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Geodesic Domes and Experimental Architectural Education Practices of the 1960s

The 1960s was a period of uncertainty and questioning of political, economic, social and cultural views, along with a growing ecological awareness. Globally, in response, there was increased student activism, most famously demonstrated through the 1968 student riots in Paris, and the emergence of various counterculture practices. In the early 1960s, architecture students from Perth Technical College began questioning the pedagogical direction of their course and its relevance in a changing world. This led to the active pursuit of alternative means of acquiring architectural knowledge. Most well known of these activities was the convening of the Fourth Australian Architecture Student Association Convention, held in Perth in 1966. Buckminster Fuller was amongst the many notable speakers at the convention and his influence can clearly be seen in a series of geodesic domes, constructed soon after by Perth Technical College architecture students. In light of recent scholarship that has sought to reconsider architecture's interaction with counterculture within Australia in the 1960s and 1970s, this paper sets out to document and explore how pedagogical initiatives and experimental building projects in Western Australia challenged institutional approaches within architectural education of that period.

Recent scholarship has seen a renewed interest in alternative architectural practices, including educational pedagogy, in the 1960s and 1970s. The ongoing research project of Beatriz Colomina et al., 'Radical Pedagogies', is one such project with a focus on the Americas and Europe.¹ Similarly, work by Lee Stickells, Glen Hill, Elizabeth Musgrave and others focus on alternative and countercultural architectural practices in Australia during this period.² Stickells' work in particular has sought to re-frame Australian architectural history through the lens of architecture's interaction with counter culture. However, according to Stickells, "a thorough account of the ways in which countercultural experiments affected the disciplines knowledge base, representational and practice forms remain largely absent".³ This paper is interested in contributing to this work by focussing on the experimental building projects of Perth Technical College architecture students constructed in the 1960s and early 1970s, and in particular the construction of geodesic domes. Significantly, our research suggests that the construction of these domes by Western Australian architecture students is one of the earliest examples in Australia of this type of experimental building that represents a shift in pedagogy in architectural education that challenged the institutional approaches of the time.

In May 1966 over 450 delegates from across Australia and overseas gathered in Perth, Western Australia (WA), for the Fourth Australian Architecture Student Association (AASA) Convention. The theme of the convention was 'Education in Architecture', with a notable line-up of speakers including Professor Richard Buckminster (Bucky) Fuller (United States of America), Professor Jacob Bakema (Netherlands), Professor Aldo Van Eyck (Netherlands), and John Voelker (United Kingdom). The local speaker was Paul Ritter, a relative newcomer to WA from the United Kingdom, who had taken up the position as the first Chief Planner for the City of Perth in 1965. The 1966 convention has achieved mythical status as a pivotal event in architectural education in Australia and at a local level regarded as the impetus for a series of experimental building projects of geodesic domes in WA in the late 1960s and early 1970s.⁴ The convention itself is well documented, including detailed accounts of each of the keynote speakers' lectures published in September 1966 in a special edition of *The Architect*.⁵ On the other hand, only fragmentary information on the experimental building projects has up to now been available. As there are few published records of these activities, and drawings, if done, have mostly long disappeared, as have most of the built outcomes that were designed as temporary, ephemeral moments, the recovery of material on the geodesic dome projects has relied significantly on recorded interviews, conversations and correspondence with those directly involved. Through this approach not only are we able to tap into a rich source of otherwise unrecoverable information from those who lived through these experiences; we also gained access to personal collections of photographs and other documents.

To understand the context of the geodesic dome projects we begin with a brief outline of the chronological development of architectural education in WA. The first formal course in architecture commenced in 1946 at Perth Technical College (PTC). Initially offered as a six-year diploma consisting of three years full-time and three years part-time in conjunction with work within a practice, by the time the first graduates registered as architects in 1951

the qualification had changed to an Associateship in Architecture. Prior to the PTC course architects had been trained as indentured students within an architectural practice. They could, however, attend outside classes organised by the articulated students' Architectural Association of WA.

