The Conference is technically a sub-committee of the Australia-New Zealand Minerals and Energy Council Standing Committee of Officials and reports to that body. Standing agenda items include reports from the Government Geoscience Database Advisory Committee (GGDPAC), National Geoscience Mapping Accord (NGMA) progress, the Chief Geological Cartographers Conference and various items of general organisational and professional value, such as cost recovery, resource assessment issues, copyright, and open range exploration. The Conference appoints delegates to the Australian Geoscience Council, the Australian Drilling Advisory Committee and the AGSO Advisory Council.

CCGG is currently reviewing its terms of reference. An option for the Conference's development would be the appointment of a representative from the Bureau of Resource Sciences

Government Geoscience Database Policy Advisory Committee

GGDPAC is the coordination and liaison sub-committee of the CCGG focusing on the coordination and liaison of geoscience related databases. Its activities have proved of increasing value in standardising data, promoting the exchange of data, improving industry liaison and reducing duplication

GGDPAC also works with industry groups such as AMIRA and Standards Australia, and national groups such as ANZLIC and AURISA to ensure that, in the long term, digital geoscience data will be produced in a form that can be readily taken up by industry and other clients.

Chief Cartographers Conference

The Chief Cartographers Conference (CCC) performs a similar function to GGDPAC in coordinating and standardising cartographic outputs from the surveys.

Coordination with the Bureau of Resource Sciences

The Bureau of Resource Sciences will provide "the Government with scientific and technical assessments, analysis and information to support the formulation of policies relevant to Australia's agriculture, forestry and fishing industries, as well as the petroleum, minerals and energy sectors". It also has been given the function to "conduct scientific research relevant to Australia's agriculture, minerals, energy, forestry and fishing industries." (BRS Vision, Organisation and Function Statement). Coordination with the BRS will clearly be important, even though not specifically mentioned in the review terms of reference.

BRS will focus on the objective of making "better use of scientific research and analysis in the development of policy". (Ministers' Statement, 21 October 1992). It has been proposed that an explicit management system be put in place to link the AGSO scientific mapping activities with the resource assessment responsibilities of BRS. One suggestion has been that this management system be based upon a memorandum of understanding between the two organisations. Such written agreements are unusual between branches of the same organisation responsible to the same authority, but AGSO has no objection to entering into such an agreement on the understanding that

the rapid rate of change in the portfolio will be likely to disturb any too prescriptive arrangements. The key objectives must be to achieve the highest quality of output with maximum efficiency, avoiding duplication of effort.

The new arrangement has some analogy with arrangements in Canada and the USA. In the USA for example, the USBM has responsibility for appraisal of mineral reserves in economic deposits, and for appraisal of mineral supply, but the responsibility for assessment of resources on a national and global scale, as well as for the development of computerised data bases and an integrated information system, rests with the USGS. The International Strategic Minerals Inventory Project (ISMI) is carried out with the participation of both the USBM and the USGS, and the results published by the USGS.

It seems clear that, to achieve the objectives, close cooperation will be required between BRS and AGSO in resource assessment, and that AGSO must have substantial responsibility for the assessment of resource potential in particular. Assessments of resource potential are a natural product of the studies of mineral and petroleum provinces under the NGMA and CMP.

Planning, Evaluation and Reporting Arrangements

The model for the AGSO Integrated Planning Cycle (IPC) has been constructed around the three annual meetings of the AGSO Advisory Council and the phases which separate each of them (see Figure 1).

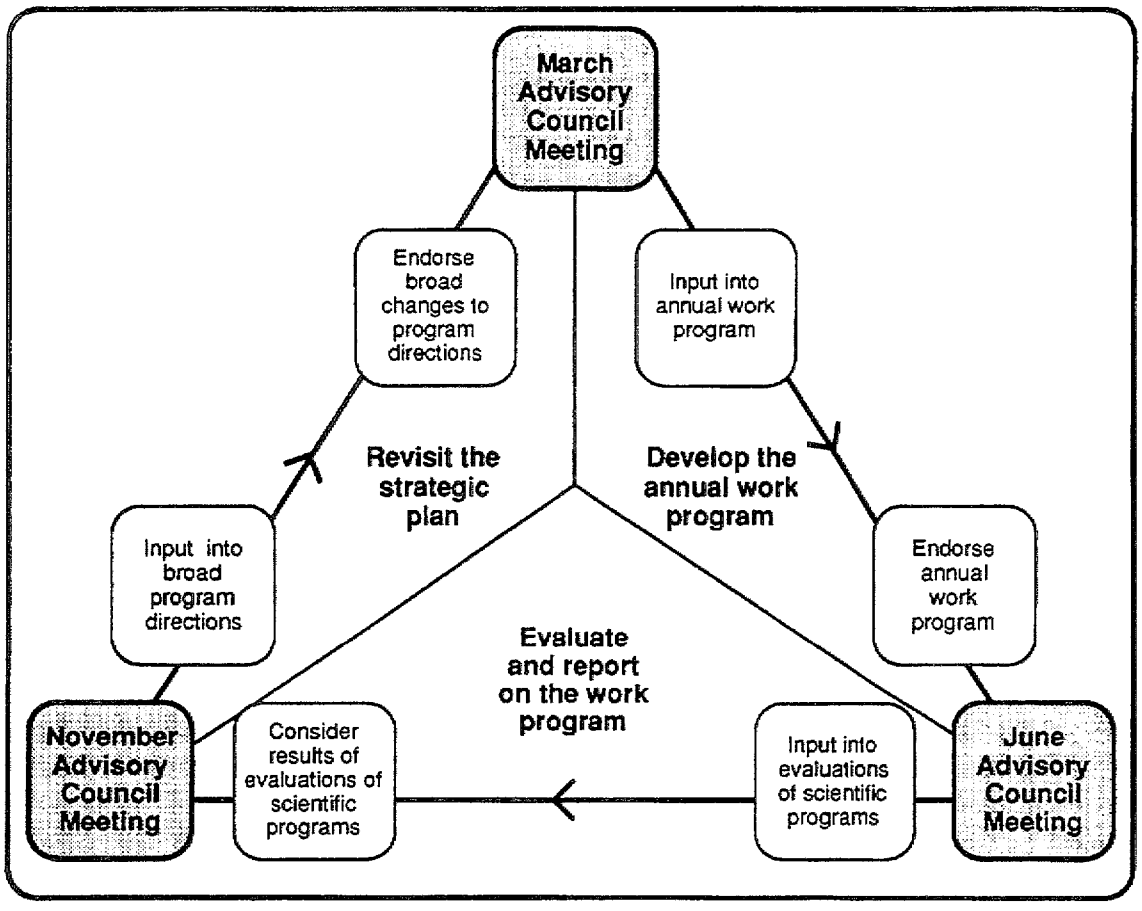


Fig. 1. AGSO's Integrated Planning Cycle

Its aim is to

- integrate the Governmental, Departmental and corporate planning, evaluation and reporting requirements
- demonstrate the linkages between the varied demands placed on AGSO
- provide key players in the Cycle with
  - an overview of how the planning, evaluation and reporting Cycle operates
  - a detailed view, where necessary, of what is expected of them.

The Cycle Meetings and Phases

There are three phases within the AGSO Integrated Planning Cycle

- the Strategic Planning Phase
- the Annual Planning Phase
- the Evaluation and Reporting Phase.

Each phase is separated by a meeting of the AGSO Advisory Council and each phase and each meeting places specific responsibilities on managers in AGSO and members of the AGSO Advisory Council. Evaluations are supervised by the Advisory Council, include stakeholders and external experts on the review panel and are sent to stakeholders for comment before finalisation.

November Advisory Council Meeting

The November Meeting of the Advisory Council marks the transition between the evaluation and reporting phase and the strategic planning phase. The results of evaluations undertaken are fed into the strategic (and annual) planning phase. The focus of the meeting is therefore on the following items

- **Strategic Planning Phase**: endorse draft strategic overview for AGSO's Three Year Strategic Plan
- **Annual Planning Phase**: provide feedback on published Annual Work Program
- **Evaluation and Reporting Phase**: discuss draft Evaluation Panel Reports on current evaluations

November–March Phase—Strategic Planning

The role of AGSO Advisory Council members in this phase is to discuss AGSO's proposed strategic statement with their constituents and provide feedback to the areas they "godparent".

The role of AGSO managers in this phase is to take the strategic statement endorsed at the November Meeting and apply it to their Program. This is done in consultation with the relevant Associate Directors and other affected Heads of Program and involves extensive informal contact with key stakeholders. This exercise may also require the agreement of long term objectives and strategies with key managers in individual Programs.

The outputs of this phase include

- the final draft of the Three Year Strategic Plan which is referred to the March Advisory Council Meeting for its endorsement

- the final reports from the evaluations undertaken in the previous phase with stakeholder reactions to the recommendations

March Advisory Council Meeting

The March Meeting of the Advisory Council marks the transition between the strategic planning phase and the annual planning phase. The focus of the meeting is therefore on the following items

- **Strategic Planning Phase**: final draft of Three Year Strategic Plan
- **Annual Planning Phase**: discuss the implications of the new Three Year Strategic Plan for the development of the Annual Work Program
- **Planning and Evaluation Phase**: Panel Reports on evaluations completed in the previous phase with stakeholder reactions and proposed implementation strategy; endorse proposed strategies for Advisory Council evaluations beginning after the next Advisory Council meeting

March–June Phase—Annual Planning

The role of the Council members in the March–June phase is to monitor the development of the Annual Work Program in areas which they "godparent". This incorporates a number of activities including

- gaining insights from the members of organisations with which they are associated
- providing advice to AGSO program managers on how to implement the directions of the Three Year Strategic Plan
- providing feedback to AGSO Program managers on the deliberations of the Advisory Council and the implications of those deliberations for Programs.

AGSO managers' major responsibilities in this period are to prepare the operational plan (work program contribution) for their Program for the coming financial year and the performance report for the financial year just coming to a close. These are done in consultation with stakeholders and Program staff, including the managers of AGSO's corporate support areas.

June Advisory Council Meeting

The June Meeting of the Advisory Council marks the transition between the evaluation and reporting phase and the strategic planning phase. The focus of the meeting is therefore on the following items

- **Annual Planning Phase**: endorse final draft of Annual Work Program
- **Planning and Evaluation Phase**: draft AGSO Program Performance Report
- **Strategic Planning Phase**: endorse strategy for annual survey of strategic environment

June–November Phase—Evaluation and Reporting

This is probably the phase where the Advisory Council members get most actively involved in AGSO activities as members are closely involved in the Advisory Council Evaluation Program, which can be quite time consuming. While not members of the review team, AGSO managers involved in evaluation are actively involved in the planning, organisation and implementation of the evaluation strategy.

The main outputs of this phase include AGSO's contributions to the DPIE Annual Report and the DPIE Portfolio Program Performance Statements, and the Three Year Strategic Plan.

SUGGESTED ROLE FOR AGSO

Scope for a Geological Survey in Australia

Australia depends upon its mineral and petroleum industries and its soil dependent primary production to a greater extent than any other OECD country. Geological survey activity is primarily directed towards providing information which improves the efficiency of these industries and the effectiveness of their regulation. Only by the collection and dissemination of such information can geoscience help " Ensure there is a full return to the community from the development of common resources" (ALP Platform, 1991, p 182).

Such research can only be carried out in Australia as many features of the Australian continent do not permit the ready transposition of geological concepts and models from overseas. On land, for example, Australia's deeply weathered surface presents special difficulties in assessing basement geology — which is far more deeply buried by overburden than in most other continents. Mapping of what is overburden in a mineral industry context also presents special opportunities for the study of the regolith, the soil and weathered material layer on which Australia's primary production depends.

Offshore, Australia's huge exclusive economic zone (12 million square kilometres, including the extension of the legal continental shelf) and relatively small population place special responsibilities on Australia to be seen to be making reasonable use of the resources of this area. Australian conditions offshore, however, are very different from other regions where offshore exploration is taking place. Our levels of salinity, carbonate deposit and the heavily faulted nature of offshore petroleum basins are obstacles to exploration using techniques and concepts widely applied elsewhere. Only a national geological survey has the capacity and incentive to undertake the research necessary as well as to help " Monitor the performance of the petroleum industry to ensure that it maximises the benefits accruing to the Australian community with particular reference to rates of depletion and the acquisition of technological capability in Australia" (ALP Platform, op cit, p 193). It is notable in this context that the major petroleum explorers have decreased their research into Australian petroleum sources in recent years, placing additional responsibility on AGSO if Australia's energy policy is to achieve its objective "to sustain an adequate level of exploration for oil and gas" (ibid, p 198).

Australia also has special opportunities in its region to contribute to the development of its neighbours and to provide entree for Australian industry to explore the region through AGSO's international contacts. AGSO's recent cruise of the *Rig Seismic* to the Philippines appears to have been particularly well regarded in improving access for Australian venturers. Further, the geology of Australia pays little attention to state boundaries, and the degree of coordination of state activity and standardisation of data standards across Australia is essential for the efficient description of Australian geology. While formal coordination with State geological surveys occurs only through the Conference of Chief Government Geologists, there is extensive less formal cooperation through the National Geoscience Mapping Accord (NGMA) projects and data standards committees and through informal contact at different levels throughout the AGSO.

The current responsibilities of AGSO are described in the 1992 Annual Work Program. These functions can be grouped under three general headings

Geoscientific Mapping Programs: In this context, mapping is multidisciplinary research. It includes pre-commercial surveys onshore and offshore by data collection, data analysis and interpretation, concept development, dissemination of information and coordination of associated activities of other agencies.

Welfare functions: These include earthquake monitoring, nuclear explosion monitoring, the magnetic observatory program, contribution to the United Nations Convention on the Law of the Sea, overseas aid programs and participation in international geoscientific information exchange arrangements.

Geoscientific research and advice: Although AGSO no longer provides resource assessment advice to government and industry, its strategic research programs (NGMA and CMP) provide the essential basis for assessments of resource potential. Its advice on other geoscientific topics is widely sought after by other areas of government, industry and the public. AGSO also undertakes some original scientific development work, often in collaboration with universities or other scientific organisations, to develop techniques and concepts associated with its core tasks.

The Resource Assessment function, which was included in AGSO's 1991 Annual Work Program, has been transferred to the Bureau of Resource Sciences. AGSO will need to maintain close contact with officers undertaking the resource assessment function to ensure the effectiveness of both organisations. Such liaison will need to occur to ensure effective mutual access to common databases, ensure resource assessment staff participation in AGSO research planning and priority setting, and to maintain professional support to geoscientists active in the resource assessment field.

Each of the Organisation's three types of functions requires advice to, and interaction with, government and industry clients. Strategic basic research is usually defined as being "directed into specified broad areas in the expectation of useful discoveries" and providing "the broad base of knowledge necessary for the solution of recognised practical problems". Its programs have to be carefully designed by the scientists concerned with the recognised practical problems in mind. It is therefore important that the scientists maintain close contact with their clients whether they be in the exploration industry or in other government agencies or departments.

