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Russell Rodrigo, *University of New South Wales*

Designs on the Atomic Age: The Architectural Translation of Australia's Post-war Nuclear Ambitions

On 18 April 1958, Prime Minister R. G. Menzies officially opened Australia's first and only nuclear reactor, the High Flux Australia Reactor (HIFAR) at Lucas Heights, a southern suburb of Sydney. By 1961, an extensive campus of laboratories, offices, services and staff facilities had been completed at Lucas Heights by some of Australia's leading architectural practices, including Stephenson and Turner, Bunning and Madden and Edwards, Madigan and Torzillo.

From an Australian perspective during the 1950s, the question of nuclear weapons capability mirrored thinking in the United States and Europe. Nuclear technology was expected to spread globally and nuclear weapons were seen as a critical component of a nation's military hardware. While the atomic bomb was seen as vital to national security at the time, there also emerged a distinctly Australian view of its economic potential. Both the socialist government of Chifley (1945–49) and the conservative government of Menzies (1949–66) were tantalized by the idea of nuclear power as a catalyst for a major leap in Australia's industrialization and the prospect of great nation-building projects that would transform Australia's interior.

With a limited industrial sector and a rudimentary scientific sector, after the war Australia was inevitably forced to look to a third party in its search to acquire nuclear technology. Through an extended period of diplomacy and joint military and scientific co-operation with the United Kingdom, culminating in the establishment of the Australian Atomic Energy Commission (AAEC) in September 1952, Australia would establish its credentials as a responsible ally, suitable to be entrusted with nuclear knowledge.

This paper examines the initial design and the evolution of the AAEC campus in the context of 1950s international debate on the impact of atomic energy in architecture and the search for an architectural form appropriate to the atomic age.

Introduction: The Promise and Threat of Atomic Energy

“So, Sir, these two buildings today, coming on top of what has been done here before add up to a new adventure, an exciting adventure, and, as I believe I may say, a highly practical adventure. They will, I believe Sir, serve to correct the widely held impression that nuclear power is an instrument of destruction. They will, as they go on, persuade more and more people to realise that what we are dealing with today is an instrument of human development ultimately to operate for great human happiness.”¹

R. G. Menzies, 23 March 1962

The detonation of two fission bombs on the Japanese cities of Hiroshima and Nagasaki in August 1945 and the subsequent end of the Second World War however, quickly focused Australian attention on the military and civil potential of the new technology of atomic energy. While initial public debate in Australia following the atomic blasts was concentrated on the military significance and morality of the use of atomic weapons, there soon emerged at both a political and a popular level, a distinctly Australian view of its economic potential.²

The central issue in Australia's post-war reconstruction planning and future industrialization was access to reliable sources of power. By the end of the Second World War, Australia was completely dependent on oil imports and faced an energy predicament.³ The Chifley government's vision for post-war reconstruction was framed by a distinctive view of atomic energy, a view that was focused on the harnessing of the new technology for the economic development of Australia. The promise of the atom and the energy it produced was however, inextricably intertwined with the threat of global nuclear annihilation. In the 1950s, Australian governments, mirroring thinking in Europe and the United States, anticipated that nuclear weapons would spread globally and become a staple feature of modern defence capability. In addition to the potential economic benefits of the harnessing of atomic energy, post-war Australian governments also believed that nuclear weapons could act as a deterrent and serve Australia's strategic interests. The possession of nuclear capability was seen by Australia as a stabilizing force in international affairs, provided they were controlled by a small number of responsible powers.

With a small industrial sector and an emerging scientific community however, post-war Australia had to look overseas in its pursuit of nuclear technology. During this period, Australian governments entered into a period of unparalleled co-operation in strategic defence initiatives with Great Britain through the so-called 'joint project', including the detonation of seven atomic tests at Maralinga, South Australia between 1956 and 1958. For Australia, this co-operation was ultimately aimed at the possession of nuclear weapon capability.

1 “Opening of the Reactor Physics Building and the Radiation, Biology, Healthy Physics Building, Lucas Heights Research Establishment.” Accessed 20 January 2014. <http://pmtranscripts.dpmc.gov.au/transcripts/00000487.pdf>.