The mid-1960s saw the next major changes with the commencement of a new course at the University of Western Australia (UWA) in 1966. Initially this was offered to students who had completed two years of the PTC associateship course and in 1970 UWA began offering the full five-year course. In 1967 the PTC course was transferred to the newly established Western Australian Institute of Technology (WAIT), although it didn't move to the new campus at Bentley until the opening of the Architecture Building in 1971.

Each Head of School played an important role in the development of architectural education in WA. William Haydn Robertson, affectionately known as Robbie, was appointed as the first Lecturer-in-Charge of the PTC architecture course. Subjects included drawing, engineering mathematics, structural mechanics, surveying and workshop practice and were often taught by lecturers from other departments. Design as a subject was not introduced until the third year of the course. The structure remained much the same until 1954, when Senor Bolland took up the position of Head of Department, after the unexpected death of Robertson in 1953. Bolland introduced a much greater emphasis on design including the introduction of a final year thesis project. His tenure at PTC, however, was short-lived when he resigned suddenly in 1958 and Clarence Bunn became the next Head of Department. Bunn was a somewhat divisive figure amongst staff and students. Margaret Pitt Morison, who had been appointed by Robertson in 1948 and was the first female lecturer in architecture in WA, resigned in 1962 after a disagreement with Bunn. The early 1960s also saw growing student dissatisfaction with the course and some of the staff. Martin Grounds, a student at PTC at the time recalls the mood amongst the student body:

We were all very reactionary, we were appalled at these old guys were just teaching us stuff from dusty old notes and seeing their days out at the Architecture department to get their pensions. They were so un-dynamic. We were dead against what we were receiving; we let them know big time. We were not sitting back and letting this go unnoticed. It was the hippy era, the world was a changing place, and we were going to change with it. PTC was seething with discontent, but they kept you working so hard, you had no time for revolution; you were pretty busy knocking out programs.⁶

This sense of dissatisfaction was not limited to PTC. In Australia and overseas the early 1960s saw a growing discussion and questioning of the future direction of architectural education in line with what was seen as the role of architects in a society that was rapidly undergoing social and cultural change. Evidence of this can be found in various publications by architecture students and the profession during this period.⁷ In 1964, Graham Harler, a PTC student and newly elected Western Australian Architecture Students' Association (WAASA) president, responded to PTC architecture students' complaints in an article published in *The Architect*, calling on them to take more responsibility for their own education.⁸ During

this period the WAASA become increasingly active, taking on the role of organising extra-curricular events, including talks and exhibitions. However, it is the 1966 AASA convention that really marks the turning point in WA architectural education in the latter part of the 1960s.

In 1965 Harler was elected as the Federal President of the AASA and successfully lobbied to hold the 1966 convention in Perth. The WAASA, of which Harler was still President, formed the organising committee, setting the theme 'Architectural Education', for it was their view that this was "the greatest problem immediately facing architectural students".⁹

The convention was an ambitious and broad reaching project that aimed to build on the recommendations from the 1965 Ninth International Conference of Students in Architecture held in Stockholm. Students from all Australian and New Zealand schools of architecture along with the attendees at the Stockholm conference, as well as representative from the British Architectural Association, were invited to attend. Paul Ritter had recently published his book *Educreation* and a copy of the book, along with a copy of the report from the Stockholm Conference, were given to all delegates at registration.¹⁰ The convention ran over five days from the 21st to the 28th of May with lectures in the mornings and informal discussions in the afternoon. While perhaps not fully meeting the set aims, accounts of the convention portray a highly memorable and exhilarating experience, not only for students but the speakers as well. Architect John Byrne, then a student from Adelaide, recalls, "Four and a half decades later, I can still taste the magical contrast of an at least three hour performance by Bucky ... about the design of the world, technology, cities, ingenuity, creativity, spaceships, global earth ... and, on the other hand, a jewel-like one-hour lecture by Aldo (with black and white slides) given to us with love and gentleness and insight and logic, about how to design a doorway for people." For Byrne the 1966 convention was "the high point for its daring, competence and game-changing impact," and that, "Buckminster Fuller said afterwards it was the most significant and meaningful meeting of students he had seen or heard of."¹¹