Conversely, it is not possible for clients to make the best use of scientific information without close contact with the scientists concerned. The scientists will often have insights into the possible applications of the strategic knowledge base for singular purposes, which will not be readily apparent from published syntheses. It is important that the scientists be involved in consultations with clients on the utilisation of the information which they produce. This is particularly so when the decisions which need to be made cannot be made solely on the scientific evidence but involve elements of social and political judgment. In such cases it is important that decision-makers fully understand the limitations of the scientific evidence.

For example, environmental protection policy can, in principle, be based on scientific analysis of the relevant cause and effect relationship, but "These scientific linkages are often complex in character, bordering on the margins of scientific knowledge, and at times transgressing the boundaries of the scientific method itself ... The resulting scientific uncertainties allow a range of views to be held concerning these cause and effect relationships ... Further it requires policy makers ... to take decisions in the face of uncertainty." (D A Everest, 1990).

ISSUES AND OPPORTUNITIES

This section seeks to identify the key issues and opportunities facing AGSO over the next decade. Consideration of such issues and opportunities will clearly be a key consideration in determining the way the structure and the composition of the Organisation should evolve. A possible restructure of AGSO programs is offerred later in the section.

Changes to client base and use of products

The use to which AGSO products are put and the client base making use of the products has changed markedly since the Organisation's establishment and it is expected to change further over the next decade. Some of the trends AGSO believes are likely to have a major impact on the way the Organisation conducts its business and the business it conducts are

- **Sustainable Land Use**: increasing interest in geoscientific aspects of land and water use
- **Resource Use**: increasing priority being given to sustainable use of resources. In geoscientific terms this will place particular stress on mapping functions and on geoscientific advice on the regulation of the mining and petroleum industries both onshore and offshore
- **Regolith**: increasing interest in developing countries in exploration for sub-surface resources and the regolith
- **Map Products**: increasing sophistication of mapping capacity will require an increased diversity of products
- **Geoscientific Welfare**: increasing government interest in the maintenance of geoscientific welfare functions such as earthquake and nuclear monitoring, Antarctic geoscience and the delineation of Australia's offshore jurisdiction
- **Data Brokers**: increasing use of AGSO products by third parties to "add value" before on-selling to other purchasers
- **Diversified Accountability**: the broad spread of AGSO's client base and the challenges that entails to ensure that products meet a particular client group's needs and are cost recovered to the optimum extent consistent with the use of the product by that client. A single product, for example, may be used by industry for exploration purposes, by government to regulate the industry, by the general public to improve land management and by scientific researchers to explore concepts and argue theories
- **Role of the Advisory Council**: The enhanced role of the Advisory Council since the Woods' Review has been a significant success in improving AGSO's external contacts and in monitoring and evaluating internal management of the Organisation and its programs. Opportunities for enhancing the Council's role exist in seeking to maintain and improve liaison with industry and within Government, although questions must arise as to the extent AGSO can continue to press for additional assistance from Advisory Council members without improved remuneration or the Council's being asked to act in the capacity of a Board of Directors
- **Priority setting and strategic planning**: AGSO has developed a sophisticated and effective system of corporate planning incorporating Advisory Council meetings and budget and evaluation cycles in an integrated way. The rapid pace of change within Government and the increasing volatility of AGSO program's

funding basis place special demands on the Organisation to maintain the effectiveness of its strategic planning and to secure its appropriation funding over the time period required for the Organisation's strategic research mission

- **Marketing of geoscientific publications**: *Aus·GEO News* and the *AGSO Research Newsletter* have been very successful in promoting AGSO products and research with the mailing list of the former publication now exceeding 3500. Sales of geoscientific products Australia wide, however, remain spread between different State surveys and AGSO. AGSO has attempted to develop reciprocal arrangements with some States and Territories to allow sale of each survey's products. Such arrangements are not as effective as the surveys' customers would prefer or modern technology permits. A modern central repository and sales centre, taking orders by phone or fax, for all data and products collected by the surveys is attractive on the grounds of cost saving to each survey and assisting access by other than casual customers
- **Budgeting and resourcing**: There is increasing pressure within Government for further devolution of responsibility to action programs, for improved cost recovery where possible and for greater flexibility in financing from appropriations. While AGSO has always operated effectively in a devolved environment, greater security in its financial arrangements and concentration of the cost recovery effort only in those areas where cost recovery is in the public interest will remain challenges over the next decade. Recent budget cuts have resulted in only three of a desirable program of six research cruises a year for the *Rig Seismic* being funded from Government appropriation, so that there is potentially serious underutilisation of the investment in the vessel, its equipment, and the scientific and technical expertise. In the case of the National Geoscience Mapping Accord, budget cuts are also curtailing the critical levels of activity that had been achieved. It is also recognised that the initial levels of activity are inadequate to reach the goals of the program within the proposed framework of twenty years
- **Mobility of staff and resources**: AGSO's scientific staff turns over at a relatively low rate. This has advantages in terms of maintaining organisational capacity but disadvantages, in some cases, in terms of staff supervision, geographic decentralisation and maintenance of a continuous supply of geoscientists for industry and government
- **Staff age profile**: The age profile of AGSO's staff continues to increase as staff numbers decline and turnover remains low. Earlier attempts after the Woods' Review through a retrenchment/early retirement program only reduced staff numbers to the level required by salary budget restrictions. It is important for the future of the Organisation that a new generation of geoscientists is brought in and given employment and training. The cost of a further retrenchment/early retirement program if funded on a loan basis to encourage such recruitment is, however, unacceptable
- **Scientific versus other obligations**: The majority of AGSO's key staff are professional scientists devoted to production of scientific work consistent with the Organisation's mission. As a result of a range of government and departmental initiatives, they are increasingly being required to contribute to other areas of government activity where they have little professional training and, occasionally, less enthusiasm. These other areas include marketing of AGSO products, preparation of policy advice, extensive rounds of interviewing for merit promotion, program financial management and general administration. It will be a challenge for the Organisation to enthuse scientific staff for some of these tasks and to ensure that they are appropriately trained to undertake them in an effective manner

- **Adequacy of accommodation**: AGSO is currently spread among 11 different buildings and its main accommodation is quite unsuited to the functions it now performs. Further details on accommodation issues are available in the Appendix
- **Geographic decentralisation**: The integrated nature of the strategic mapping and much geoscientific work requires a centralised location for a national geological survey. Only with such a centralised location for the scientific staff can the Organisation achieve sufficient interaction between scientists, flexibility in the allocation of professional staff, and ready access to the knowledge base of colleagues. Nonetheless, the Organisation is aware of the benefits of some decentralisation in terms of improving liaison with industry and cooperation with other geoscientific agencies, even if there is an additional administrative cost in such arrangements. Clearly, the Organisation will have to look carefully at establishing one or more regional offices during periods when an extensive mapping program could be administered more effectively from a capital city or regional centre
- **Promotion of the contribution of geoscience**: Geoscience is increasingly able to make a contribution to a range of policy issues. It is clearly the responsibility of a national geological survey to ensure that policy makers and the public are aware of the contribution which geoscience can make to resolving issues and to be able to negotiate effectively for any additional resources required to meet policy objectives
- **Advice to other departments**: AGSO currently contributes to achieving the DPIE portfolio goals of
  - a more competitive and diversified resource industry base
  - better management of natural resources on the principles of ecologically sustainable development
  - improved and more accessible information about the resource base
  - favourable outcomes for Australia in the international arena

AGSO also contributes to the DASET objective of "enhancing Australia's scientific, environmental and economic interests in the Antarctic and in preserving Australian sovereignty over the Australian Antarctic Territory" and in "achieving ecologically sustainable use and long term conservation of the environment". In the case of the Department of Foreign Affairs and Trade, AGSO helps "to contribute to enhance global security" and to aid objectives. AGSO objectives are also consistent with those of the Aboriginal and Torres Strait Islander Commission and the Australian International Development Assistance Bureau. With the increasing capacity of geoscience to contribute to policy issues, liaison with these other organisations will need to be strengthened

- **Relationships with other agencies**: The Organisation has a special professional relationship with geoscientists in the CSIRO, State Geological Surveys and the Cooperative Research Centres. It is essential that these contacts be maintained and enhanced over the next decade, wherever it is cost effective to do so
- **International obligations and opportunities**: As the national geological survey AGSO has international obligations to maintain and enhance contact with other surveys and to contribute to international geoscientific programs. In addition, it is clear that AGSO has a substantial capacity to contribute to the development of nations in the South Pacific and in South East Asia and to advise on techniques of pre-commercial exploration in countries with similar geology, terrain or working conditions to Australia. These opportunities are aid related and also have a capacity for commercial cost recovery

- **Cost recovery and pricing**: There is significant potential for improved cost recovery within any national geological survey. Few surveys have, however, been asked to improve cost recovery beyond a very limited level due to the public good elements of their work, the problems associated with the use of products by clients with significantly different capacities to pay, and a well founded caution as to the response of an internationally based exploration industry to a unilateral increase in government charges
- **Maintenance of scientific standards**: Probably the most important challenge facing Australian geological surveys is to maintain the high standards and reputations which they have achieved over the past century or more at a time of increasing criticism of government activity in this area and escalating set-up costs for leading edge products

Organisational responses to these issues and opportunities

In addition to existing functions, there are also a number of new opportunities for AGSO to take on added responsibilities to the benefit of Australia. These opportunities can be summarised as

- **Accelerated mapping**: AGSO's core function of providing pre-commercial geoscientific mapping services is a continuing role, but the current mapping program could be accelerated. The NGMA program has been estimated to take 40 years at the initial level of support, but this could be reduced, with additional support, to 20 years, to the significant benefit of Australia.
- **Environmental geoscience**: Increased activity in environmental geoscience will pay significant dividends in the monitoring and assessment of groundwater, in land use and coastal zone management, and in natural hazards mitigation.
- **Database development**: Development and widespread use of Geographic Information Systems (GIS), almost all of which use or could benefit from one or more geoscientific layers, places special responsibility on geological surveys to ensure compatibility of data.
- **Interdisciplinary/intersectoral coordination**: Increasing acknowledgement of the interface between geoscientific data and other resource sciences and climate studies provides special opportunities for information exchange and cooperation
- **Export of geoscientific services**: Export of geological survey services to the adjacent region offers potential benefits and improved cost recovery, improved productivity of capital equipment, and provides a competitive advantage for Australian industry.

AGSO suggests that support for the existing National Geoscience Mapping Accord Program should be increased so that its goal of producing a new generation of geoscientific mapping of Australia's principal mineral and petroleum resources can be achieved by 2010. Support for the existing Continental Margins Program also should be restored to a level which will permit cost effective utilisation of the RV *Rig Seismic*.

There is a particular need to complete the systematic airborne regional coverage of the Australian continent and also to embark on a program of systematic airborne geophysical coverage of Australia's offshore areas, beginning with the most prospective areas. A recent pilot study has clearly demonstrated the potential value of the latter.

This submission also argues for the development of similar strategic geoscientific programs in support of sustainable land use, focusing on the geoscientific basis for soil and groundwater management. Many Australian soils are poor in both major and minor nutrients as a direct result of their geological history. Strategic geological mapping can categorise the areas where sustainable land use is possible, where production can be enhanced, and which should be restored to other uses. It can also identify the most appropriate sources of lime, phosphate and potassium. The Murray Basin Groundwater project, carried out in collaboration between BMR and State agencies, and the Cape York Peninsular Land Use Strategy (CYPLUS) being carried out in collaboration between State and Commonwealth agencies, including AGSO, provide excellent examples of the potential value of such strategic programs. The need for such programs emerges also from the ASTEC Future Directions Paper and from the Reports of the ESD Working Group.

AGSO considers therefore that its strategic regional programs need to be structured as follows:

Petroleum Program: National Geoscience Mapping Accord in Sedimentary Basins and Continental Margins Program

Minerals Program: National Geoscience Mapping Accord in Basement Provinces

Sustainable Land Use Program: National Geoscience Mapping Accord, Soil, Groundwater Resources

These programs would focus on different geographic areas to meet their particular priorities. It should be noted that, although the three proposed programs under the National Geoscience Mapping Accord generally will have different areal priorities, they do nevertheless depend substantially on similar data sets. In both the Minerals and Land Use programs there is a particular concern with understanding the nature and properties of the regolith, the veneer of weathered and/or transported material that overlays the bed-rock of Australia.

The new generation of mapping for sustainable development is based on data generated by airborne magnetic and radiometric surveys and by multispectral satellite imaging. Thus it has been possible in the case of the NGMA program and the CYPLUS program in Queensland to have close coordination in data acquisition and valuable interaction, and avoidance of duplication, between the staff involved. In the two elements of the petroleum program the new generation mapping is largely sub-surface and heavily reliant on seismic surveys, but this technique is becoming increasingly important in providing the third dimension in the mapping of mineral provinces. Gravity surveys are also increasingly important.

The new generation mapping envisaged in these programs is highly dependent on the acquisition of major geophysical data sets — geophysical "surveys" in a narrow sense. The mapping, however, is multidisciplinary research involving a wide range of specialist disciplines, and the application of new concepts. It integrates a wide range of information to provide a four-dimensional description and understanding of the geological structure and history. A team approach is required.

For example a strategic approach to the mapping of mineral provinces needs to be based on an understanding of mineral deposit geology and to be supported by specialists in mineral deposit genesis, geochemistry and geochronology. Similarly, a strategic approach to mapping of petroleum basins needs to be based on an understanding of petroleum generation, migration and entrapment and supported by specialists in seismic stratigraphy, palaeontology source rock geochemistry and structural geology.

Strategic mapping for problems of land degradation will involve high technology (aircraft and spacecraft remote sensing), soil, geological, regolith topography mapping and drilling, sampling and hydrogeological studies. A national groundwater assessment program involves similar capabilities and technologies with the added disciplines of geochemistry and modelling. Strategic mapping of Australia's coastal zone, both offshore and onshore, requires the added disciplines of sedimentology and geomorphology coupled with a marine data acquisition and sampling capability.

In order to carry out these strategic geoscience programs based on geophysical surveys in the national interest, the organisation needs

- a highly professional, multidisciplinary staff dedicated to cooperation in achieving national goals and with the capacity to see and adapt to new opportunities
- adequate national facilities and resources for the acquisition of major regional geoscientific data sets and for the analysis and interpretation of the data.

These programs provide the geoscientific basis for the sustainable management of Australia's resources, including the assessment of the local and regional impacts of resource extraction and use.

In addition, it is necessary to assess the consequences for Australia of global impacts, notably climate change and sea level change. The geosciences are crucial in their potential to provide an understanding of the natural changes on which the anthropogenic changes are superimposed, and which may dampen or accentuate the latter. The Great Barrier Reef and the Australian Antarctic Territory (onshore and offshore) provide unique natural laboratories for such studies. An **Environmental Change Program** is therefore required to assess natural variability and to undertake a strategic geoscience mapping program of the coastal zone and to provide the basis for management strategies. Such data also provides the basis for understanding and mitigating natural geological hazards. ASTEC's Future Directions paper states, "there is no coordinated long term research and base line monitoring of the environment to provide the necessary data for informed decision making by government". Geochemical mapping as a basis for assessing environmental and human health, and environmental impacts is particularly important.