2 Alice Cawte, *Atomic Australia 1944-1990* (Kensington: New South Wales University Press, 1992), 9.

3 Cawte, *Atomic Australia 1944-1990*, 9.

Australia moves into the Atomic Age

Coupled with this foreign policy subservience to Great Britain, the Australian government also sought to develop local scientific expertise and in 1946 established the Australian National University in Canberra, the centrepiece being a school of nuclear physics. By the early 1950s therefore, the Australian government had developed a significant investment in atomic energy with the ultimate aim of securing access to overseas nuclear knowhow. This included the development of a local uranium mining industry, principally based at Rum Jungle in the Northern Territory, the construction of the Maralinga trials site and associated services at Salisbury and the involvement of eight universities in nuclear-related research.⁴

In addition to these achievements, a key initiative in the development of a local atomic energy sector was the creation of the Australian Atomic Energy Commission (AAEC). The establishment of the AAEC would provide Australia with the credibility to be seen as a responsible ally, capable of being trusted with atomic knowledge. The AAEC was established as a statutory body by an Act of Parliament on 17 April 1953 and was charged with three main responsibilities:

“to promote the search for, and mining and treatment of, uranium in Australia with power to buy and sell on behalf of the Australian Government; to develop practical uses of atomic energy by carrying out and assisting research, constructing plant and equipment and employing and training staff; and to collect and distribute information on uranium and atomic energy.”⁵

The AAEC was established at a time of a rapid growth in the international development of peaceful applications for nuclear energy as well as the urgent need for uranium for defence purposes. The initial focus of the AAEC's activities was to stimulate the local production of uranium at Rum Jungle and later at the South Alligator River in the Northern Territory, and Mary Kathleen in Western Australia. Another key focus of the initial establishment of the AAEC was the need to develop an atomic energy research program. For this to be effective however, access to nuclear expertise from global leaders in the field was required. In 1954 an agreement was concluded with the United Kingdom that resulted in the AAEC establishing its own research team at the Atomic Energy Research Establishment, Harwell in the UK, building on a small group from the CSIRO that had been based there since 1947. In the same year in anticipation of full nuclear co-operation with Great Britain, the Australian government agreed to recruit fifty more scientists for the AAEC and to establish new laboratories in Sydney for atomic related research.⁶

4 Wayne Reynolds, “Rethinking the Joint Project: Australia's Bid for Nuclear Weapons, 1945-60,” *The Historical Journal* 41 (1998): 864.

5 Phillip Baxter, “Australian Atomic Energy Commission, The First Ten Years: 1953-1963,” *Atomic Energy*, April (1963): 4

6 Cawte, *Atomic Australia 1944-1990*, 98.

The Lucas Heights Research Establishment

Plans for an atomic research establishment were initially focused on existing AAEC property in Maroubra, a coastal suburb of east Sydney. However, following further discussions with their UK counterparts, the AAEC sought a larger, more isolated site and located the facility on vacant Crown Land on a 64 hectare site at Lucas Heights, located approximately 32 km south of Sydney:

“The site is admirably suited to the Commission’s requirements. Although it is only about twenty miles from the centre of Sydney, the area within which it is situated is entirely unoccupied, the nearest habitations being about one and a quarter miles away. The land is elevated and fairly level, and the underlying sandstone provides good foundations for large structures. Power and water services can be made available, and a road passing the site connects it with an arterial highway at a distance of about two miles.”⁷

The Lucas Heights Research Establishment was originally created with three purposes - to test materials and train scientists and technicians for use in future power producing reactors and to carry out research aimed at developing a reactor specifically suited to Australian conditions.