Fuller and his ideas, according to Bonnemaison and Macy,

particularly appealed to the younger generation. His extra-ordinary vitality and idiosyncratic and personal speaking style are legendary. But it was his disdain for "conventional wisdom" and his insistence on "whole world thinking" that struck a chord among an idealistic youth critical of notions of progress and consumer society. Fuller became their prophet, bringing his domes and his vision of technological redemption as he lectured to students in over 300 universities around the world from the 1960s to the 1980s. In short, Fuller's geodesic structures achieved their phenomenal popular success because they seemed to correspond to the emerging insight about the global dimensions of life on earth.¹²

In many ways it was Duncan Richards who was instrumental in supporting and encouraging the PTC experimental dome building projects through his pedagogical initiatives. Richards,

a PTC graduate who had been a student during Bolland's tenure as head of the course, had taken up a teaching position in 1962. He had a strong interest in architectural pedagogy and was experimental in his approach to teaching. He believes this was made possible because of the context within which he was working, as he recalls:

The great and largely unnoticed virtue of the department during that decade was the looseness intrinsic to the academic system. Partly this was due to administrative ineptness, but it was also partly intended. Senior administrative staff such as Arnold Camerer and Alan Douglas had a remarkable organisational style. They seemed to believe that it was the role of administration to minimise 'academic bull' and shield the teaching staff so that they could get on with the job of teaching students as well as possible. They weren't inherently radical in outlook, but they were willing to listen to anything and I can assure you they had to. This looseness led to remarkable and diverse projects not all of which were successful.¹³

The geodesic dome experiments are perhaps the most significant of these projects as it gave students the tools to explore what architecture could be and what it could do. It was something that could be done on the ground and represents a type of activism that centred on not only on the power of the collective but also the individual's ability to bring about change.¹⁴

Marcus Collins was a key figure in the development and dissemination of dome theory and other experimental practices in WA during this period.¹⁵ From 1965 to 1966 Collins attended PTC, before switching to UWA in 1967 to complete his studies. Immediately following the 1966 convention, Collins completed a study of geodesic domes, tessellations, polyhedra and space filling polyhedral.¹⁶ This study, *Geodesic Principles and Design*, was completed as part of a design unit taught by Richards, and undertaken because of the lack of sources available. The study included spherical trigonometry that Collins taught himself from books at the PTC library. On completion, Collins was commissioned by Richards to construct a timber dome play piece.¹⁷ Collins built the dome with components, mainly comprising of two inch by four inch timber members, at home and then assembled the structure at the



Fig. 1 Students assembling timber play dome, Darlington, 1966. Marcus Collins private collection.

Richards' home in Darlington with the help of fellow students. Although the dome was a simple construction that did not require a high skill level, Collins was able to call on his carpentry skills from having built yachts as a youth.

Collins' interest in experimental structures went beyond geodesic domes, as was also the case for other PTC architecture students at the time. A talk and exhibition centred on progressive architecture was organised by the students and held in an inflatable structure designed and built by Collins and Ray Sweeney.