The national geological survey organisation needs particularly to coordinate the national effort and to build a systematic national knowledge base. This program links to DASET portfolio objectives. National geological surveys world-wide also have responsibility for geological/geophysical observatory functions. These include earthquakes and volcanic hazards, and magnetic observatories (the mapping of earthquake risk and of the magnetic field). Australia occupies approximately 5% of the world's land area and also has responsibility for large areas offshore and in Australia. The **Observatories Program** therefore also has an important dimension of international obligations. In addition, Australia has committed itself to a major international role in nuclear monitoring and AGSO has close links with DFAT in this area.

There is an international dimension to all these programs. AGSO needs to be abreast of the most advanced geoscientific concepts world-wide in conducting its programs. It needs to contribute to international geoscientific programs where appropriate. It needs to support Australia's foreign policy objectives through aid programs funded by AIDAB. The globalisation of technology and of the mineral and petroleum industries is leading to increasing opportunities for Australian industry overseas. AGSO needs to provide the scientific infrastructure to provide a firm base in Australia and also to help identify opportunities overseas. There is, therefore, an increasing need for an effective **International Program**, tailored to Australia's interests. Such programs have long been an important element of the work of other geological surveys such as those of Canada, France, Germany, UK, and USA.

In summary, therefore, AGSO envisages that its future programs in the national interest should consist of six main elements

Petroleum
Minerals
Sustainable Land Use
Environmental Change
Geophysical Observatories
International

These programs need to be supported, as at present, by **Cartographic, Library, Marketing** and **Publication Services** and by **Engineering Services** and **Information Systems** expertise.

The opportunity clearly exists to broaden BMR's existing strategic programs and database coordination to cover the whole range of geoscientific resource and environmental information on the regional and continental scales. It is therefore proposed to give increased emphasis to **Geoscientific Information Management**.

Geoscience datasets are a national economic and scientific resource, analogous to physical resources. Such datasets are a renewable resource — anyone should be able to repeatedly mine them for their information content. Data represent the currency of the post-industrial world. Their utility is increased manyfold by the degree to which they are organised into databases, accessible, and interlinkable. This requires technical management, development, and coordinated planning.

In 1984, BMR was given the responsibility for "coordinating government geoscience database activities" by Ministerial Council (AMEC).

The Woods Report recommended BMR develop publicly available Australian geoscience databases, coordinate databases required in land use issues, and act as a repository of data. AGSO is still the most appropriate body to carry out these functions.

The role of National Database Coordination involves:

- Long term custodianship of geoscience databases (Government, industry, academic)
- Setting geoscience data standards to enhance the use of databases by clients
- Liaison with international and national bodies to further enhance data standards
- Providing a forum for State/Industry/Federal geoscience database policy coordination
- Providing a forum for discussion on national geoscience data issues
- Development of integrated databases, for resource industries, and the needs of other sectors such as land use, environmental, transport
- Development of advanced tools for effective database enquiry

Historically, these roles have translated to functions administered by different parts of a changing organisation:

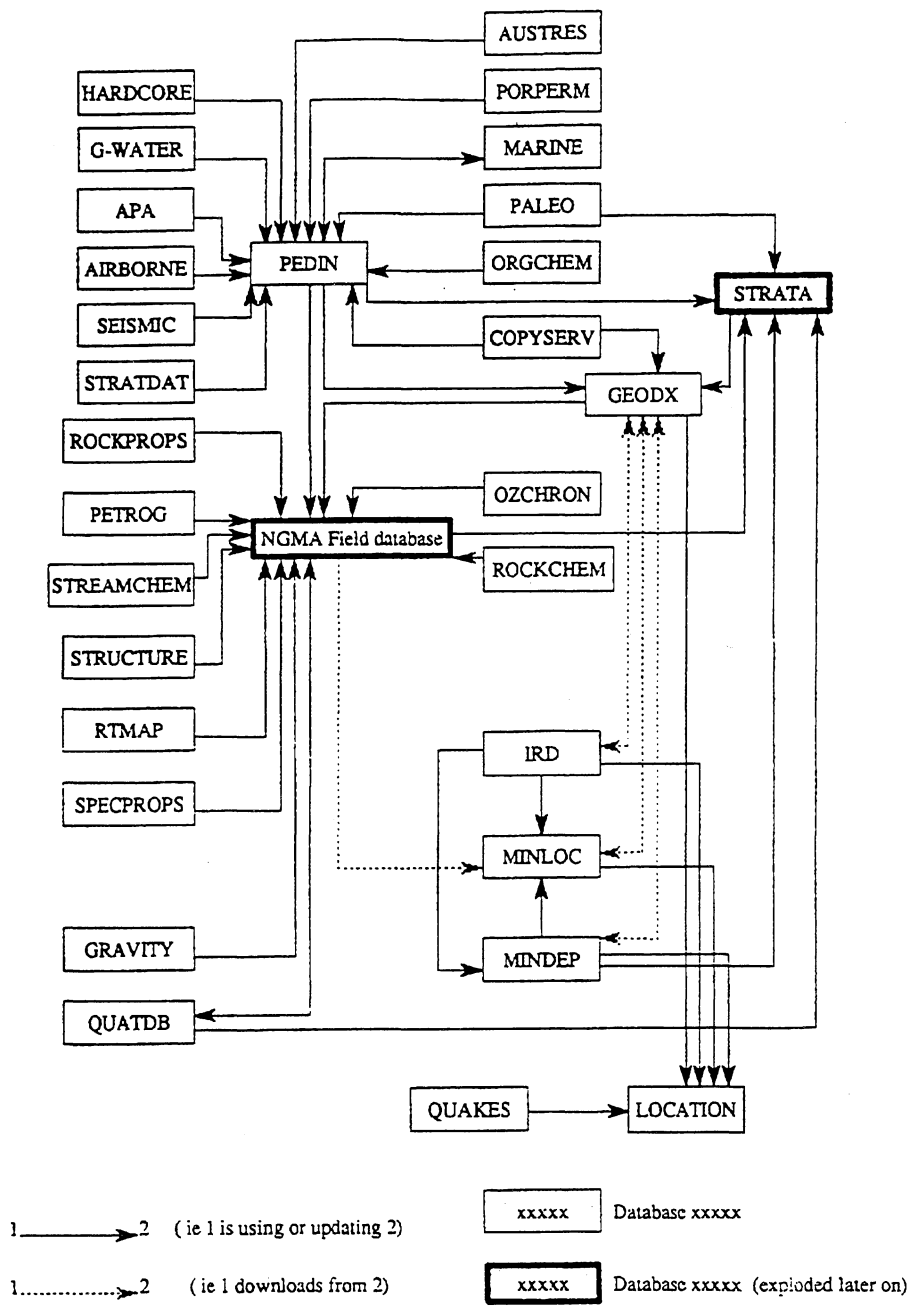
- Database specification, design and some development and the entry and quality control of data is currently undertaken by relevant Programs, but is coordinated, managed (and also developed) by the Information Systems Branch (ISB)

- Database technical coordination and policy coordination (i.e. non scientific) is undertaken by ISB (from the States to International levels), and also by the National Resource Information Centre (NRIC), now part of BRS
- NRIC develops software to make possible a national database directory and takes data for use in multidisciplinary studies

Opportunities exist in:

- further promoting AGSO's database capabilities overseas
- identifying and applying new database and communications technology
- creating new classes of data products or analyses and delivery methods for clients

AGSO Database Dependencies – see Appendix B for complete list of databases



- cultivating new interdisciplinary client bases
- creating a properly funded data repository for the preservation of national data archives

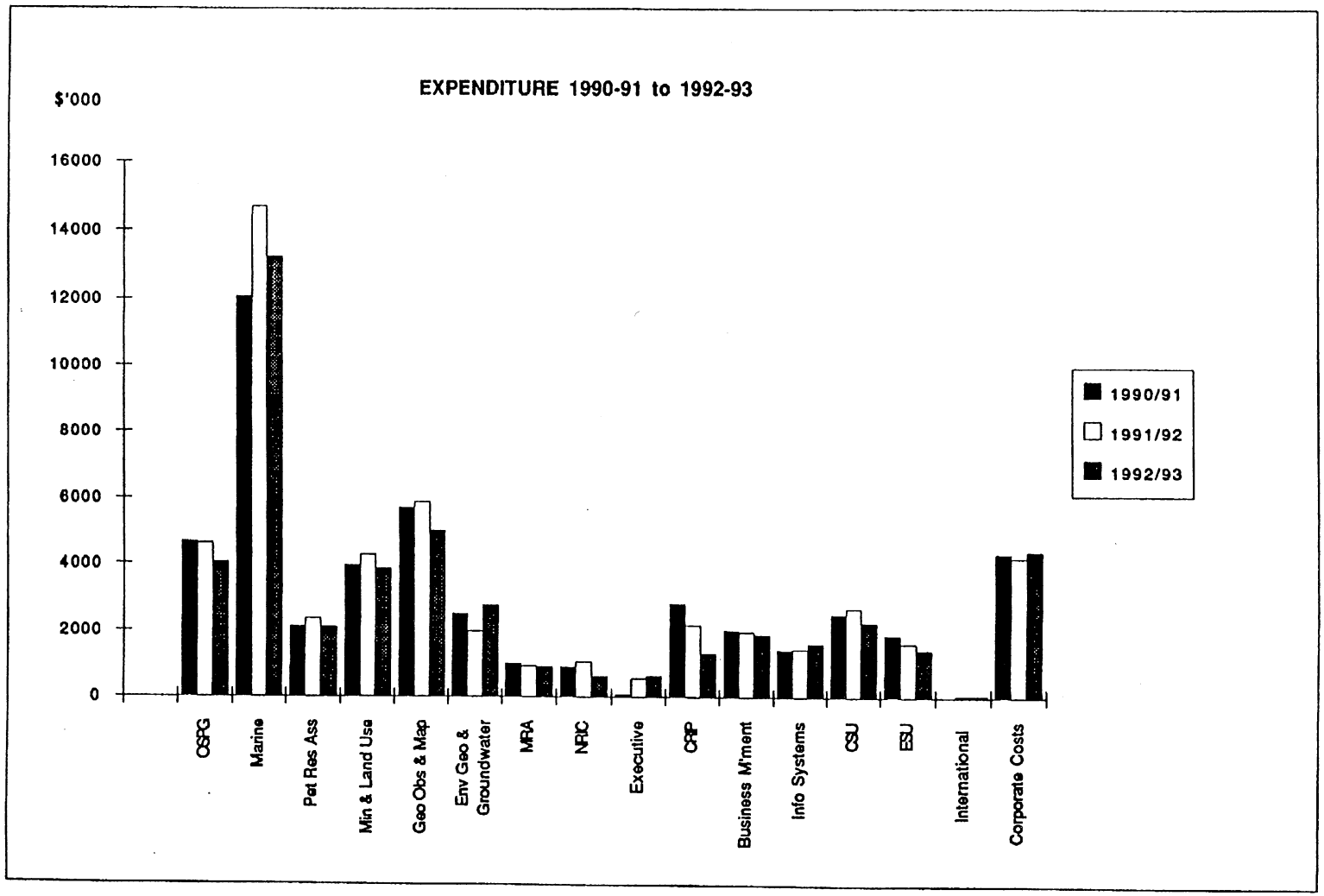
FINANCING

AGSO obtains funds from several sources — government appropriation, cost recovery from the sale of products and services and from services performed at cost for other agencies. It also obtains substantial in-kind assistance from industry by way of data and samples lodged under legislation and from other national and State geological surveys. All revenues are directed to enhancing approved programs. In keeping with international practice and the public good nature of its work the most important source of funds is government appropriation.

A range of arguments has been advanced as to why geological survey programs should be funded essentially by government appropriation

- Priorities for strategic programs need to be determined by the longer term national interest. The government needs to ensure that it has an independent source of geoscientific information and advice on the nation's resources and environment. In particular, mineral and petroleum resources are national assets which need to be inventoried, managed and developed in the national interest.
- Outputs from the programs have a wide range of uses by government, industry and the public
- The public benefits are very large in relation to the public investment
- Benefits from the programs are spread over several decades and the private beneficiaries cannot be determined in advance
- Any nation which does not provide the scientific infrastructure for exploration is seriously disadvantaged in attracting investment and in international competitiveness
- In order to preserve the incentive value of the programs, funding should be from the results of successful exploration rather than as a pre-exploration cost to industry
- Government resource assessment programs are highly dependent on information freely provided by industry and this is encouraged by the provision of the scientific infrastructure at low direct cost.
- Details of the AGSO resource base over the last three years is shown in tabular form (and diagramatically at attachment) below.

EXPENDITURE	$'000 1990/91	$'000 1991/92	(ESTIMATED) $'000 1992/93
OSPG	4,661	4,610	4,038
Marine	12,075	14,692	13,227
Pet Res Ass	2,123	2,349	2,091
Min & Land Use	3,962	4,262	3,843
Geo Obs & Map	5,705	5,888	5,008
Env Geo & Groundwater	2,513	1,980	2,766
MRA	1,000	922	893
NRIC	905	1,037	619
Executive	66	539	626
CRIP	2,809	2,158	1,319
Business M'ment	2,004	1,963	1,879
Info Systems	1,424	1,446	1,621
CSU	2,484	2,649	2,231
ESU	1,875	1,615	1,416
International	0	45	43
Corporate Costs	4,284	4,162	4,352
Total Program Exp	**47,890**	**50,317**	**45,972**
Below the Line	1,730	2,460	2,000
Redundancies	1,690	674	326
Executive			324
Corporate P&E			1,411
Total Expenditure	**51,310**	**53,451**	**50,033**



The above graph includes expenditure made against warrant provided from external sources

Cost recovery

Direct cost recovery from users of products is appropriate for tactical research undertaken for specific customers. Where individual companies are the sole beneficiaries of research it can be argued that cost recovery should cover all costs and allow for a profit margin. In the geosciences the Commonwealth currently funds CSIRO to carry out research into exploration techniques and related studies. This work ranges from the strategic to the tactical and some could be regarded as consulting. Such work permits significant cost recovery. This level of research, however, involves close collaboration with individual companies and can involve the utilisation of confidential company information. Companies have previously expressed a view that they would be reluctant to enter into similar arrangements with AGSO in case confidential information was used by government against corporations' interests.

In AGSO's national geological survey role priority has been given to strategic program, the results of which need to be in the public domain to be effective. The value of AGSO's work for future mineral exploration and development is only maximised when it is made as widely available as possible to potential explorers and investors in exploration both in Australia and overeas.

Characteristics of strategic research in the geosciences militate against significant cost recovery. Its high cost and specialised nature make it difficult for individual companies to obtain competitive advantage given the long time delay between expenditure on strategic exploration and commercial exploitation. The significantly higher discount rates applied to commercial activities are a further obstacle. Suggestions for more direct funding, for example, by an industry levy, would also be opposed by industry on the grounds that its taxation contributions already substantially exceed the costs of the service, and would require priority to be given to research in areas of interest to industry in the short term, rather than areas of importance from a national longer term perspective.