In September 1954, the Australian government approved a budget of £5.5 million over five years for the construction of the Lucas Heights facilities. In November 1954, construction commenced at Lucas Heights. By this time also, a UK firm had been contracted to construct and fabricate the core of a small heavy-water moderated, enriched uranium, high neutron flux-materials testing reactor.⁸ While costs for the Lucas Heights campus had doubled by the end of 1956 and the construction of associated laboratories were delayed by budgetary restrictions, construction of the reactor proceeded to schedule and on Australia Day 1958, HIFAR ‘went critical’ for the first time.⁹ The facility was officially opened by Prime Minister R. G. Menzies on 18 April 1958:

“This is first and foremost a research establishment, and one of its results will be that we in Australia will be scientifically and technically equipped to take advantage of the best that there is in the world, whether that best comes from older and larger and richer countries or from our own.”¹⁰

This reliance on overseas knowhow, is highlighted in the provision of detailed plans and specifications from Great Britain for the Lucas Heights reactor as well as associated buildings and services. Located in Oxfordshire, Harwell was established in 1946 as Britain’s first Atomic Energy Research Establishment and accommodated five research reactors of various types and associated research facilities. The Lucas Heights facility was seen by the AAEC as one based essentially on British plans and specifications of the Harwell facilities.¹¹

7 Australian Atomic Energy Commission, *Third Annual Report* (30 June 1955), 42.

8 Cawte, *Atomic Australia 1944-1990*, 100.

9 Cawte, *Atomic Australia 1944-1990*, 101.

10 Australian Atomic Energy Commission, *Sixth Annual Report*, 21.

11 Wayne Reynolds, *Australia's Bid for the Atomic Bomb* (Carlton South: Melbourne University Press, 2000), 139.

While the more technically specialised buildings such as HIFAR were imported from the UK, all other buildings were locally designed and constructed. The Lucas Heights Research Establishment comprised the steel shell reactor building with supporting laboratories, workshops and experimental areas around the reactor, laboratories for chemistry and chemical engineering, library and administrative buildings, gatehouses, garages, stores, boiler house, liquid metal laboratory and an effluent control laboratory.

The Architecture of the Lucas Heights Research Establishment

The architects Stephenson and Turner were engaged by AAEC in 1954 to design the overall layout of the site for the first stage of development at Lucas Heights. The “general disposition and design”¹² of buildings as proposed by Stephenson and Turner is illustrated in the AAEC *Third Annual Report*. This drawing shows all facilities located within a gated precinct with key buildings focused around a large central square.

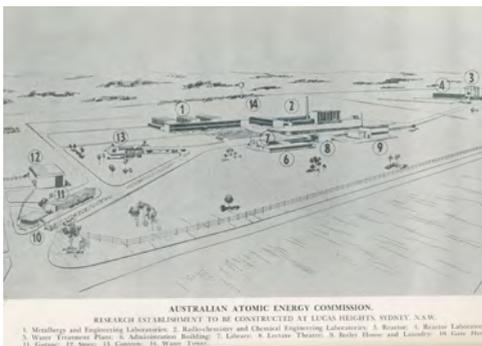


Fig. 1: Schematic Site Plan, Stephenson & Turner. Source: Australian Atomic Energy Commission, *Third Annual Report* (30 June 1955), 1. Reproduced with permission of the Australian Nuclear Science & Technology Organisation.

No overall site plan for Lucas Heights was ever developed however, and the general grouping and orientation of key buildings as constructed, differs significantly from the Stephenson and Turner schematic drawing.

Two key factors guided the initial layout of buildings - the requirement that the reactor be separated from the laboratory buildings by a minimum of 274 m and the need for on-site liquid waste disposal.¹³ While the required separation between the reactor and other buildings can be seen in the 1954 schematic drawing, the requirement for onsite waste disposal appears to have been a significant factor in the as-built layout of the site.

¹² Australian Atomic Energy Commission, *Third Annual Report* (30 June 1955), 42.

¹³ Norman Phillips, “The Development of Lucas Heights,” *Architecture in Australia* June (1961): 53-54.



Fig. 2: Site Plan 1968.
Source: Australian Atomic Energy Commission, *Lucas Heights* (Lidcombe, N.S.W.: Land Printing House, 1968) unpaginated.
Reproduced with permission of the Australian Nuclear Science & Technology Organisation.

