

Geological

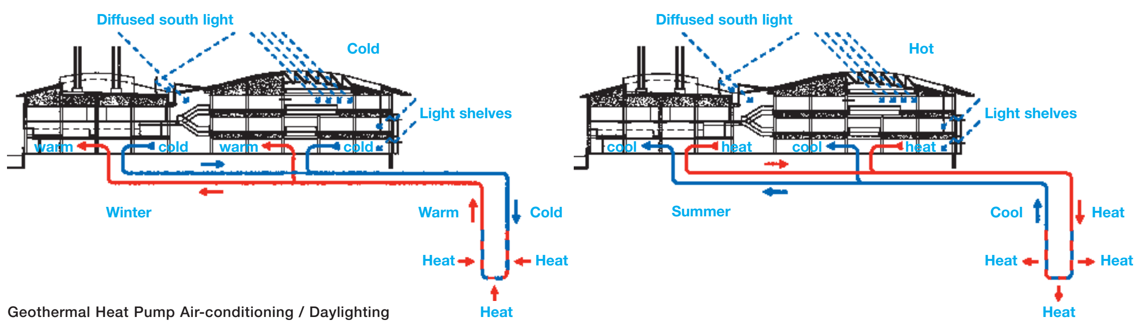
Built with a scientific agenda, the award-winning AGSO building is assessed here from an environmental perspective.

Australian Geological Survey Organisation / Canberra
Architects / Eggleston Macdonald DesignInc
Review by Lindsay Johnston
Photography by Jeremy Simons

● **The new headquarters of the Australian Geological Survey Organisation** (AGSO) has been occupied for two years. It is located on what might be described as a 'fringe' site in the industrial area of Symonston on the south-east edge of Canberra, yet only 5km from Capital Hill. Consisting of 42,000 sq.m of space in two linked buildings under a series of wave formed roofs, the building cost A$109 million and could easily have been a 'behemoth'. The new complex brings together several previously remote divisions of AGSO with the objective of reinforcing a shared sense of purpose among the staff of around 500. It provides 30 highly specialised laboratories, offices, a library, public display space and other support facilities. The complex was recipient of the 1998 RAIA Canberra Medallion, the highest award of the RAIA ACT Chapter, and a World Environment Day Award.

The primary strategy has been to create a totally internalised and sealed environment within a simple floor plate, with a strong visual but virtually no physical connection to the outside other than some strip balconies at upper levels. Relief to the large rectangular form comes from a bold east to west multi-level internal street and three major internal atria lit from above through saw-tooth south-facing roof lights, which spill generous natural light during daylight hours into the centre of the building. The central of the three void spaces is a feature over the entrance and reception area, which is accessed from outside by a sinuous and free-standing concrete canopy identifying the main entrance on the north façade. The other two voids penetrate down into the staff working areas and have large mature palms creating green internal garden areas, onto which internal office spaces have an aspect, and around which are grouped shared working and reference spaces.

The planning of the building cleverly segregates the public access area around the central reception zone at ground floor level, creating a secure access zone throughout the remainder of the building at various levels, which cross the reception zone on bridges above. The office areas are zoned both north and south of the internal street and the laboratory areas to the south of the building. In order to facilitate the installation, maintenance and upgrading of the complex servicing to the laboratories, there is a dedicated services 'floor' under the labs with full headroom which facilitates access. The curved roof



Geothermal Heat Pump Air-conditioning / Daylighting

profile is said to reflect the surrounding rolling countryside and allows the building to sit comfortably into the landscape. The central box gutter becomes a major architectural statement and extends off the building at east and west. Clusters of service flues to the laboratories on the south roof extend above and punctuate this secondary curved form. Inset sun control solar 'pergola' areas on the north edge of the roof provide a feathering to the 'leading edge' of the wing.

The predominant external language of the building is at the secondary level in the detail of the elevational treatment. Over the natural stone-faced spandrels an elaborate filigree of steel sun shading and light shelves along the north creates a three dimensional complexity to what might otherwise have been an overwhelming mass. To east and west, curved perforated sun screens cast shadows over the acid etched and polished precast concrete gable walls and windows. On the south high level windows there is a band of perforated steel vertical fins at varying angles to eliminate early morning and late evening sun.

The internal language of the building is a sophisticated working of three-dimensional volumes, natural light and finishes, which creates a spacious and tranquil working environment. The use of a split-level section configuration either side of the internal street allows views through the working areas to the exterior.

Discreetly linked to the east is the support building, which houses large stores of archives and print material, geological samples from all over Australia and workshops.