We had two big, linked inflatables taped together out of plastic film triangles, forming giant icosahedrons, inflated in a Perth Tech studio. One was built out of segmented triangular, clear plastic sheet, taped together, and the other one was done using white plastic sheet. They were two inflated icosahedrons, linked by a tube tunnel. To enter, we had two big sausage balloons, touching side by side that you squeezed through. It was the only way we could work out how to keep the air pressure and get in and out. You had to squeeze through these big blubbery lips to get in – very comic. We had an exhibition inside them of stuff we had done, stuff out of books on the future of architecture, with several projectors going outside the inflatables so the walls had movies going on them.¹⁸

Another experimental structure intended to house a student exhibition was constructed in 1966 at the Floreat Forum shortly after the inflatable pavilion. Designed by Rob Dann it consisted of scaffolding members linked by connectors to form the structure.¹⁹ Collins recalls,

The Floreat scaffold structure had an internal white translucent plastic film 'tent' taped together in panels the same shape as the scaffolding but about 200mm smaller. The tent nodes had attached tapes that were tied to the scaffolding nodes to tension it. After it was nearly finished it was pulled down. We didn't have enough material to mount the exhibition.²⁰

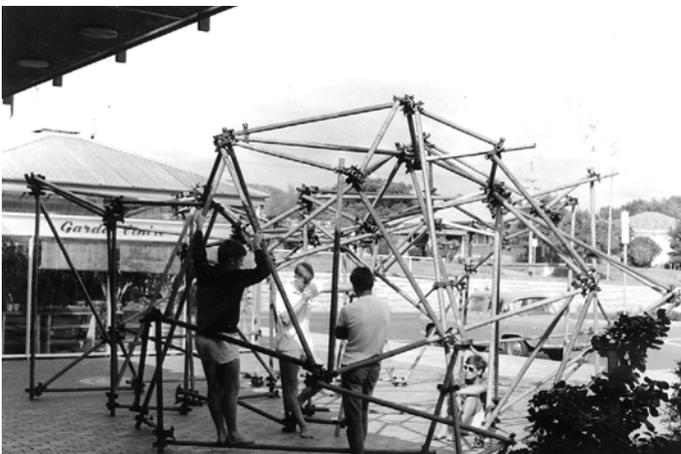


Fig. 2 Scaffold Structure, Floreat, 1966.
Marcus Collins private collection.

Around the same time, a second year design program run by Richards and fellow teaching staff member John White called for the design of an exhibition structure to display student work. After the studio exercise a group of the students decided to take the project further and to actually build a structure and have an exhibition of the work. A snail-like structure using bird wire netting plastered with plaster of Paris leaning against the building was proposed for outside the school on St Georges Terrace, positioned between the building and the footpath, however, it did not get approval from the department and was never constructed. Collins also recalled the student body experimenting with cardboard furniture and poster design along with other projects that have since been lost or forgotten.²¹

Collins' next dome project was a significant step up in terms of scale and ambition, a studio for Western Australian artist George Haynes. This was built and designed when Collins was a student at UWA and completed in early 1968.²² Haynes lived across the road from Richards, and seeing the small timber dome previously erected in his front yard, he enquired about having his own constructed for a studio. Collins designed a complex dome with fabricated aluminium parts and joints. The 35-foot dome was erected around a central mast, and comprised of 90 panels bolted along their side flanges with four hub connectors on each panel and aluminium tube struts. The panels were cut from a twenty-gauge aluminium sheet, and four millimetre aluminium sheet connectors cut and bent to shape. There was minimal wastage in the making of the panels, as they were cut as flat trapezoids, before being folded into the three dimensional panels. The panels were arranged into four different configurations, A, B, C and D, and once bolted into sequence the dome was formed. The Haynes dome was erected over several weeks again with the help of UWA students including Martin Grounds, Jack Kent, Ray Sweeney, John Bingham and Fred Zuideveld. The total time required in erecting the dome was not long, but time was required to organise the best erection method, fitting the panels together and solving the waterproofing. It was run as a social event, with tools, wine, and beer and barbecue food taken up on the weekends, with many more people than was required. Compared to the many geodesic dome experiments of this time, the Hayne's dome is a highly sophisticated and technically resolved project.²³



Fig. 3 George Haynes (l) and Marcus Collins (r) on site during the construction of the Haynes Dome, Darlington, 1967. Marcus Collins private collection.