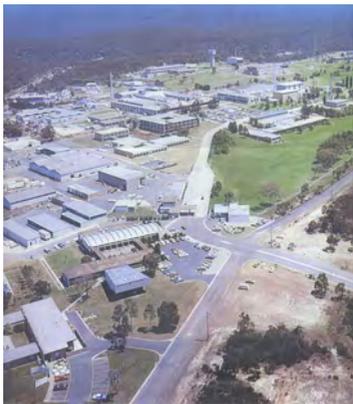


Fig. 3: Aerial View, 1982.
Source: Australian Atomic Energy Commission, *Atomic Energy in Australia* (July-October, 1982) Cover.
Reproduced with permission of the Australian Nuclear Science & Technology Organisation.

In this regard, a ridge approximately bisecting the site is the key determinant for the siting of key buildings. An effluent treatment plant was sited on the southern side of the ridge in a natural gully. Buildings on the ridge or located south of it were then able to have liquid waste gravity fed to the treatment plant. Areas north of the ridge accommodated administration buildings, stores, boilerhouse, garages, canteen which incorporated conventional drainage systems.

In the 1961 *Architecture Australia* commentary of the Lucas Heights facility, Professor F.E.A. Towndrow notes that on first viewing, a lack of overall cohesion in site layout is evident, in particular a lack of a focal point and distinct order or groupings of buildings.¹⁴ While it was argued that the

14 F. E. A. Towndrow, "Some Aesthetic Aspects - A Critical Appraisal," *Architecture in Australia* June (1961): 58.

original Stephenson and Turner layout proposed a distinct heart for the facility in the form of a square in front of what is now the Metallurgy/Engineering buildings, the disposition of the buildings had been loosened and the proposed formal relationships between buildings was no longer as strong as in the schematic plan. Commentary also noted the lack of an architectural expression reflective of the new technology of atomic energy:

“Regarding architectural expression in the individual buildings it has been suggested that these - being the first of their kind in our brave new nuclear world - should have expressed something of that mighty change in human affairs which has been brought about by the birth and development of atomic science. I do not think this is a valid criticism; first, because few of us understand the real import of this change, and second, even if we understood it, we could not express in architectural terms its reality or the sentiment which it inspires.”¹⁵

Given the political imperatives to establish a local atomic research program within a relatively short period of time, it is clear that opportunities for the exploration of new architectural expression at Lucas Heights would be limited - “The buildings have been designed with a view to functional efficiency and constructional simplicity, and when completed will be an interestingly modern group of structures.”¹⁶ There is however, an overall consistency in architectural language across the site, including an emphasis on structural expressiveness and the use of a similar palette of materials, construction modules and colours.

Construction at Lucas Heights was undertaken in three key building stages. Stage 1 (1955–58¹⁷) involved the construction of the HIFAR Reactor Group - laboratories, workshop, offices and experimental areas associated with the reactor; Chemistry/Chemical Engineering building; and a Library/Administration building. Stage 2 (1958–60¹⁸) involved the construction of the Metallurgy/Engineering research laboratories and workshops; Isotopes/Technical Physics building; Beryllium laboratories; Staff Canteen and Australian Institute of Nuclear Science and Engineering (AINSE) headquarters building. Stage 3 (1961–62¹⁹) involved the construction of the Reactor Physics building, containing the low-power research reactor Moata and the Radiation Biology/Health Physics building.

The development of the Lucas Heights site over this period captured the imagination of the architectural and engineering professions, receiving extensive journal coverage including publication in *Architecture in Australia*, *Australian Architecture Today*, *Building: Lighting: Engineering*, *Constructional Review* and *Foundations*. While the overall architecture of the facility conveys a utilitarian machine-age language, a number of buildings are significant in terms of their technical or formal design aspects.