The complex has been acclaimed for its Environmentally Sustainable Design (ESD) strategies, the outstanding feature of which is, appropriately for a geological survey organisation, the largest geothermal-based air conditioning system yet to be installed in Australia. A team approach was adopted as essential from the outset of the design process to produce an integrated design solution.

The overall impression is of a well considered, resolved and executed building that meets the needs of its users, provides excellent working and support amenities and which creates a flexible facility to grow and change with the AGSO into the future.

opening spread, details left to right: Skylights, entry canopy and flues. *right:* The curved forms of the west elevation.

this page, left to right: The acoustic ceiling; a stair detail and the central light court.

facing page, left: The central 'street' – daylighting used as a key energy saver. *right:* Three foyer views.

ESD Features

Building envelope The simplicity of the building envelope gives an efficient external wall to floor space ratio thus reducing potential sources of heat loss and gain.

Orientation The main building is located on an east-west axis presenting long façades to north and south and thus reducing the thermal load from low summer morning and evening sun on east and west elevations.

Sun control Strategies for the elimination of unwanted summer sun and the admission of winter sun have been integrated into the design concept. The north elevation has a filigree of horizontal steel sun control devices and a solar pergola zone on the main roof, which eliminate summer sun and admit winter sun. East and west elevations have curved and vertical perforated metal screens combined with an internal blind system substantially eliminating unwanted summer sun. The south elevation has an overhanging colonnade that shadows ground floor windows and a band of vertical perforated steel blades on the upper level windows angled to eliminate early morning and late evening summer sun from penetrating laboratory spaces.

Natural light penetration As up to 30 percent of a building's energy demand may be from lighting, considerable thought has been given to admission of natural light into the building without the harmful effects of solar heat gain. Light shelves on the north façade bounce natural light back into the office spaces while eliminating direct sunlight. The feature 'south light' saw-tooth roofs and curved 'eyebrow' rooflights both spill generous quantities of diffused natural light into the interior and atria spaces without any direct sunlight. It is claimed that there is adequate natural light 62 percent of the time.

Insulated façade and condensation control High-performance, low-emissivity glass is widely used to reduce glare and heat radiation on north, west and east elevations. Double glazed units to these façades are 6mm low E glass, a 20mm air gap and 6mm clear type K glass. Clear double glazing is used in south-facing windows and skylights where there is virtually no direct sunlight. The aluminium curtain wall system incorporates an insulated thermal break neoprene pad against the structural steel mullions to avoid heat and cold bridging in hot and cold Canberra conditions.

Roof/wall insulation In addition to glazed areas, the walls and roofs have a high level of bulk insulation. The overall cost of high insulation standards was a small component in the total cost and achieves significant energy and running cost savings.

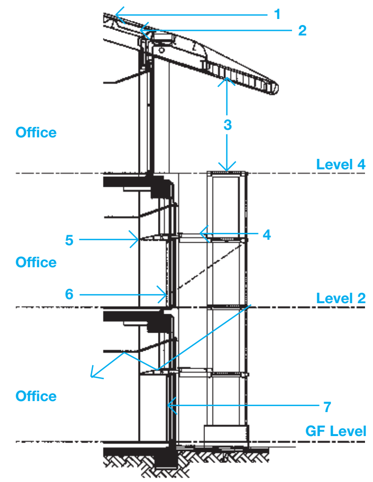
Air-locks/infiltration The external envelope is sealed to prevent drafts. Airlocks are designed for the main entrances to eliminate heat and cool losses in heavily trafficked routes. Secondary entrances for occasional use are well draft sealed.

Artificial lighting design The artificial lighting systems incorporate high quality energy efficient glare-free fittings with good colour rendering. They are fitted with daylight sensors and a central control unit adjusts artificial lighting for changing levels of daylight. Infra-red movement detectors ensure that artificial lighting is switched off when areas are unoccupied.

Geothermal air-conditioning One of the most significant features of the building is the omission of conventional cooling towers and the use of a geothermal field in the ground around the building at 17-18°C as a heat source in winter and as a heat sink in summer. A total of 352 bore holes, 100m deep, 4.5m apart, covering an area of 6000 sq.m, supply 220 individual packaged heat pumps located around the building in concealed cupboard zones. These provide zoned air-conditioning which allows flexible control of areas. The size and configuration of the geothermal ground loops was modelled by Oklahoma State University, using the program GLHEPRO. It is reported by the design consultants Bassett that the capital cost was 10 percent lower than a chilled water VAV system, energy costs are predicted as two percent lower and cost of maintenance is 16 percent lower with a predicted running cost saving of A$936,000 over 25 years. These figures have yet to be validated.