It is also possible that requirements for increased direct cost recovery would affect the interests of government if they

- ran counter to government policy of encouraging investment in exploration and development
- prejudiced the independence of AGSO's advisory role
- had the capacity to reduce the value of AGSO's work by limiting its availability
- reduced the flow of information from industry which is important for government policy formulation
- replaced national priorities for strategic mapping with shorter term industry priorities.

Pricing policy

The constraints described above in terms of the breadth of market for AGSO's products reduce the capacity for AGSO to develop a hard and fast pricing policy for the wide range of products it generates.

As a general rule, however, AGSO prices its products to cover the cost of their publishing and printing. Where a product is directed largely towards a market with a significant capacity to pay (for example, with the Petroleum Prospectivity Packages generated by the Petroleum Resource Assessment Branch) effort is made to place a premium price on the product. Otherwise products are priced so as to be competitive with equivalent products in other countries and by making a subjective assessment of

the likely value to a customer. This approach is consistent with Government endorsed principles for the costing and pricing of public sector research which require, *inter alia*, that "decisions on price should be based on an understanding of the respective objectives and responsibilities of the research performer and funder, and the extent to which benefits from the conduct and results can be captured by each party." (Free, *op cit*, 1992, p 42). Pricing decisions are made by the Head of Program on the advice of a marketing committee.

AGSO is also working on Commonwealth Committees currently considering the question of a national pricing policy on the supply of land related data, as required under the Intergovernmental Agreement on the Environment. Policies which emerge from the process may have implication for current charging regimes.

Corporate publications, such as the *Annual Work Program, Yearbook, Aus·Geo News* and the *Research Newsletter* are distributed at no charge by AGSO, except for the *AGSO Journal* where a subscription charge is imposed. Information brochures on matters of geological interest are also distributed at no charge. The major users of this service are educational institutions, which also benefit from the Organisation's publications gift and exchange program and discounts on the purchase of AGSO products. This approach is consistent with AGSO's view of its public interest responsibilities.

Financial arrangements

As a division within the Department of Primary Industries and Energy, AGSO operates under the same finance rules and accounting systems as the rest of the Department. These rules and systems are considered to work satisfactorily in terms of accountability and compliance and AGSO has a good record of relatively unqualified audit reports and absence of critical attention from parliamentary committees.

Elements of AGSO's financial arrangements could however be significantly improved and the key elements are as follows

1. **Accounting systems**: AGSO's accounting needs are significantly different from the balance of the portfolio both in volume and in kind. The Organisation sought approval to purchase an accounting package suitable to its needs in 1990 but approval was deferred pending agreement and establishment of a department-wide system. This system is currently being implemented. So far as the management of scientific programs is concerned, the current arrangement, pending the installation and dissemination of access to the new system, has significant defects. These include an inability to inform programs of their financial allocation sufficiently early each financial year, the requirement for manual maintenance of commitment registers, lack of integration of assets registers with expenditure records, and lack of real time access to account details.

2. **Annual appropriations**: Under current arrangements AGSO is funded on an annual basis for its research programs. Very few of these research programs are expected to last less than one year and several have been maintained since the Bureau's inception in 1946. While budgeting for long term research programs from a base of annual appropriations was satisfactory to the Bureau during its early years, it has become increasingly evident that a longer term base, as enjoyed for example by CSIRO with three year appropriations, would better suit the nature and the time scale of AGSO's work. The increasing capital cost involved in initiating research projects, declining real budgets, the increasing proportion of short term external funds and the sponsorship of projects of increasing scientific complexity (where, for example, AGSO undertakes a scientifically sophisticated program in conjunction with the states and territories or other partners) strongly

suggests that the cycle of annual appropriations is an unnecessary obstacle to AGSO sponsorship of long-term capital intensive research.

The Joint Committee of Public Accounts Report 318 into Public Sector Research and Development endorses this conclusion (Recommendation 16.34).

3. **Efficiency Dividend**: The Department of Finance currently reduces all AGSO's research programs and administrative expenditure by 1.25% each year as an Efficiency Dividend. The same arrangements apply to other programs within the Department except where they are separately appropriated. The arguments for doing so rest essentially on the premise that the efficiencies and increased production brought about by improved technology permit reductions in outgoings and on the perceived need to encourage portfolio agencies to harvest such dividends on behalf of the Consolidated Revenue. In AGSO's experience, however, it is rare that any scientific research program produces the required output more cheaply over time. While equipment and techniques become more efficient in terms of the data collected and the analysis provided, this is met by an at least equal increase in demand for those data and analyses so that for the AGSO's programs, the minimum standard acceptable to AGSO's clients is often effectively the leading edge of technological development. In 1965, for example, single channel seismic exploration would have been state of the art. In 1992, 240 channel seismic data collection is regarded as the minimum acceptable in Australia. The cost of data gathering remains much the same in total in real terms. Added to this, it has been AGSO's experience that equipment, for example, the research vessel *Rig Seismic*, does not become cheaper to run each year; rather, maintenance, running and standing costs increase at a rate at least equivalent to inflation. Similarly, as scientists working on an individual project gain experience, the cost of their remuneration increases.

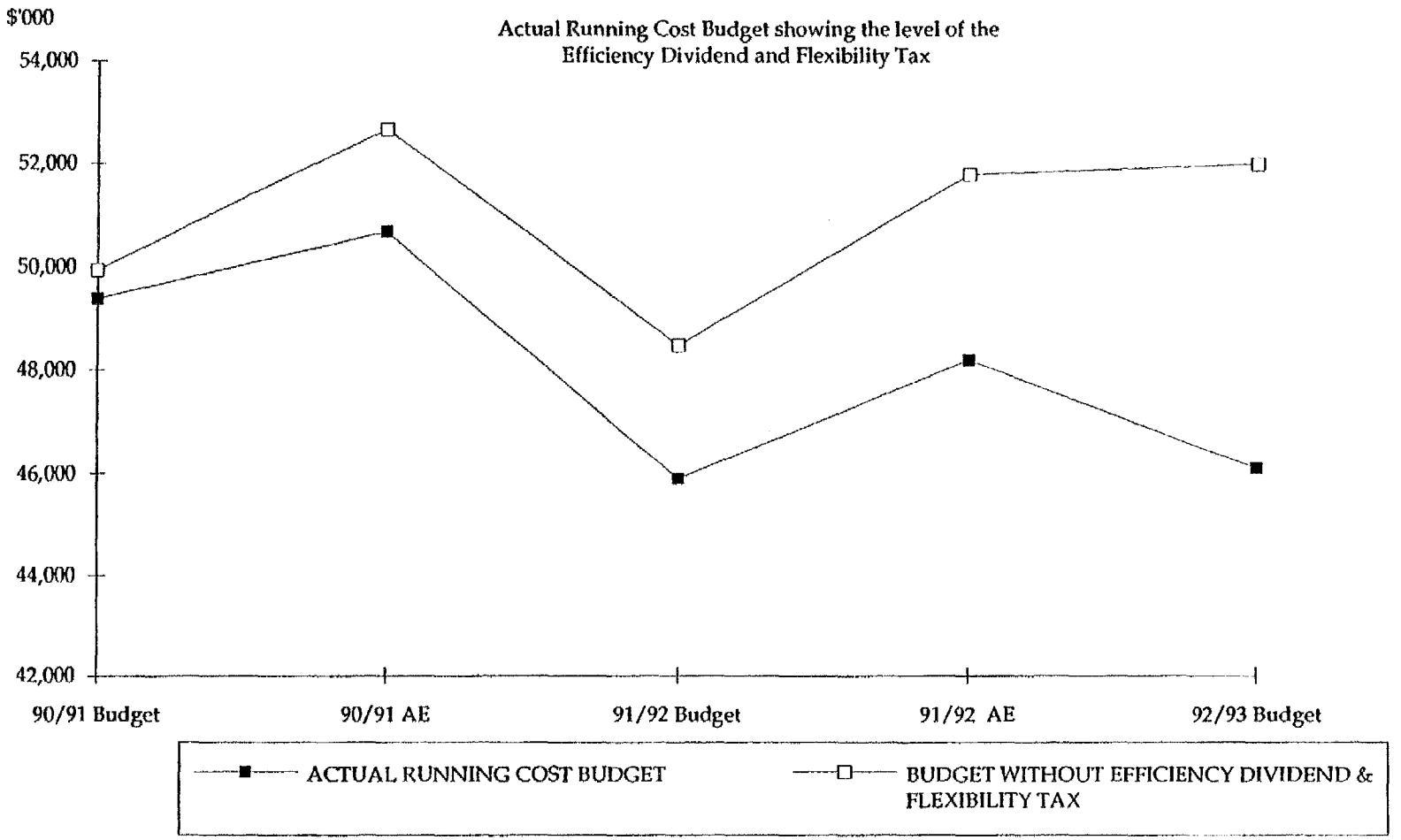
   In such circumstances small reductions in appropriation can lead to a large reduction in the operational effectiveness of a project and its output. In the case of the *Rig Seismic*, this has meant that the number of cruises it can undertake from appropriation funding decreases each year.

   The Joint Committee of Public Accounts has recommended in its Report on Public Sector Research and Development that the research costs of (AGSO) programs be exempt from the application of the Efficiency Dividend (Recommendation 16.34).

4. **Flexibility Tax or Secretary's Savings**: Elements of the Department whose appropriations are classified as "running costs", as are those of AGSO, are subject to an internal departmental taxing mechanism intended to improve the capacity of the portfolio to respond to ministerial priorities by redistributing resources across the Department. This operates in addition to the Efficiency Dividend imposed by the Department of Finance. Funds raised under such taxing arrangements are redistributed at ministerial discretion to groups within the Department as new projects. While AGSO has benefited from this arrangement by attracting some funding for new projects, the net result has been a reduction in resources available to existing and ongoing program.

   AGSO believes that its research expenditures would be more properly classified as program expenditures as are research expenditures of much of the other funded research programs in the portfolio. The effect of the current classification of AGSO's research as "running cost" rather than "program" expenditure for Efficiency Dividend and taxing purposes is to transfer resources away from core research undertaken by government while increasing the proportion of the research undertaken externally. There appears to be no deliberate government decision to this effect, particularly in respect to strategic geoscience research which can only

effectively be undertaken by a national geoscientific agency. The Public Accounts Committee has recommended that the Organisation restructure the form of its estimates so that the costs of its research programs are separately appropriated and not aggregated as running costs. (Recommendation 16.34)



Conclusion

In recent years, demands on the Geological Survey Organisation have increased, costs have increased in real terms, but available resources have been reduced. Current resource allocations are insufficient to meet identified program needs or make full use of capital equipment without competing for work outside Australia. Report 318 of the Joint Committee of Public Accounts (pp 296–304) reflects one external assessment of AGSO's needs. All of the Committee's recommendations would improve the funding arrangements for AGSO.

In particular, strategic geoscience programs need to be planned and executed on the basis of secure funding for individual programs on a rolling basis of at least three years. The national assets of human resources and national facilities must be built within a management framework which also guarantees a base level of funding for the fully effective utilisation of these assets.

In recent years, the Organisation has actively sought supplementary funding from other sources to enhance its program activities. It believes that it should continue to do this to enhance and accelerate the delivery of program outcomes. But the pressure for additional funding should not be such as to divert the organisation from its proper program goals. It should be noted in this context that industry levy funds are not available from the petroleum and mineral sectors as they are in the agricultural sector. Furthermore, direct research in support of industry, which lends itself to cost recovery, is the research into exploration techniques undertaken by CSIRO. The organisation has also sought funding, mainly through AIDAB, for overseas projects in support of government objectives. In particular, this has permitted increased utilisation of the *Rig Seismic*. Again, however, the base level of funding for the Continental Margins Program should ensure that such activities are not undertaken at the expense of the domestic program.

The organisation has also made strong efforts to increase the level of cost recovery from sale of products by careful differentiation of its products so that higher recovery is made where there is a significant element of private appropriation of benefit in addition to the basic public good purpose. Recent experience has shown that this approach cannot be taken further without compromising achievement of the basic objectives of the programs. At least some States, for example, believe that the purposes of the joint National Geoscience Mapping Accord are best served by pricing all products at the cost of supply.

The Organisation therefore believes that

- appropriations should guarantee an effective base level of funding
- cost recovery strategies which do not prejudice program goals should continue to be pursued
- there should be no formal cost recovery target
- funds obtained from cost recovery for each program should be used exclusively for the enhancement and acceleration of the program concerned.

PROGRAM IMPLEMENTATION

The suggested changes to financial arrangements described above would have significant effects on the operation of the Organisation's programs.

Exemption from the Flexibility Tax and from the Efficiency Dividend would provide much needed stability in funding arrangements for the longer term research programs

and permit the Organisation to set program goals with greater confidence. The recording of program expenditure as separate program appropriation would exempt AGSO programs from the Efficiency Dividend and taxing arrangements as well as improving accountability and reporting to Parliament. It would also clearly identify the programs undertaken by the national Geological Survey in response to national priorities and encourage program managers to identify more closely with approved programs.

It is worth noting in this context that a significant part of AGSO's programs are commissioned specifically by the government of the day with long term national objectives and with specific performance targets. The need to continually reassess program priority and to downgrade targets in response to funding constraints militates against effective government control of these programs.

Cumulative net effect on AGSO Running Cost budget of the Efficiency Dividend and Flexibility Tax from 1990/91 to 1992/93

	Efficiency Dividend	Cumulative Effect of Efficiency Dividend	Flexibility Tax	Flexibility Tax Return	Net Effect of Flexibility Tax	Cumulative Effect of Flex Tax	Cumulative Effect of Flex Tax plus Eff. Dividend
1990/91	-549,000	-549,000	- 1,458,000	1,260,000	-198,000	-198,000	-747,000
1991/92	- 572,000	-1,121,000	-1,016,900	1,352,000	335,100	137,100	- 983,900
1992/93	-570,400	-1,691,400	-1,710,000	0*	- 1,710,000	-1,572,900	- 3,264,300

* $0.5M provided as a new policy allocation rather than for an existing program

Contracting for services

A significant number of AGSO operations could reasonably readily be contracted out to the private sector. In particular the collection of airborne data, onshore seismic and offshore seismic and seismic processing could be provided by the private sector for for analysis and publication by AGSO staff.

Although some elements of the Bureau's operations are already contracted, for example, building security, cleaning and maintenance and vehicle operations, the Organisation has found that, although this system of management is widespread in the private sector and in some other countries overseas, as a general rule internal operation of major scientific facilities or processes is as cost efficient as private sector contracting and has additional benefits. Following the recent review of the Continental Margins Program, however, the Organisation will be looking again at the options available to contract out a proportion of its seismic processing activity.

Some of the additional advantages of maintaining an in-house capacity in major scientific activities, especially where there is a long term program identified by government, include

- a higher public image for AGSO activities and consequential improved contact with clients and stakeholders
- less complex variation and adjustment of data collection schedules
- reduced variability in cost of data acquisition during variations in the exploration cycle
- greater reliability in the provision of the service
- reduced load on scientific staff to administer and supervise contracts.