15 Towndrow, “Some Aesthetic Aspects - A Critical Appraisal,” 58.

16 Australian Atomic Energy Commission, *Third Annual Report* (30 June 1955), 42.

17 Australian Atomic Energy Commission, *Fifth Annual Report* (30 June 1957), 32.

18 Australian Atomic Energy Commission, *Sixth Annual Report* (30 June 1958), 23, 29.

19 Australian Atomic Energy Commission, *Tenth Annual Report* (30 June 1962), 23.

HIFAR Reactor Group

Major building work at Lucas Heights began with the construction of the reactor group of buildings located in the southwest corner of the site. The design chosen for the Lucas Heights high-flux research reactor group of buildings was based on Harwell's DIDO reactor with full plans and specifications made available by the United Kingdom Atomic Energy Authority and the Ministry of Works. While the translation of the design data of the Harwell reactor was relatively straightforward, major changes to the orientation of the adjoining two-storey laboratory block were made by Stephenson and Turner.²⁰ Following consultation with AAEC scientists, the block was re-orientated 90 degrees and placed with its main axis north-south, allowing for a better relationship with the topography and the level of the reactor and cooling towers. While the laboratory buildings remained the same in overall design as their Harwell counterparts, the aluminium and glass curtain walls facing north-south were now required to be retro-fitted with adjustable sun louvers.

Chemistry/Chemical Engineering and Metallurgy/Engineering Buildings

The two largest laboratories on the Lucas Heights site, the Chemistry/Chemical Engineering and Metallurgy/Engineering buildings were designed by Stephenson and Turner and comprise a basic plan of a two-storey block of laboratories in front of taller research bays arranged at right angles to the rear. The two building sites are located adjacent to each other, arranged at right angles with the Chemistry/Chemical Engineering building orientated east-west and the Metallurgy/Engineering building orientated north-south. Effective sun and glare control were key issues for all the research buildings on the Lucas Heights site and due to the east-west orientation of the Chemistry/Chemical Engineering building, adjustable horizontal louvers were required to be retro-fitted to both long facades of the building. Noting this retrofitting, Professor Towndrow in his commentary in *Architecture Australia* laments the unquestioning translation of International Style aesthetics:

"It is interesting to reflect here that as sunlight and glare control is of paramount importance in Australia whether it would not be better to design our buildings with this in view right from the very outset and develop our own concepts of external wall-cladding - instead of copying glass curtain-walling from sunless climes."²¹

Isotopes and Technical Physics Building

Designed by the architects Max Collard and Guy Clarke, the Isotopes and Technical Physics Building is unique in its application of a courtyard typology. The two discrete functions are housed in a series of wings grouped around an internal garden courtyard with shared common facilities including

²⁰ Phillips, "The Development of Lucas Heights," 53.

²¹ Towndrow, "Some Aesthetic Aspects - A Critical Appraisal," 60.

reception, offices and common room. Utilizing a structural system of steel columns supporting open-web roof trusses and external non load-bearing brick walls and aluminium framed windows, the building was designed on a modular basis, allowing for the repetition of standard interior units and joinery. Structural efficiency was the basis of the design, with the framing system allowing for quick erection of the basic wall and roof structure to allow for internal construction to proceed with minimum delay. As the facility housed delicate scientific instruments, a key technical innovation in its construction was the use of a low-level background radiation concrete mix.²² Control of solar gain and glare was also a key design consideration with natural daylight restricted in the laboratories through the use of extended roof overhangs and horizontal timber louvers.



Fig. 4: Model Photograph, Staff Canteen/AINSE Headquarters group.
Source: Australian Atomic Energy Commission,
Atomic Energy (March, 1959) Cover.
Reproduced with permission of the Australian
Nuclear Science & Technology Organisation.

Staff Canteen/AINSE Headquarters group

Of all the Lucas Heights buildings, the Staff Canteen/AINSE Headquarters buildings, designed by Bunning and Madden, received the most extensive journal publication, including international coverage²³. In contrast to the 1954 schematic plan of Stephenson and Turner, the Staff Canteen/AINSE Headquarters building is located outside the restricted area of the site, allowing it to function in a broader role as the site's key entry and gateway building. The buildings are notable for their dynamic contrasting forms, expressive of their functions and their siting around a formal square of patterned concrete and blue-black brickwork measuring 24 by 15 m.