Energy performance Energy usage for the building was modelled using the CSIRO BUNYIP computer program with consultants Enersonics. It has been claimed that the building is performing 30 percent below the normal electrical energy consumption for Commonwealth office buildings. Measurements and comparisons are complicated by the size and complexity of this building. Credit is due to AGSO for engaging professional energy management consultants Building Controls Management to systematically monitor energy consumption. The current reported actual total energy consumption figure for the central services and office power and lighting of the offices, laboratories and support facilities is 28,520 GJ per year, which is 713 MJ/m2/year overall, down from an earlier figure of 906 MJ/m2/year. The total building annual energy consumption expressed in MJ appears to be about 67 percent electricity, 33 percent gas split. The all-electric energy consumption of the central services and power and lighting of the office component represents 527 MJ/m2/year. This is 16 percent below the Commonwealth Government target figure of 625 MJ/m2/year for a building of this size and office population. Translating the reported energy consumption figures for the office component of the building into greenhouse gas emissions (GGE), as used by SEDA's (Sustainable Energy Development Authority) NSW Building Greenhouse Rating Scheme, this calculates at CO_2 emissions of about 138 kg/m2/year, an excellent, almost 5-star rating, which is below 125 kg/ m2/year, and achieved without having to compensate by using the 'Green Power' option of buying electricity generated from renewable sources.

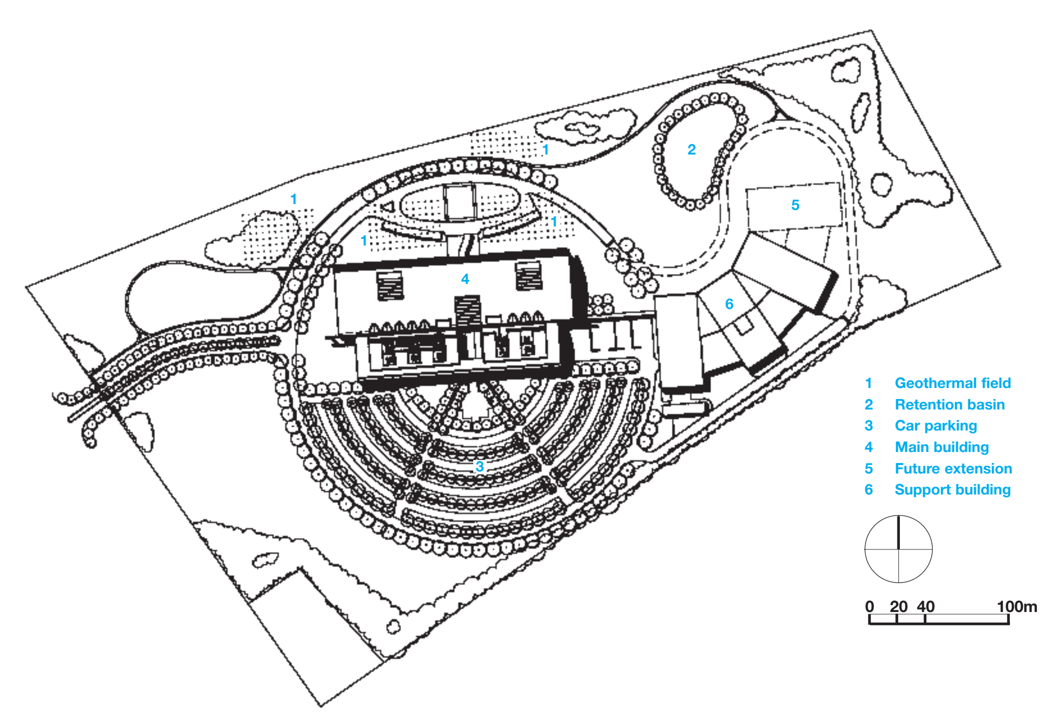
Associate Professor Lindsay Johnston is Deputy Dean of the Faculty of Architecture, Building and Design, The University of Newcastle, NSW.