It should be noted moreover that the range and quality of private contracting services available in Australia is much less than that available in North America or Europe. In some areas therefore, AGSO provides a pool of scientific and technical expertise not otherwise available in Australia. The capacities for deep seismic surveys onshore and offshore are important examples. The existence of these capacities, as well as the capacity to fly airborne surveys, has been a major factor in maintaining those strategic programs in the national interest.

ORGANISATION STRUCTURE — OPTIONS

In the Minister for Resources' Press Release of 13 August, Mr Griffiths indicated in the preamble to the Terms of Reference of this Inquiry that the Government recognised "that the national Geological Survey Organisation is an important strategic asset as (Australia) approaches the 21st Century". The Government also recognised "the need to maintain an integrated and coherent national Geological Survey Organisation with a clear identity".

Key factors relevant to administrative arrangements and geographic location of AGSO have been identified elsewhere in this submission. The most important that impinge on the Minister's undertakings are

- Programs are undertaken in response to national priorities and must have a national focus. The activities "must be seen to be a national activity promoted by the national government for the nation."
- Programs are essentially for the ''public good''. They serve interests of several departments and close liaison with those departments is desirable.
- The Organisation is an essential element in attracting exploration investment to Australia and needs to maintain its present strong and independent international visibility.
- The national geological survey functions require secure long term funding on a rolling basis of at least 3 years.
- There needs to be direct accountability to Government for the discharge of the national geological survey functions.
- Geological survey functions have a distinctive character and geological surveys need to foster a distinctive scientific culture which is different from that of other scientific organisations.
- A major function is the coordination and management of the national geoscience information system. This reinforces the argument for an integrated cohesive organisation in a central location.
- The national geological survey functions are complementary to those of state geological surveys.
- The national geological survey has a unique body of expertise and operates unique national facilities which need to be deployed through all areas under Australian jurisdiction.
- The national geological survey has the expertise to play a lead role in significant international development programs thereby providing offshore opportunities for Australian industry in the private, public and academic sectors.

Within the objectives outlined above Mr Griffiths noted that the Inquiry into the administrative arrangements under which AGSO operates would look at whether the Organisation should "be established as separate institute within CSIRO or remain within

the Department of Primary Industries and Energy (DPIE)". In the broad these options reduce to whether AGSO should remain as a Bureau within a portfolio department or should be established as a statutory authority. If the former option is selected, the question arises as to which portfolio would be most appropriate for AGSO's activities and, if the latter, whether AGSO should be incorporated within a statutory authority such as CSIRO or whether it should be established under its own separate statute. This section seeks to bring out some of the issues associated with each of these options and their effect on AGSO's operations.

Considerations affecting organisational type

There are a number of considerations mentioned elsewhere in this submission which affect the selection of organisational type to perform the functions of a national Geological Survey. It may be useful to summarise these here.

1. **Accountability**: The Organisation's formal accountability currently as a Bureau within a Department of State is to the Secretary of the Department and the Minister. The AGSO Advisory Council has an informal role in determining AGSO priorities and a formal role in advising the Minister on the value of AGSO projects. AGSO also seeks to be responsive to its clients and to reflect their priorities in its programs.

   As a statutory authority AGSO would be more directly accountable to its Advisory Council or equivalent Board of Directors and to the Minister. This strengthened role for the Advisory Council would tend to improve contacts with major clients in industry, academia and other geological surveys and the effectiveness of the evaluation program. There appears to be a general presumption in favour of the statutory authority framework for scientific research.

AGSO's overall performance will also continue to be measurable against the performance of comparable geological surveys in other countries. Its participation in relevant international programs such as the Ocean Drilling Program and the Sub-Commission of the International Union of Geological Sciences on international geoscientific databases will help ensure that it remains at the leading edge of best international practice.

- As an Institute within CSIRO, AGSO would be responsible to the Board of CSIRO which currently includes several industry representatives but only one geoscientist. Other Institutes in CSIRO have Advisory Councils although these fulfil a similar, but usually more restricted, role to the Advisory Council in AGSO.

- Internationally, the most common arrangement appears to be for the national survey to be attached to the resources portfolio and work directly to the Minister responsible. Attachment to a science portfolio or a mining portfolio is less common.

2. **Professional independence**: The professional independence of AGSO, or the previous BMR, has rarely been publicly questioned. It is clearly possible for either a Bureau within a Department of State or an independent statutory authority or an Institute within CSIRO to establish a reputation as a source of objective, independent, scientific advice. Such a reputation is likely to be most transparent for an independent statutory authority.

3. **Profile**: There is no question that the then BMR enjoyed a high national and international reputation and public profile as Australia's national geological survey. AGSO will be able to build on this reputation despite some initial transitional loss

of profile and public image. In AGSO's view, it is likely that establishment as an independent statutory authority would give the national Geological Survey the highest public profile; while incorporation as an Institute within the larger scientific organisation of CSIRO would allow the image of the survey to be subsumed within a larger corporate profile.

4. **Efficiency**: The increased flexibility offered by a statutory authority arrangement in a scientific environment, improved contact with industry and access to industry data, and the possibility of exempting some AGSO staff arrangements from Australian Public Service restrictions would be likely to provide at least a marginal increase in efficiency for a national Geological Survey Organisation operating as a statutory authority over one operating within a public service framework. The larger the statutory authority, however, the more likely it appears that bureaucratic staffing arrangements and corporate overhead offset the benefits of statutory authority status. There may, however, be some potential advantages in the shared use of CSIRO facilities and improved links with its research, if they could be achieved.

5. **Cost recovery**: The increased flexibility provided a statutory authority is likely to improve the capacity of the organisation to cost recover. The organisation would be seen as a competitor by some commercial organisations undertaking similar work and it is likely that a government policy of improving cost recovery from industry would be more effective under statutory authority framework than under departmental arrangements.

   If the current cost recovery policy adopted by AGSO was to be maintained, it would be important that the geological survey Institute be exempted from the CSIRO's cost recovery target should the National Geological Survey role be transferred to CSIRO. It is worth noting in this context that AGSO's cost recovery levels as a national Geological Survey are already higher than most other equivalent national geological surveys.

6. **Budgeting**: While it is true that most statutory authorities, particularly those with a science base, enjoy more secure funding arrangements than departmental based agencies, there appears to be no technical reason why departmentally based bureaux undertaking scientific research, such as AGSO, cannot be afforded the same budgetary and financial arrangements as statutory authorities.

7. **Coordination**: AGSO activities depend on access and influence with State surveys and international agencies. It is arguable that such functions are best performed from within a portfolio structure where there is more ready access to formal coordination mechanisms such as Ministerial Councils. Maintenance of such access to the Minister and formal coordination will be especially important for development of the NGMA and any similar arrangement to cover soils and water.

Overall, there now appears to be a clear balance of argument in favour of an independent statutory authority arrangement for AGSO. Such an arrangement would allow the functions of a national geological survey to be best defined, funded, and carried out, with full accountability to Government. Any formal requirements to provide services to Government departments or agencies could be built into the enabling legislation.

The Australian Nuclear Science and Technology Organisation provides a useful model. AGSO has noted particularly ANSTO's view that a key factor in its success is its size: "ANSTO is small enough to enable the establishment of a corporate culture and an organisational philosophy which has allowed change to occur rapidly, effectively and quietly (although not painlessly)". The same is true of AGSO.

Like ANSTO, AGSO as a statutory authority should have a relatively small management board dedicated to overseeing the achievement of corporate goals. Each program should have an Advisory Committee with strong client representation from government, industry and the public, as appropriate, and these Advisory Committees should report to the Board through the Executive Director.

Portfolio

Whether constituted as a statutory authority or as a bureau within a Department of State, the national Geological Survey role will need to be allocated to a ministerial portfolio through the Administrative Arrangements Orders.

AGSO's current clients include the Department of Primary Industries and Energy, the Department of Foreign Affairs and Trade, the Australian International Development Assistance Bureau, the Department of the Arts, Sport, the Environment and Territories, and the Department of Defence. AGSO also has less regular and less formal contact with a range of other departments including the Aboriginal and Torres Strait Islanders Commission, the Australian Science and Technology Council, the Office of the Chief Scientist, the Resource Assessment Commission, the Department of Industry, Trade and Commerce, and other government agencies, including the CSIRO.

While the Organisation's key client remains the resources component of the Department of Primary Industries and Energy, the Organisation's function identifies more closely with the DITAC portfolio which includes several statutory authority agencies with science responsibilities including CSIRO, the Australian Nuclear Science and Technology Organisation and the Australian Institute of Marine Science. Parallels also exist between the work of AGSO and the Australian Meteorological Bureau, currently placed in the Department of the Arts, Sport, the Environment and Territories.

The present portfolio arrangement has been preferred since 1946 because of close linkages between the policy department responsible for petroleum and mineral resources and the research and resource assessment functions of a national geological survey organisation. The Woods Review of 1988 endorsed this view and recommended close integration of the resource assessment and research functions of BMR. The decision to separate research and resource assessment functions, however, diminishes this argument.

The current separation of BRS and AGSO is based on the view that appropriate linkages between the research and resource assessment functions can be achieved by formal management agreement between the two organisations. The view has been put that AGSO's functions do not fall within the core business of DPIE (policy advice and program development/administration/ improvement) and therefore that alternative arrangements are now appropriate for AGSO.

Placement of functions between particular portfolios is a Prime Ministerial prerogative and depends on a range of considerations which impinge on the efficiency of the arrangements and the objectives of the government. In AGSO's view the content of its functions and products are most closely associated with the resources sector and portfolio, but the disciplines it espouses and the nature of its research are more closely in tune with the Industry, Trade and Commerce portfolio.

Geographic Location of AGSO

It has been recognised by Government that there is a need to maintain an integrated and coherent national geological survey organisation with a clear identity. This would be facilitated if AGSO continues to be placed in a single location, ideally in a single

building. In this respect the functions of a national geological survey have been compared to those of a large general hospital, where a range of subdisciplines needs to be available to diagnose and treat a patient — occasionally, as in a hospital, at short notice (Dallas Peck, pers comm). However, it is recognised that there are some arguments in favour of a measure of re-location to other states in Australia.

The principal arguments for the organisation to remain centrally located in Canberra are that the co-location of the various programs

- assists AGSO in developing a national perspective across the whole range of geoscience relating to resources and the environment
- facilitates the development of a National Geoscience Information system and a Centre of Excellence as a single point of contact for national geoscience information.
- facilitates close liaison with client departments and agencies in providing information and advice
- ensures the effective utilisation of a range of unique national facilities
- provides clear complementarity to State geological surveys, located in each of the State capitals
- best meets the needs of existing staff
- is more cost effective in terms of capital works, running costs and establishment arrangements.

The principal argument against co-location in Canberra is that the organisation's visibility and contact with industry clients would be facilitated if offices were established in various states. This, however, would militate against the advantages of centralisation identified above and would tend to dissipate the national effort as complementary to that of the States. It would be counter-productive for AGSO to establish offices in all State capitals and, given the geographic dispersion of commercial exploration activity, unfair to other state capitals if Programs were dispersed to particular cities.

There is, however, a case for closer integration with State Geological Surveys in the pursuit of specific field programs under the National Geoscience Mapping Accord. There is also a case for State geological survey personnel to obtain greater benefit from national facilities in Canberra.

A special argument can perhaps be made for AGSO's Continental Margins Program (CMP) to relocate to a suitable location on the coast such as Fremantle. This program is concerned with offshore areas under Commonwealth jurisdiction and there are no complementary State programs like those onshore. However the current integration of AGSO's two petroleum programs (offshore and onshore) would be seriously undermined unless relocation involved both. In such a case, there would be substantial additional costs and significant staff losses involved and coordination of the offshore and onshore petroleum programs, which have become increasingly interdependent, and their contact with BRS and their shared databases would be more difficult. Use of common facilities and specialist groups (e.g. laboratories and specialist expertise such as geochemistry and palaeontology) would be hampered. Contact with other elements of the industry involved in these Programs research would not be assisted.

There may be a case for establishing an office in Townsville which could focus on environmental geoscience and coastal zone studies. In its present location AGSO is centrally located to the major zone of degraded agricultural land in southeastern Australia which will require increased research effort.

AGSO has therefore concluded that the central location of AGSO in Canberra should be maintained but that further consideration could be given to the relative costs and benefits of decentralising aspects of AGSO's programs.

Organisation title

The previous Bureau of Mineral Resources, Geology and Geophysics considered options for its possible renaming on several occasions. While different options have their attractions, it is clear that the title Australian Geological Survey provides the clearest description of the Organisation's activities and the closest parallel with state and international surveys performing equivalent duties. The additional description "Organisation" adds little to this title, other than to differentiate the abbreviated form from the Australian Government Solicitor.

If the acronym drawn from the title Australian Geological Survey is likely to be confused with other abbreviations, it is suggested that Geological Survey of Australia may be a suitable alternative.

THE MANAGEMENT AND ADMINISTRATION OF BMR

1 Background

At the time of the 1988 Woods Review, the BMR had a staffing level of around 600, a budget of about $50 million and was responsible for significant physical assets including property, a ship and an aircraft. Although being a large research organisation with complex management requirements arising from the nature and variety of activities performed and the diverse categories of staff consequently employed, it possessed only a limited capacity to manage these substantial resources efficiently and effectively. Many of the resource management functions and related corporate services were performed centrally by the Department of Primary Industries and Energy (DPIE) and, prior to that Department being established, by the Department of Resources and Energy. These functions were therefore not directly within the control of Bureau management.

Four years later in 1992, the management and administrative arrangements of the AGSO are dramatically different. Woods recommended (recommendation 14) the establishment of a dedicated capacity to undertake all corporate management functions headed by a professional manager. The quick implementation of this recommendation in 1988 and 1989 coincided with the DPIE Executive Management Review which led to a new decentralised departmental structure. As a result, previously centralised responsibilities for the coordination, control and delivery of financial and human resource services were devolved to BMR.

Apart from the Woods Review and the DPIE Executive Management Review, a third element providing the impetus for organisational development was the influence of general public sector reforms, particularly those emanating from the Government's Financial Management Improvement Program (FMIP). A focus of FMIP was to 'let the managers manage'. The application of this principle ensured a more effective restructuring of BMR following the Woods Review and provided a well defined framework for management improvement activities generally.

The three elements identified above had an impact on BMR almost simultaneously and provided a complex interaction of forces towards management improvement. As a result of these interactions there has been a continual development of the management systems and capabilities at BMR during the last four years. The establishment in late 1988 of what are now the Business Management and Corporate Relations, Information and Planning Branches provided the vehicle for this significant organisational development.

2 Organisational and managerial development

In line with public sector reforms and the recommendations of the Woods Review, a number of initiatives were taken to develop the appropriate management and organisational arrangements necessary to meet the changing role and responsibilities of the BMR.