The Staff Canteen building accommodated a large communal dining area for 300 patrons, a kitchen, an adjoining small lounge, and a small private dining room. The building is notable for its 8 m high barrel vaulted structure spanning 22 m, composed of thirteen exposed bowstring arches painted black - the first use in Australia of a suspended roof system.²⁴ As a sleek synthesis between architecture and engineering, the Staff Canteen building with its 9 m long self-service counter and milk bar was designed for both daily use by Lucas Heights' then 650 employees as well as allowing for the potential for large social events on site.²⁵

22 "New Buildings at Atomic Energy Commission", *Building: Lighting: Engineering* June (1960): 25.

23 "Nuclear Science Buildings at Sydney", *Architectural Review* February (1961): 109-11.

24 "Dynamic Shapes in Atomic Energy Architecture", *Australian Architecture Today*, May (1960): 30.

25 "New Buildings at Atomic Energy Commission", *Building: Lighting: Engineering* June (1960): 27.

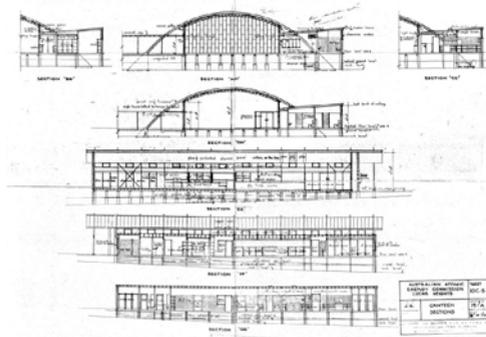


Fig. 5: Staff Canteen, Bunning & Madden.
Source: Australian Nuclear Science & Technology Organisation.
Reproduced with permission of the Australian Nuclear Science & Technology Organisation.

The canteen is sited around a formal square adjacent to the AINSE Headquarters building, which provides a relatively sheltered outdoor dining area, screened from the main entry road. The curved steel arches set up a distinctive entry sequence to the Staff Canteen building with the curtain glass and aluminium wall facing the courtyard set back to allow for a sheltered walkway and entry area along the full length of the building. Lightweight covered walkways connect the Staff Canteen building to the AINSE Headquarters building.



Fig. 6: Lecture Theatre, Bunning & Madden.
Source: Australian Atomic Energy Commission, *Eight Annual Report* (30 June 1960), 54.
Reproduced with permission of the Australian Nuclear Science & Technology Organisation.

The Australian Atomic Energy Commission took the lead in establishing AINSE as a focus for national cooperation in the nuclear scientific and engineering fields and as a means of encouraging access by universities and other research institutions to the emerging research facilities at Lucas Heights. The AINSE Headquarters Building accommodated two key functions - a study block and a lecture theatre. The single storey study block is a flat roofed structure accommodating thirteen study units, a small library, conference room and offices planned on either side of a corridor. The simple rectangular form of the study block acted as a neutral foil to the dynamic forms of the canteen and lecture theatre. The AINSE Headquarters building is dominated by the expression of the lecture theatre which rises dynamically in height and cantilevers approximately 3 m beyond its supporting walls, creating a large undercroft area facing the main entry road. The 120 seat lecture theatre is

wedge shaped in both plan and section and constructed from vertical precast concrete panels edged in black painted pressed metal. An overall colour palette of contrasting black, white and grey unites both the Staff Canteen and AINSE Headquarters building, punctuated only by lime yellow panels below sill level in the black mullioned wall of the study block.

Conclusion: Aesthetics and the Search for an Atomic Architecture

Atomic power represented a paradox. On the one hand it held great promise for humanity as a form of industrial power and on the other hand it also represented the threat of nuclear annihilation. The anxieties of the age are founded in this paradox of nuclear promise and destruction. This anxiety became more visible in mainstream culture through the aesthetics of organic forms and atomic energy with the imagery of the atomic model emerging as a key expression of the vocabulary of abstract organic forms.²⁶ Abstracted atomic particles were reproduced in many areas of design from architecture to textiles and wallpaper, representing the replacement and extension of the promise of the machine to the promise of the atom and the energy it held.