Typical North Wall Section

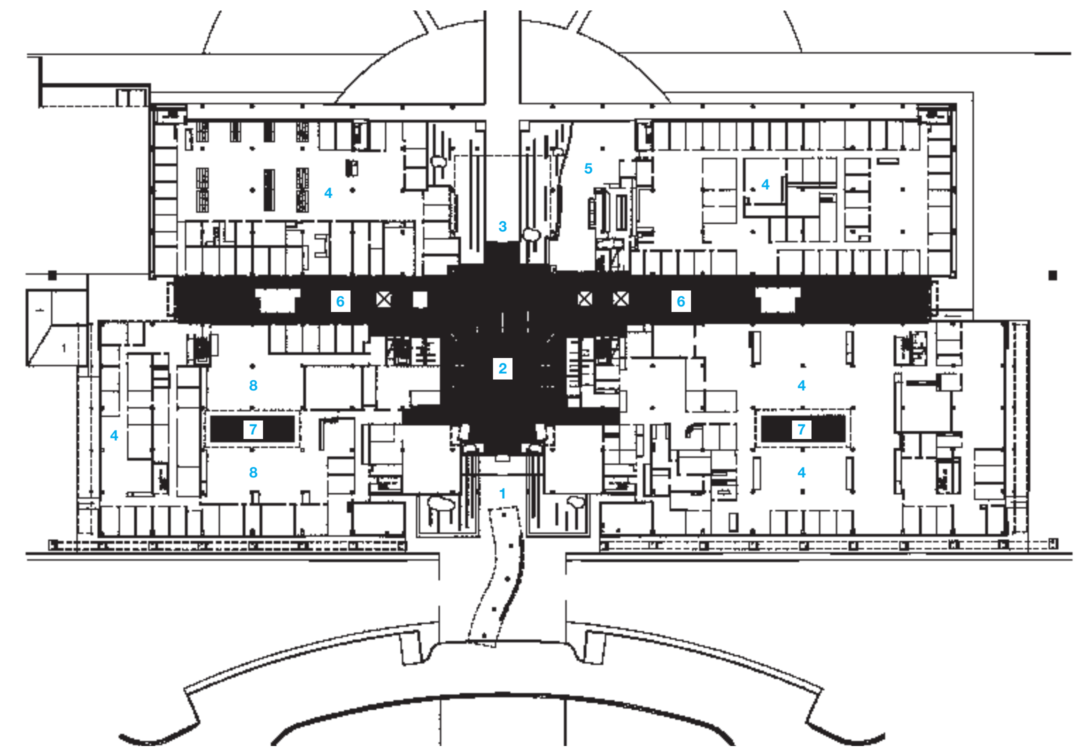
0 1 2 5 10m

1 Metal deck roof
2 Insulation
3 Louvres
4 External light shelf
5 Internal light shelf
6 Vertical Blind
7 Low direct sunlight blocked by vertical blind



1 Geothermal field
2 Retention basin
3 Car parking
4 Main building
5 Future extension
6 Support building

0 20 40 100m



1 Visitor entry
2 Reception/museum
3 Staff entry
4 Offices
5 Cafeteria
6 Central street
7 Internal court
8 Library

0 5 10 25m

Project Summary Australian Geological Survey Organisation **Architect** Eggleston Macdonald DesignInc Pty Ltd **Project team** Trevor Keatley, John Macdonald, Alan Ball, Yashushi Honda, Helen Gunther, Trevor Rees, David Cox, John Scanlon, Vi Vuong, Greg Fish, Rohan Wilson, Bettina Bufé **Project manager** Australian Pacific Projects Corporation **Client** Australian Geological Survey Organisation ***Consultants:*** **Structural engineer** Scott Wilson Irwin Johnston **Mechanical, fire, lifts & geothermal** Bassett Consulting Engineers **Electrical, lighting & communication** Barry Webb & Associates **Hydraulics** CR Knight & Associates **Quantity surveyor** WT Partnership **Cost planner** Wilde & Woollard **Programmer** Tracey, Brunstrom and Hammond **Landscape architect** Tract Consultants **Energy management** Enersonics **Geotechnical engineer** Coffey Partners International **Head contractor** Baulderstone Hornibrook **Size** 42,000sq.m **Time to complete** 24 months ***Materials:*** **Cladding** Polished and acid-etched precast concrete; insulated metal panels **Roof** Colorbond XSE aluminium coated steel **Guttering** Stainless steel **Paving** Precast concrete; ruled insitu concrete; honed stone tiles **Windows** Aluminium double glazed **Glass** Low 'E' glass, toughened and laminated ***Interior materials:*** **Ceiling** Mineral fibre tiles; plasterboard **Internal walls** Dry wall; plasterboard cladding **Lighting** Low-brightness fittings **Flooring** Access floors, carpet tiles **Furniture** Project specific design **Heating/cooling** Geothermal heat pumps to office areas