The platform for future change and improvements in program management was the development of a relatively sophisticated corporate planning and evaluation cycle. Consultants from Coopers and Lybrand assisted in this development, conducting a series of workshops which involved all members of the organisation. In developing the corporate planning cycle management practices have been improved through a realignment of program goals to the Bureau's mission, an increased focus on results and subsequent improvements to the process of allocating resources to achieve those results. The approach adopted by BMR to program planning and evaluation has been used as an example of best practice by the Royal Institute of Public Administration, Australia[1]

The planning cycle has three main phases. The strategic planning cycle, which sets out changes and development in BMR's strategies, directions and key activities over the coming three year period; the operating planning cycle where the operational aspects of the strategic plan are reflected in an annual work program; and the evaluation and reporting cycle, whereby work programs are

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1. Lee, M and Watson, H, "From Woods Review to Geoscience for Australia's Future", *Canberra Bulletin of Public Administration*, No 63, December 1990, pp 48 - 57

evaluated and performance reports prepared. Each of these cycles flows on from the other and input into each stage is obtained from wide consultation with clients and stakeholders including the BMR Advisory Council.

Having established the platform of change through the planning process and the work of the management consultancy, a concurrent step was to fundamentally change the organisational structure. The objectives of a new structure were to allow implementation of program management and budgeting, improve accountability, strengthen links between activities with a common client focus or scientific objective, and generally move BMR further towards the integrated management of both its scientific and corporate resource outcomes.

A major determinant of this process involved taking BMR from an array of largely scientific discipline-based Divisions (Figure 1), to a program-based management system. A number of scientific programs were established (Figure 2), each headed by a Chief of Division (SES equivalent in the research scientist classification) responsible for the effective achievement of the Program's scientific and corporate management objectives. This responsibility embraces setting the Program's scientific direction, maintaining effective client relations within the Program's fields of interest, creation and maintenance of an environment conducive to optimum achievement of program objectives, and continual evaluation and modification of existing projects.

The scientific programs are also brought together into two client and outcome oriented groups. Each group is led by an Associate Director who focuses on both the external political and client environment in which the Bureau operates, as well as on the interrelationships between, and effective integration of, the strategic directions of those Programs for which he or she is responsible.

Complementing the corporate plan, the program management structure enabled greater attention to be focused on achieving results rather than on inputs and processes. The reorganisation of BMR towards program management meant that Program Heads (and, in turn, project leaders) gained greater responsibility for the objectives of their individual programs and, as a consequence, obtained increased authority over the resources and processes required to achieve expected

outcomes.

The restructure described above fundamentally transformed BMR's management of scientific programs, accelerating the shift, initiated by the Woods Review and subsequent corporate planning processes, from purely scientific management to multi-focused leadership of all Program activities. This included the effective management of the human and financial resources required to achieve Program outcomes. The transition to multi-focused leadership was nowhere more apparent than in the selection criteria developed to assess candidates for Chief of Division positions in BMR's new top structure. These criteria adopted the Senior Executive Service core criteria with appropriate amplifications to accentuate the specialist scientific responsibilities of these officers. Similar developments in relation to BMR's middle management, whose non-scientific responsibilities now align with those of middle managers across the Australian Public Service (APS), are also consistent with this shift of focus.

As a result of the restructure, enhancements to BMR's executive management arrangements were possible. The BMR Executive, comprising the Executive Director and two Associate Directors, plays a critical strategic role in terms of both BMR's scientific direction and internal resource management. The Executive performs an important representational role at the corporate level and has wide involvement with industry, State and federal government and associated agencies, and external stakeholders generally. The Executive also constitutes BMR's major internuncial conduit with the DPIE and is supported by the heads of both the Business Management and Corporate Relations, Information and Planning Branches.

These arrangements allow for significant flexibility in terms of allocation of resources within the framework of BMR's three-year strategic plan as well as a strong interface with, and responsiveness to, BMR's major stakeholders. Further enhancements have recently been implemented whereby the Executive's activities receive additional input from a group of representative Heads of Program (Development Committee) providing integrated feedback from programs on research opportunities and potentially beneficial future scientific

directions. A second group (Operations Committee) is intended to provide advice on critical resource issues and priorities, as well as suggesting improvements to integrated program delivery mechanisms.

The revised structure of BMR has led to significant improvements to its management systems. The devolution of authority and responsibility to program managers has enabled them to make decisions that directly affect their ability to meet the results expected of their programs against a background of accountability for those decisions. The structure also enhanced BMR's capability to contribute technical advice to the policy formulation process derived from its primary role of research.

3 Human Resource Management

Decentralisation to Departments of controls over human resource management functions together with developments in areas such as performance management, allowances and entitlements, recruitment, and organisation and work design, provided the increased flexibility required by BMR managers to meet the increased demands for effective, accountable management with measurable efficiency gains. Coupled with further decentralisation of responsibility for the human resource management functions within DPIE, AGSO is now able to access the range of human resource management tools available within the APS to shape and reshape a working environment which responds to the unique, cultural imperatives of the organisation as it endeavours to meet the challenges with which it is faced. BMR's leading role in the 1991 Structural Efficiency Principle (SEP) case for APS research scientists and the subsequent introduction of a highly successful performance appraisal scheme for research scientists illustrates the capacity of the BMR to provide an innovative, equitable and cost effective management framework for its human resources within which significant productivity improvements can be gained.

The Bureau's Personnel Management Section (PMS) was established in 1989. The need to resource this Section did not diminish the funding available for scientific programs. Instead, the funding for the PMS was derived from funds transferred from the headquarters of DPIE during the devolution process

together with a reallocation of existing clerical resources. In addition to having core operational responsibilities for traditional personnel activities (eg payroll processing, leave entitlements, recruitment etc) the PMS has an important role in continuing the process of cultural change which commenced with the Coopers and Lybrand work and also to undertake substantial development work on a range of human resource issues which had been a source of disharmony and industrial unrest over a number of years. The focus of human resource management effort is reflected in the current program structure of PMS. Eight principal program areas have been identified:

1. Cultural Change and Evaluation

    1.1 Competency Development
    1.2 Organisation Health and Evaluation

2. Structures and Staffing

    2.1 Recruitment and Workforce Planning
    2.2 Organisation and Work Design
    2.3 Equity

3. Personnel Policies and Programs

    3.1 Pay and Benefits
    3.2 Employee Relations
    3.3 Personnel Policies and Practices

As well as undertaking specific projects directed towards a closer alignment of human resource (HR) practices with BMR specific HR requirements, the human resource management function is a catalyst for further change and improvement in the overall management of the organisation. In particular, the overall effort is directed towards the explicitly stated recognition that our people are the key to our future and that management practices and policies should assist staff to

realise their full potential to contribute to BMR's Program.[2]

There is an impressive track record of achievement on HR issues during the last four years. This includes:

- the development and introduction of a new top structure, which included the creation and introduction of new designations not just into the BMR but also into the APS (Chiefs of Division Grades 1 and 3);

- the streamlining of merit advancement promotion arrangements for research scientists and the extension of these arrangements to science-based professional officers;

- the development and successful management of a redundancy program affecting almost 10% of staff;

- acting as a lead agency in the development and presentation of a case to the Industrial Relations Commission in accordance with the Structural Efficiency Principle (SEP) to introduce a new structure for research scientists within the APS including substantial increases in remuneration

    - this case also resulted in the BMR merit advancement processes being used as the standard for APS-wide application and the successful outcome of the case also resulted in a ground breaking introduction of performance appraisal arrangements, the elimination of arrangements for automatic incremental advancement of salaries and the introduction of regression arrangements for under performing staff;

    - in making his decision, the Industrial Relations Commissioner observed that the thorough and detailed manner in which the parties had presented their argument permitted him to reach a quick and favourable decision and that the case before him was of

similar significance to the 1970 hearing by the Public Service Arbitrator for this category of staff;[3]

- the introduction to BMR and the APS of the Chief Research Scientist classification;

- the implementation of SEP arrangements for other categories of staff and the introduction of the Senior Officer Structure;

- the development of a climate for and specific activities to promote training and development opportunities relating to particular corporate priorities, especially those concerned with improved management practices, teambuilding and cultural change;

- the introduction of welfare and counselling services including through the use of specialist external agencies and consultants; and

- substantial improvements in the application of various conditions of service particularly those related to land and sea based field duty.

The benefits to BMR from having a dedicated group of human resource professionals have been substantial. This is evidenced by the strong relations which now exist with the Department of Industrial Relations and the Public Service Commission and that AGSO is now regarded as a lead agency in relation to a number of human resource management issues. This positive view also appears to be shared in general terms by both staff and unions. As a consequence of HR developments during the last four years, the AGSO is also now well positioned to take full advantage of emerging HR challenges particularly those arising from future workplace bargaining arrangements.

4 Financial Management and Administrative Services

The devolution of financial resources from central agencies and the DPIE was

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3. Commissioner Smith, *Decision, Case No's 36731 and 95093 of 89* ,Industrial Relations Commission, 8 May 1991

continued with further devolution to Programs within BMR. This devolution process allowed greater managerial flexibility to Program Heads and project leaders as it further increased their authority and responsibility in the planning and delivery of their work. It gave greater responsibility to managers to use their resources efficiently within a given resource base. The more effective utilisation of the running cost budget system further increased the flexibility of managers to be able to manage their resources to meet changing objectives. It also gave them the autonomy to adjust their resources to changing priorities, particularly between staff and administrative expenses. Such flexibility and autonomy was not possible where resources were centrally controlled.

Devolution within BMR reinforced the responsibility and accountability of Program Heads for the effective management and efficient use of resources within their programs. To help them manage their resources effectively and to meet accountability requirements, a resource manager was appointed to each program. Each resource manager is responsible for coordinating human and financial resource matters for their program, as well as preparing reports and providing administrative advice to the Program Heads. In undertaking this role resource managers not only provide a link between specific research projects and the program as a whole but also between the program and the corporate areas of BMR.

In accordance with public sector developments generally, cost recovery and revenue raising have emerged as important issues for BMR during the last two years. There are two mechanisms within BMR for retaining revenue from external sources. First, a resource agreement with the Department of Finance permits the crediting of receipts from the sale of products and services against Section 35 of the Audit Act of 1901. This agreement allows BMR to retain all revenues up to a threshold amount above which the Department of Finance retains a one-third share in the interest of community return. The resource agreement with the Department of Finance formed the basis of a case study by the Management Improvement Advisory Committee (MIAC) in 1991.[4] The report suggested that the BMR agreement and the approach adopted to

4. Resource Agreements, *MIAC Report No 4*, June 1991, pp 22 - 27

implement the recommendations of the Woods Review may hold some positive lessons for other agencies and that the BMR case study "provides a model of savings sharing as an incentive to change."[5]

The second mechanism by which funds are received is the BMR Research Trust Account. This account is not subject to any sharing arrangements with the Department of Finance, although costs such as superannuation are paid to the Consolidated Revenue Fund. The main sources of funds for the Research Trust Account are research grants from external bodies and direct crediting from other Commonwealth agencies for specific work performed.

As with many other government agencies the issue of cost recovery within BMR is not straightforward. The decision of when cost recovery is appropriate can be difficult when weighed against the requirement that much of the work undertaken by BMR also be in the public interest. In an effort to simplify the issue of external charging by Programs, an internal framework is currently being developed.

The challenge of transforming the program areas of BMR from a science-oriented outlook, with little or no formal resource management considerations, to one with a combined scientific and resource management outlook made it necessary for the resource management processes within BMR to be as transparent as possible. The transparency in the way in which total resources are now allocated has enabled managers to be more aware of the steps and processes involved in resource management as well as budget adjustments arising externally from the impact of Government and departmental decisions. It has also helped remove perceptions that a residual pool of unlimited funds exist within corporate areas which can be drawn upon when the need arises. Transparency enables managers to see the financial 'bottom line' both for their Program and the BMR as a whole and again reinforced their responsibility to manage program activities and resources effectively within given budgets.

A feature of BMR is that as a government organisation it is relatively asset rich,

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5. Ibid, p 26

with approximately $30 million of assets worth over $2,000 alone. This is specifically due to the nature of the scientific activities it undertakes. BMR has recently completed an assessment of its asset holdings and has established a computerised system for recording. This system will enable greater management control of resources as well as improving reporting and evaluation practices. BMR constantly reviews its holding of less productive assets. For example, the vehicle fleet has been rationalised and the number of field vehicles in the fleet reduced by over 18% with consequent financial savings made available for reallocation to scientific programs.

Within DPIE, BMR has been a forceful advocate for the acquisition of a new financial system. This has resulted in the purchase of a new computerised system which, amongst other things, will substantially enhance the level of management information available to Programs and projects. This system is currently being implemented.

Because of the complex nature of AGSO's operations, the financial operations within AGSO represent a substantial part of the total financial operations of DPIE. The purchasing and procurement activities, for example, represent approximately half the total of DPIE as do the transactions processed by the AGSO Collector of Public Monies. In addition to the high level of routine financial operations, substantial effort has been devoted during the last four years to improving the resource allocation processes, the management of assets, the provision of management information to enable more informed decision making and the acquisition of new or the retention of existing resources. Strong relations have also been developed directly with the Department of Finance and this was also observed in the MIAC report.[6]

Achievements in the management of the organisation's finances and provision of administrative services have included:

- the acquisition of new funds to obtain a replacement aircraft ($0.9 million);

6. Ibid, p 26

- increased funding for repairs and maintenance to existing property ($1.5 million);

- the allocation of funds for the initial design and development of a new special purpose building for BMR ($4.5 million);

- a loan from Department of Finance to fund the redundancy program ($3.2 million);

- the retention of Cabinet approved funds to continue NRIC and Groundwater Program activities ($1.3 million); and

- successful negotiations to retain a share of savings with Department of Finance arising from the Woods Review ($0.5 million).

Significant financial challenges exist for the future regardless of the organisational form which emerges for AGSO. Many of these were identified in a recent report of the Joint Committee of Public Accounts of the Commonwealth Parliament.[7] The Committee recommended that the resource base of BMR should be enhanced for a variety of program activities, that funding appropriated for research programs should not be aggregated as part of running costs, that BMR should be exempt from the application of an efficiency dividend and that overall funding should be approved by Government on a triennial basis in the same way as that approved for other government funded research agencies.

In addition to these issues, there is also a natural tension between the drive towards devolution, the trend towards 'one line' appropriations and the regrowth of more centralised controls under the guise of 'coordination'. These risks are clearly evident in a large and diverse organisation like DPIE and have a marked impact on the funding base, resource allocation and management processes in an organisation like BMR. In particular, the risks to budget are high in terms of the reallocation of resources away from strategic and basic scientific research to meet the more immediate demands of policy development and

7. Public Sector Research and Development, *JCPA Report 318*, Vol 1, June 1992, pp 293 - 304

implementation activities.

The effective management and resourcing of BMR needs to take account of these issues. The challenge is to implement the recommendations of the JCPA and address the other impediments to more effective management and resourcing of geoscience.