The dawn of the atomic age also focused the imagination of the architectural profession. Early commentary focused on communicating what was understood of the technical aspects of the new technology of atomic power. In an article published in the 17 November 1950 issue of the UK journal *The Architect and Building News*, for example, it was argued that there would be no direct impact on architecture or town planning as the principles of power distribution and application would remain unaffected. The real impact on architecture it was argued, would be in the design of buildings specifically for the handling of radioactive material and nuclear processes. Here the understanding of appropriate environmental conditions was emphasised - effective ventilation, water disposal, methods to control penetrating radiation and cross contamination, and design for decontamination.²⁷

Four years later, in a lengthy article in the December 1954 issue of the US journal *Architectural Record*, the impact of atomic energy on architecture is framed not only in terms of the promise of abundant power, but also now in terms of its potential destructive power.²⁸ Here the most important effect of the atomic age is predicted to be on the design of communities and cities - particularly in relation to reducing the destructive effect of nuclear blasts and the efficient evacuation of cities, and the improvement of building standards to address future attack including the incorporation of mandatory basement refuges in all new buildings. Methods for designing decentralized and

26 B. K. Rapaport and K. L. Stayton, *Vital Forms: American Art and Design in the Atomic Age 1940-60* (New York: Abrams, 1980), 24-25.

27 "The Impact of Atomic Energy on Architecture," *The Architect and Building News*, 17 November (1950): 542-44.

28 John Ely Burchard, "Architecture in the Atomic Age," *Architectural Record*, December (1954): 119-30.

dispersed cities were also seen as potential solutions for reducing the impact of future atomic blasts on populations.²⁹

Commentary in relation to the potential for an architectural expression inspired by atomic energy however, is not evident in architectural journals until the late 1950s. The November 1958 issue of US journal *Progressive Architecture* for example, included a major feature on "Atomic Architecture" noting the aesthetic challenge that lay ahead:

"No architectural-engineering challenge is newer than that of the design of buildings to house nuclear reactors and their auxiliary facilities. It is so new, in fact, that no more than a handful of architects has even a nodding acquaintance with the design problems involved. Yet is clearly an architectural problem - these awesome new scientific tools require shelter - and the architect and engineer have important roles to play in providing the shelter."³⁰

The feature recognised that architects would not be involved in the design of the reactor itself but instead would be required to design the enclosure of the reactor. This was seen as a key opportunity for design expression. The feature included a number of speculative design schemes by architecture students from the Pratt Institute, who were "free to 'dream up' whatever they wished"³¹ within the bounds of basic functional knowledge. The two week project involved the design for a nuclear science facility comprising a reactor and associated laboratories. Schematic flow diagrams were provided to the students as a basic introduction to nuclear process and construction requirements. Critique of the student work, while noting functional deficiencies, was focused primarily on the need for a nuclear-reactor-expressive form. Published designs included monumental cylindrical forms, bubble-like arrangements and moulded organic schemes.³² The exploration of the design potential of atomic technology demonstrated in the publication of the student designs is indicative of the willingness of the architectural profession to understand and engage with the aesthetic challenge of a new scientific epoch.

The architecture of the Lucas Heights Research Establishment predates these debates in the profession for the need for an architectural expression appropriate to the atomic age. While popular culture was increasingly inflected with atomic and space age imagery during this time, the design of the Lucas Heights facilities was influenced by more pragmatic concerns. The political imperative to establish an Australian research program within a relative short period of time meant that architectural concerns were more focused on the speed and efficiency of construction. Prefabrication processes and modular design techniques were evident in the architecture of Lucas Heights, however, there was also evident the use of innovative building techniques and structural

29 Burchard, "Architecture in the Atomic Age," 122-25.

30 "Atomic Architecture," *Progressive Architecture*, November (1958): 101.

31 "Atomic Architecture," 101.

32 "Tomorrow's Reactors - The Student Lets His Imagination Roam," *Progressive Architecture*, November (1958): 133-39.

expressive forms appropriate to function - a relatively modest design ambition that is echoed in international commentary of the time:

"We are at the beginning of a new and revolutionary era. The challenge in it for architecture - the mirror of man's achievements and aspirations - is to interpret its needs and means in terms of function and form so as to combine in its unique way both the high aesthetic and the fully practical in one working whole."³³

³³ "Architecture, Atoms and a Peaceful World," *Architectural Record*, March (1957): 182.