5 A New Building

During the last three years, considerable resources and effort have been directed towards obtaining new accommodation for the BMR. In 1992 this had reached the point where cumulative funds of $4.5 million had been allocated by Government to the project since 1989/90, a site for the building had been finally agreed between all parties including the Territory and Commonwealth Governments, the relevant planning authorities had endorsed the proposal and the Department of Finance had agreed that a new building was necessary and had indicated support for obtaining Cabinet approval in the 1992/93 Budget process.

The project's momentum and the process of final Cabinet approval for construction was interrupted by the administrative changes announced for the BMR and the subsequent inquiry into future organisational arrangements. In the event that AGSO continues in some form as an organisational entity, a new building will still be urgently required.

The acquisition of new accommodation for the BMR has a long and chequered history. The need for a new building was first independently identified in 1978 and this need has become progressively more serious and urgent since then as the deterioration of existing accommodation has accelerated. This need has most recently been reinforced by the JCPA (recommendation 92).[8] The requirement for a new building can essentially be summarised as arising from:

- independently assessed fire, health and safety problems which are serious and insurmountable in the existing headquarters building of Anzac Park

8. Ibid, paragraph 16.25, p 301

East (APE);

- the age, structure and planning restrictions associated with APE

  - since it was first occupied in 1965, improvements to APE have largely been limited to relatively minor cosmetic changes;

- the inability to satisfy regulatory standards associated with laboratory activities within APE regardless of how much funding is provided for this purpose, and the consequent risk of having essential functions closed down; and

- the dispersal of existing accommodation in over ten locations in the ACT.

The above considerations collectively represent a strong imperative for a new building which is both compelling and has been accepted by all agencies involved in determining Commonwealth accommodation requirements. The notional cost of a new building has been estimated at around $146 million although the actual cost, having regard to taxation implications and other returns to Government is likely to be closer to $60 million. This cost will be lower than previously estimated due to the relocation of former BMR staff to the Bureau of Resource Sciences.

Costings are summarised in Table 1 and the favourable relationship between this proposal and other Commonwealth premises is included in Table 2. The independent financial evaluation of the proposal concluded that "in terms of financial costs to the Commonwealth the construction of purpose built accommodation is justified and should proceed on financial and technical grounds".[9]

A new building for AGSO will represent a significant Government commitment to research and development through a major investment in a national research

9. Financial Evaluation, *BMR Accommodation Study Summary Report*, Australian Construction Services and Australian Property Group.

facility. It will also reflect a firm commitment to the health and safety of Commonwealth employees (a commitment which was embodied in recent Commonwealth legislation) and, because of the incorporation of leading edge design elements relating to energy and building management, would be a tangible demonstration of the practical application of Ecologically Sustainable Development policies and practices.

6 Summary and Future Challenges

The evidence outlined in this submission indicates that the management and administration of BMR has come a long way in four years and that there is a significant track record of achievement. An effective structure and system of program management and evaluation has been put in place, management and accountability requirements have been enhanced, career and promotion opportunities have been improved for BMR staff with commensurate increases in remuneration, the application of mainstream APS HR policies and practices have been attuned to BMR's particular requirements and budget management arrangements have been improved and made more transparent. The staffing level of the organisation has declined from a peak of 600 at the time of the Woods Review to 550 at the end of June 1992. The budget has also been brought in on target during each of these four years of substantial change and upheaval.

The management of change has also been characterised by an ongoing process of external scrutiny and review. The BMR Advisory Council has been particularly active in this regard especially in relation to program planning and evaluation. Somewhat unusually, there has also been regular and authoritative examination of aspects of change management which have resulted in published reports, the citations for which have been included in this paper. A further example of this is an Australian National Audit Office (ANAO) report to Parliament which advised that "the ANAO found that the Bureau has taken necessary action to implement the (Woods) Review recommendations".[10] During its audit, the ANAO also informally indicated that other agencies, including ANAO, could learn from the Bureau's program planning and evaluation processes.

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10. *ANAO Report 5 of 1990-91*, p 98 - 99

Further evidence of the effectiveness of the leadership of management improvement in BMR can be found in the number of senior BMR officers involved in these processes who have been appointed to key management positions within DPIE during the last 12 months. One has been appointed Chief Executive of the new Bureau of Resource Sciences, another was appointed as head of human resource management for the Department, a third is currently the Director of DPIE financial operations and a fourth officer was appointed human resource manager for the Australian Bureau of Agricultural and Resource Economics.

Improvements in financial and human resource management and the provision of administrative services have largely been achieved through servicing and management support arrangements provided internally. This has permitted a high degree of management control over these changes and an optimal direction of resources focussed on a strategic agenda of management improvement. It is doubtful that the Bureau's change management would have been as effective or have been achieved more quickly or at a lower cost under alternative arrangements. In this respect it is worth comparing, for example, the human resource management environment entailing high costs, poor work practices and unresponsive servicing and support arrangements which existed at the time of the Woods Review through what effectively amounted to 'outsourcing' those services (through central office administration removed from the 'coal face') with those which exist now.

At an operating cost of about $2 million per annum, the Business Management Branch, which is principally responsible for providing these management and support services, represented approximately 4% of the Bureau's 1991/92 outlays. This compares very favourably with other corporate areas within the APS even without taking account of the increased staff numbers required to support the Bureau's complex activities, particularly in relation to field work, stores and procurement, asset management, vehicle fleet management, etc.

While much has been achieved, much more needs to be done. A number of these future challenges have already been identified, although how they will

now be pursued is heavily dependent on the final organisational form determined for the AGSO. Apart from resetting the program framework to align with a revised organisational mission, these management challenges are essentially of a financial nature and include:

- establishing a more secure and predictable financial base within which strategic and basic research having longer term lead times can be undertaken more effectively and efficiently

  - specifically, the objective is to obtain triennial funding, itemised appropriations and exemption from the efficiency dividend;

- obtaining a recognition that cost recovery and revenue represent a useful way of improving the utilisation of capital intensive assets and providing products and services which meet the more immediate demands of clients, but that income derived should be wholly retained and be complementary to Government funding the core business of providing strategic science, maps and data sets in the national interest;

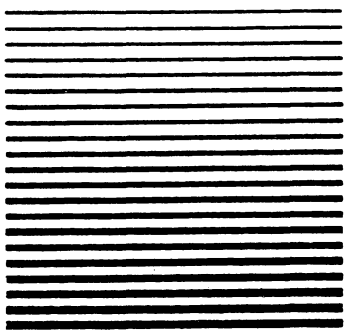
- securing funding and construction approval for a new building should AGSO remain as an organisational entity; and

- ensuring that a climate of equal partnership exists with the AGSO host Department for the effective management and administration of the organisation.

The foregoing outlines an important agenda for further change and improvement in the way in which geoscience is managed for Australia's future. Achieving this agenda is vital if the progress and development of the organisation during recent years is to be built upon.

Figure 1

Operational Structure and Senior Officers



DIRECTOR

Geoscience Planning & Information Branch

Resource Management Branch

Division of Petrology & Geochemistry

Division of Continental Geology

Division of Marine Geosciences & Petroleum Geology

Division of Geophysics

Resource Assessment Division

Geoscience Computing & Database Branch

Mineral Project Evaluation Branch

Petroleum Branch

Mineral Commodities Branch

Figure 2

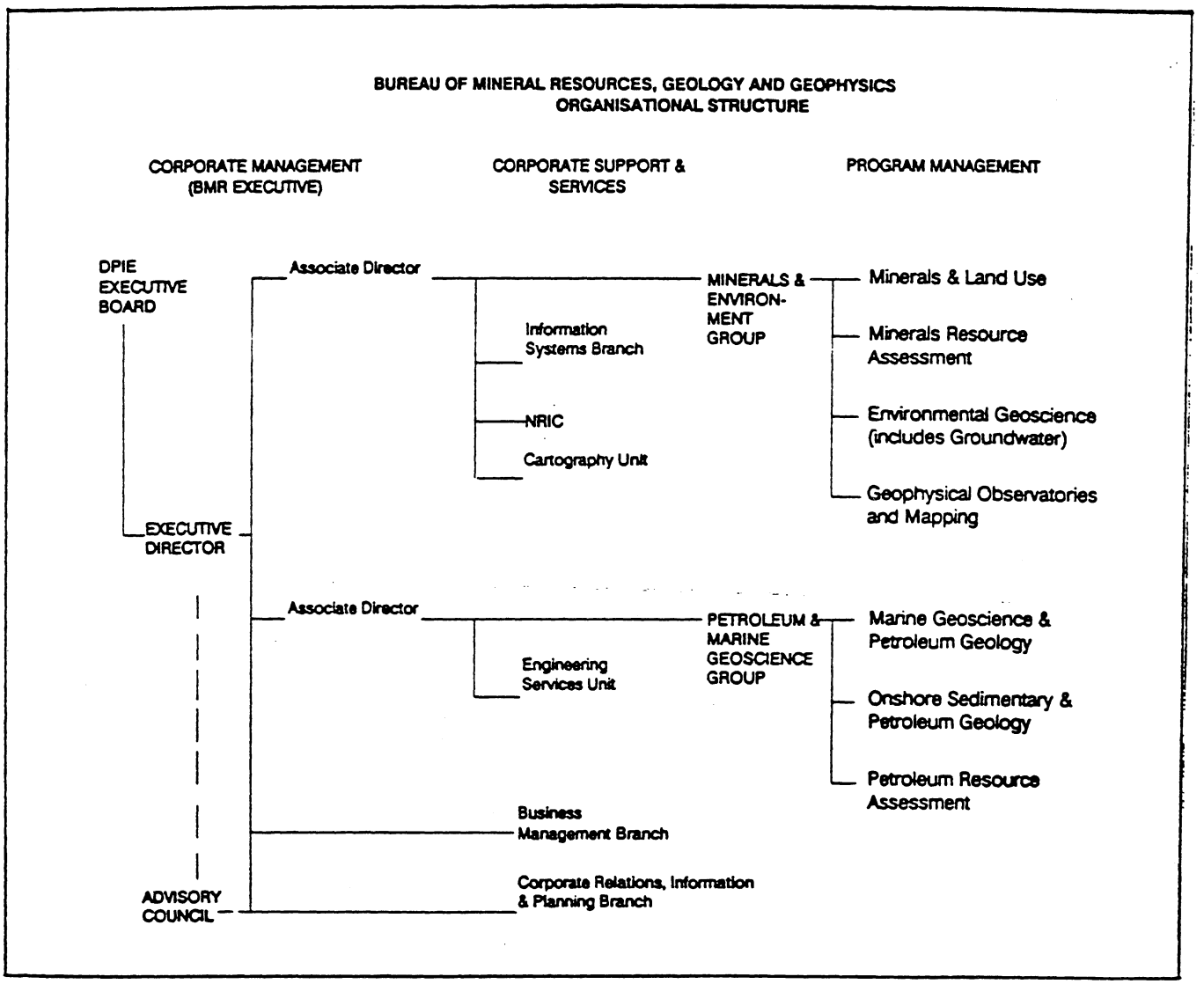


TABLE 1

AGSO BUILDING PROPOSAL - COSTINGS

		$m	$m
1	Elemental costs		
	- Building cost	63.55	
	- Low energy design premium**	9.10	
	- Fitout	24.61	
	Building sub-total	**97.26**	
	- Site and external works	21.65	
	- site acquisition	3.00	
	- Fees, allowances, contingencies and consequential costs	24.12	
	Site and fees sub-total	**48.77**	
	Total Indicative Cost (July 1992 prices)		**146.03**
2	The actual cost of the proposal to Government is reduced by the following factors:		
	- Estimated value of Anzac Park East building at scheduled handover in 1997 after refurbishment	48.40	
	- Estimated return to Government through direct and indirect taxation during life of project	20.00	
	- Decreased cash outlay from land swap arrangement between Commonwealth and ACT Government	3.00	
	- Considerable percentage of fees will be paid to Government agencies resulting in no actual impact on the Commonwealth budget	14.16	
	Total Reduction		**85.56**
3	Net cost of proposal to Government		60.47

** *Recoverable in 3 - 5 years in life cycle costs*

TABLE 2

AGSO BUILDING PROPOSAL - COMPARISONS

1 Total Area and Costs

These building cost comparisons exclude external and site works which vary according to site conditions.

	Gross Floor Area m^2	Cost per m^2	$m
Proposed AGSO building (office and laboratory space)	35 862	2 712	97.26
Therapeutic Goods Authority (formerly NBSL) (office and laboratory space)	17,480	3 364	58.80
Defence Signals Directorate (special purpose)	27 400	3 193	87.50
DFAT York Park Proposal (office space)	59 048	2 418	142.80

2 Gross Floor Area per Person

	Offices	Offices/Labs
Proposed AGSO building	$46m^2$	$61m^2$
DFAT York Park proposal	$49m^2$	-
Therapeutic Goods Authority	-	$78m^2$

Note: Figures are not available for DSD.

3 Area Efficiency (Net Rentable to Gross Floor Area)

Proposed AGSO building (office space only)	82 percent
DFAT York Park proposal (office space)	75 percent

Note: Figures are not available for DSD and TGA

Australia's National Geoscience Databases

- Incorporating these for which Bureau of Resource Sciences have custodianship

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The Australian Geological Survey Organisation is the prime custodian of the nation's geoscientific databases. It has a long-term commitment to developing and maintaining databases to do with the composition, structure, dynamics and evolution of the Australian continent and continental shelf. Traditionally these databases have been oriented towards the search for minerals and oil, but increasingly they are directed to environmental and land-management issues.

The majority of the databases are now implemented on AGSO's Oracle database management system. More and more these corporate databases are being used in conjunction with computerised methods of data analysis and presentation - particulary by geographic information systems. The automation of data handling and presentation is also driving a need for data standards, and most of AGSO's relational databases have a large standards component, with many authority tables. As well as its data custodial role, AGSO has the related task of establishing and promoting national standards for geoscientific data. Many of AGSO's standards-related tables will be made available for external on-line access in the near future.

This brochure presents an overview of national geoscientific databases for which AGSO is the custodian, or has an involvement. Phone the indicated person for up-to-date information on a particular database. Unless otherwise shown all phone numbers have an 06 area code, or a '61 6' international prefix.

PETROLEUM

PEDIN - The national Petroleum Exploration Data Index is an Oracle database containing basic information and statistics on petroleum exploration and development drilling, and geophysical surveys, which have been carried out in Australia and its territories. PEDIN contains data on all wells and aeromagnetic and gravity surveys subsidised under the Petroleum Search Subsidy Act (PSSA), and will incorporate data relating to all PSSA seismic surveys. Data on some additional gravity and magnetic surveys catalogued by AGSO have also been entered. In addition, well data obtained under the Petroleum (Submerged Lands) Act (P(SL)A) are being compiled and entered into the database. Some basic data have been entered for nearly all P(SL)A geophysical surveys. Sandy Radke, 249 9512.

TITLES - This PEDIN-linked Oracle database lies behind the published Petroleum Titles Key to AGSO's Petroleum Titles Map. It includes company equity information and is updated twice a year. Sandy Radke, 249 9512.

RESERVES - This is a confidential Oracle database of Australia's oil and gas reserves by field. A public summary is generated from the database every 6 months. Steve Le Poidevin, 249 9703.

AUSTRES - A PEDIN subset used for the assessment of petroleum potential and future production. Data extracted from AUSTRES are analysed by the PC-based AUSTPLAY system. David Forman, 249 9756.

Australian Geological Survey Organisation GPO Box 378, Canberra ACT 2601: phone 06 249 9111, fax 06 249 9999

ORGCHEM - A petroleum source-rock database, linked to PEDIN, with source-rock analyses of samples from hydro-carbon exploration, including organic carbon, Rock Eval, extracted organic matter, maceral composition, thermal alteration indices, spore colour indices, vitrinite reflectance and elemental composition of kerogen. ORGCHEM now has 35 000 open-file samples from over 900 wells. Sold as ASCII or Oracle-export files. Chris Boreham, 249 9488.

STRATDAT - Linked to PEDIN, STRATDAT has interpretive biostratigraphic data relating fossil zones to absolute time scales in selected onshore and offshore petroleum exploration wells. In addition to absolute and relative time scales for basin modeling, STRATDAT can include other well data such as sequence boundaries, formation tops and other log pick data. Data may be retrieved in various timescale formats, such as Harland, Haq, Exxon or AGSO, and also different vintages of interpretive biostratigraphic data. Planned links to ORGCHEM and other prospectivity databases will allow selection of their data in specified time-slice intervals. John Bradshaw, 249 9659, Clinton Foster, 249 9447.

PORPERM - An Oracle database containing porosity, permeability, lithology and grainsize data from petroleum exploration, development and stratigraphic wells, drilled in Australia and Papua New Guinea - 130 offshore, 421 onshore. Contains 6278 AGSO core-plug analyses. Sold on diskette as a Lotus 123 worksheet, and as a report illustrating statistical relationships between core-plug properties. Shige Miyazaki, 249 9715.

Core and Cuttings Laboratory - The core library houses material from (i) AGSO's own stratigraphic drilling projects; (ii) subsidised company drilling operations (1959-1974); (iii) all company offshore drilling operations. Some additional onshore material has been donated by companies. The laboratory holds over 1 250 000 catalogued samples from 5000 wells. Facilities are provided at the laboratory for inspection and non-destructive testing. Material for destructive testing is available under certain conditions. 1000 destructive-analysis reports are on open file. Joe Staunton, 239 1890.

MINERALS

MINLOC - The Mineral Occurrence Location Database (Oracle) has fully referenced data on name, location, description and commodities of economic interest for about 20 000 Australian mineral occurrences. More than 60% of the continent has now been covered at least on a first-pass basis, and the database continues to be actively expanded by the Mineral Databases Section jointly administered by BRS (Bureau of Resource Sciences) and AGSO. Data may be purchased for standard map sheet areas. A subscription service (for total database holdings) is available to MINLOC sponsors. Plotted map overlays at 1:250,000 and 1:100 000 scales are also available. Brian Elliott, 249 9502.

MINDEP - A Mineral Deposits Database (Oracle) with information on 235 major gold deposits in NSW, WA, Qld and NT (in press). The locality, geology, resources, production, development history, host-rock and orebody characteristics, genetic models and controls, ownership, and bibliographic references are covered for each deposit recorded in datafiles. No further work is planned on MINDEP, but a mineral deposits database with fewer attributes than MINDEP but national coverage is planned for the NGMA database suite. Brian Elliott 249 9502.

Identified Resources - This newly developed Oracle database contains public and confidential information on the names, locations, classification, grades and tonnages of Australia's ore deposits. Ore reserves are classified according to commodity and degree of certainty. The database has links to MINLOC/MINDEP. Bill McKay, 249 9553.

GEOPHYSICS

Gravity - National repository for gravity data in Australia. The copy of the database currently available on magnetic tape or diskette contains about 600 000 point values irregularly spaced over the continent and continental shelf. Coverage at a spacing of 11km is virtually complete onshore. Offshore coverage is along ships tracks. Gravity values conform to IGSN71 and are in micrometres/second^2. Michael Morse, 249 9251.

Airborne Magnetics & Gamma Ray Spectrometrics - AGSO has acquired airborne magnetic and radiometric data in Australia since 1951 - as analogue strip charts prior to 1968, but wholly digital since 1975. Where the quality warrants, analogue data have been digitised and reprocessed. Digital data are stored on magnetic tape as point-located data, and are available for about 80% of Australia. The data are used to produce a range of machine-drawn magnetic and gamma-ray spectrometric profile and contour maps. Hard-copy maps and magnetic tapes of point-located and gridded data are sold. Duncan Souter, 249 9223.

Magnetic - Oracle databases comprise 3RD_ORDER and MAGSAT. 3RD_ORDER is the Australian 3rd-Order Geo-magnetic Dataset, consisting of 8097 observations by road and helicopter between 1967 and 1975. MAGSAT is a filtered 'quiet-day' data subset representing 163 MAGSAT passes over the Australian region from 26/11/79 to 20/4/80. Prame Chopra, 249 9540 or Charles Barton, 249 9611.

Palaeomagnetic - Definitive palaeomagnetic results exist as both Global and Australian databases. The Australian database is more exhaustive than Australian entries in the Global set. Information stored includes pole positions and associated statistics, geological unit details, references and a geological time scale. The databases are currently implemented in Oracle on a 486 PC. Corporate Oracle versions are planned. John Giddings, 249 9319 or 249 1507.

Australian Earthquakes - The Australian Seismological Centre maintains a database with the location, magnitude, and other information of some 30 000 earthquakes recorded since 1859, in the region 0° - 90°S, 75° - 165°E. The file can be searched on a range of criteria, and the results printed or plotted. Kevin McCue, 249 9675.

QUAKES - A World Earthquake Database, implemented in Oracle, which includes over 450 000 events from 1904 until the present, and is updated annually from tape. Kevin McCue, 249 9675.

NUCEXP - The Australian Seismological Centre keeps an Oracle database of nuclear explosions with the location, time and size of explosions around the world since 1945. Outputs tailored to requests. Spiro Spiliopoulous, 249 9494.

Seismological Stations - A list of stations, names, locations and instrument types. Some 4000 stations from around the world are listed. Outputs can be tailored to requests. Spiro Spiliopoulous, 249 9494.

Seismic Reflection - There are approximately 120 AGSO seismic reflection surveys covering 22 basins throughout Australia between 1949 and 1986. The majority of these surveys are on the Australian mainland, however early work in the Antarctic as well as early marine work in the Timor sea is also covered. An index to the surveys is available in AGSO Record 1987/2. Jock Taylor, 249 9760.

ENVIRONMENTAL GEOSCIENCE

QUATDB - The Quaternary Climates Database, currently being developed in Oracle, records Australian climate change information, and incorporates geochronology, geochemistry, palaeontology, palynology, magnetostratigraphy and geomorphology. Elizabeth Truswell, 249 9427.

Coastal Zones - A database of geoscientific information from the Australian Coastal Zone is being developed in conjunction with the National Resources Information Centre. Bob Burne, 249 9291.

GROUNDWATER

BORESTRA - A PC-Knowledgeman database of the interpreted stratigraphy of 3000 boreholes into the Cainozoic of the Murray Basin. The database contributes to the Murray Basin Hydrogeological Project, a Commonwealth-State venture coordinated by the Murray-Darling Basin Commission's Groundwater Group. Documentation and microfilm are published in BMR Report 262. BORESTRA data will be incorporated with data held by state water agencies, into a basin-wide Oracle hydrological database. Pump test data, standing water levels, hydrochemistry (including isotopes), palynology, as well as stratigraphy are being compiled by 1:250 000 map sheet. Ray Evans, 249 9738.

Great Artesian Basin - Hydrogeological Data, waterwell data, stratigraphy, borehole construction, well tests, water levels, discharge, temperature and hydrochemistry data from the state water and geological authorities of Queensland, New South Wales, South Australia and Northern Territory, and AGSO, are stored in a PC-based Paradox database. Part of these data are used in PC and UNIX workstation Oracle databases, and in Arc/Info GIS, to prepare input data for a basin-wide groundwater computer simulation model. Rien Habermehl, 249 9426.

Great Artesian Basin - Wireline Log Data from AGSO's collection of wire-line logs obtained from 1250 waterwells in the Great Artesian Basin - comprising natural gamma-ray, neutron-gamma, temperature, differential temperature, flowmeter, caliper, spontaneous potential, resistivity and casing collar locator logs - are available as an index in BMR Report 241. Digitising of the logs is in progress, and the digital log data and basic well data, including stratigraphy, will be published on CD-ROM. Rien Habermehl, 249 9426.

MARINE

MINDEX - The Marine Division index has about 80 000 items of data collected by AGSO since 1965, together with output from the processing of these data. The dataset includes the Continental Margins Survey (1970-1973), Contintental Margins Program (1985 - present), Southwest Pacific (SOPAC) data, data from cooperative surveys, and some private company data. The items in the index include digital field tapes of seismic, navigation, gravity, magnetic and bathymetric data, all support-data in paper form, as well as processed geophysical and navigation data in digital, map and stacked-section forms. Peter Petkovic, 249 9278, or David Pryce, 249 9551.

GEOSCIENCE MAPPING

NGMA - National Geoscience Mapping Accord field data are being consolidated into an Oracle database that standardises recording of point locations (SITES), outcrop data (OUTCROPS), and lithology/sample data (ROCKS), and is linked to the NGMA laboratory databases - e.g. OZCHRON, ROCKCHEM and PETROGRAPHY. Use is made of the Stratigraphic Authority Database for validation of stratigraphic names, geological provinces and subprovinces, and geological time terms. Authority tables for 1:100 000 and 1:250 000 maps, location methods, basic rock types, lithology names and sample attributes, are all part of the database. Rod Ryburn, 249 9605 or Richard Blewett, 249 9713.

ROCKCHEM - A national database of whole-rock geochemistry (formerly PetChem). Includes majors, traces, parts-per-billion, and bibliographic references. It contains nearly 30 000 samples, mainly from Australia, Antarctica and Papua New Guinea. Major and trace element analyses currently available on tape or floppy disc as Oracle export or ASCII files. Separate regions are covered by a series of 12 AGSO data records. Lesley Wyborn, 249 9489.

OZCHRON - A national database of isotope geochronology that includes bibliographic references, analytical data and pooled results from K-Ar, Ar-Ar, Rb-Sr, Nd-Sm, U-Pb Mineral, and SHRIMP (high resolution ion microprobe) methods, for samples from Australia, Antarctica and Papua New Guinea. Rod Page, 249 9280.

RTMAP - The regolith-terrain mapping database is linked to the NGMA Field Database. It currently includes data from Kalgoorlie, NSW and Cape York, and is being developed by AGSO's Regolith group. Colin Pain, 249 9469.

STRUCTURE - The structural geology database is integrated with the NGMA Field Database. It includes structural measurements from the Eastern Goldfields and the Arunta Block. Peter Williams, 249 9389.

PETROGRAPHY - A new database for microscopic observations of rocks in thin section, with authority tables for minerals and other thin section attributes. Few data so far. Peter Stuart-Smith, 249 9293.

STRATIGRAPHY

GEODX - The Geological Data Index is a central register of Australian stratigraphic names. Indexed from publications received in AGSO's library, the data include stratigraphic names and their usage (e.g. mention, definition), geological provinces, geographic locations and full bibliographic references. Also stored are names reserved by field geologists for future definition and use. The index has been maintained since 1949 and currently exists as a card file for material to 1969 and as a computer database since 1969. Bev Allen, 249 9200 or Cathy Brown, 249 9123.

STRATA - The Stratigraphic Authority Database is a new Oracle database that attempts to set national standards for stratigraphic nomenclature (STRATLEX), geological provinces and subprovinces of Australia (GEOPROVS), and the geological time terms (GEOTIME). The initial 8000 stratigraphic units were culled from GEODX whose 23 000 references also provide an on-line bibliography. Geological provinces are based on BMR (AGSO) Bulletin 181, "The Geology of Australia". The time scale follows the publications of AGSO's Time-Scale Project. STRATLEX - Cathy Brown 249 9123, GEOPROVS - David Palfreyman 249 9465, GEOTIME - John Laurie 249 9412.

BIOSTRATIGRAPHY

PALEO - An Oracle database of AGSO's fossil collection - its provenance, geology, biostratigraphy, bibliography, nomenclatural status, and storage. 15 609 CPC specimens entered so far. Used mainly for curation, it also is a source of valuable biostratigraphic data. A series of catalogues of published species is produced from it - brachiopods, bryzoans, archaeocyatids, sponges and corals are already available (BMR Reports 298, 305, 307). Des Strusz, 249 9416.

REFERENCE

Library - The AGSO library is the most comprehensive geoscience library in Australia. Holdings include 25 000 monographs, 4000 serial titles (most received on an exchange basis with other Australian and overseas geoscience organisations) and a repository collection of AGSO/BMR publications. The library exists primarily to serve AGSO's scientific staff, but external users are also welcome to use the library. Library material is available for loan through the inter-library loan system. AGSO Library is part of the Australian Bibliographic Network. Reference - Bev Allen 249 9200, Inter-library loan - Anna McCall 249 9469.

Map Library - AGSO's library of Australian and international geoscience maps is a subsection of the main AGSO Library. Holdings comprise many thousands of single and series geoscientific maps and a large number of specialised atlases. The major emphasis is on geological maps; but substantial holdings of geophysical, geochemical, topographical and thematic material are also maintained. It holds most BMR and state-produced maps. External users are welome to use the Map Library. Cartographic material is available via the inter-library loan system. Annette Sugden 249 9138.

AESIS - The Australian Earth Sciences Information System is the world's largest database on Australian earth science and resource information, with over 100 000 references to published and unpublished material. AESIS is maintained by the Australian Mineral Foundation (AMF) in cooperation with AGSO, CSIRO, State Mines Departments and Geological Surveys, the National Library, the Australian Geoscience Information Association (AGIA) and many companies. AESIS is comprehensively indexed and uses the Australian Thesaurus of Earth Sciences and Related Terms. It resides on software run by INFO-ONE International in Sydney, and may be accessed on-line - e.g., from AGSO's library - or via requests to AMF or INFO-ONE. Kevin Bond (AMF, Adelaide) 08 379 0444, Bev Allen (AGSO Library) 249 9200.

NDAR - The National Directory of Australian Resource datasets is a metadatabase of spatially referenced information on datasets for decision makers and resource professions. It is managed by the National Resource Information Centre (NRIC), Bureau of Resource Sciences, Canberra, and runs on Oracle-based FINDAR software marketed by Wizard Information Services, Canberra. NDAR contains comprehensive information on Australian resource databases, including most AGSO databases. AGSO upkeeps all NDAR entries on AGSO databases. Paul Shelley (NRIC) 272 3495, Rod Ryburn (AGSO) 249 9605.

Prepared 11/11/92 by R.J. Ryburn, Database Liaison & Coordination, Information Systems Branch, Phone 249 9605