This was the last dome experiment that Marcus Collins undertook. His 1969 fifth year student project clearly demonstrates a developing Archigram influence and a widening of his interests. His design thesis “Suspended Urban System” was presented with an eight-page comic book ‘Yabble Dabble’ complete with a ‘sensorial simulator’, a toy clicker distributed at the presentation.²⁴ The thesis detailed a suspended pod like structure, and the comic followed the adventures of Super Twit and Wonder Brat. The presentation took place in the original seminar room at UWA, which was complete with block out blinds. Collins recalls that the room was filled with the sounds of Jefferson Airplane and Tiny Tim, and two projectors showing images of the space race and the Vietnam War on the walls.²⁵

In 1967, the year after the convention, PTC students Martin Grounds, Malcolm Wilson, Geoff Holmes and Gordon Douglas erected a geodesic dome at the university as part of a second year project. This group of students had decided that sometime during the year they would embark on a project involving the group physically constructing something. The idea as they saw it was to “build something, go somewhere, do something.”²⁶ The project began half way through first term that year, with the aim to build a 25 foot, three-frequency geodesic dome. Tests, models and studies were carried out to determine the materials and methods of construction. The dome was constructed using Collins’ study. The head of the metal work department donated the sheet metal required, and the four students cut out the required 420 joints in the schools workshop. The dome was to be skinned with sisalation, as it was cheap, durable, resistant to tears, opaque and insulative. The students constructed a fully skinned 1/8 section of the dome, with fixing model and took it to the sisalation company in an effort to get the material sponsored, resulting in three rolls of sisalation 450 and eight rolls of pressure tape.

Whilst organising the dome, Richards’ class on Building Construction required the students to study and make measured drawings of a piece of vernacular architecture. This serendipitous requirement suited the four students, and the decision was made to take the dome up to Moora to live in and study a farm complex in the Berkshire valley. For these students the project gave them the opportunity “to live within the volume of the dome was



Fig. 4 Wilson, Grounds, Holmes and Douglas Dome, Berkshire Valley, 1967. R. M. Wilson, et al., Untitled booklet, 1967.

an exciting and valuable experience, especially at night when the colour of objects would be projected onto, and reflected by the triangular sisalation panels."²⁷

A full construction of half of the dome was undertaken a few weeks later on the school grounds, but on the first night a storm blew up and ripped the dome apart, and flung it several feet into the air, ripping the sisalation and breaking many of the members. The dome experiment was over.

The last projects to be covered in this paper are two domes constructed by Kim Dovey in 1973 as part of his final design thesis. Dovey studied at WAIT from 1969 to 1973, and Richards supervised his thesis that included a series of dome building workshops and a report *An Introduction to Geodesic Dome Building*.²⁸ The report dealt primarily with two aspects, an exploration of the natural structural laws of the universe, and their practical application in Geodesic construction.²⁹ Dovey ran two workshops on dome construction. The first was held at Lance Holt Primary School in Darlington, with Dovey helping the students to construct a dome that they could then use as a shelter on their frequent school bus trips. This was followed by an event held at the WAIT architecture building for 25 participants, consisting of a theory session conducted by Dovey followed by a day of dome building on the grassed area outside. These domes were constructed from dowel, polyurethane and other materials that were scrounged and begged off from suppliers. This workshop inspired the WAIT student guild to commission Dovey and use one of the domes constructed at this workshop to take across to the Aquarius Festival in Nimbin that year for use as shelter.

The Nimbin festival was a potent cultural landmark; one where the multiple domes erected resonated as a symbol of the festivals countercultural status.³⁰ The function of the domes, as countercultural symbols, is important when comparing to the earlier dome experiments. The shift from dome as a spatial and geometric experiment of Collins', very much a formal, structural exercise, to the dome acting as a symbol of a new emerging alternative culture allows us to observe the changing position of student output and thought. The dome shifts from a symbol of the brave new world, a technological challenge, to a symbol of the 'hippy' world, with promises of alternative living modes.



Fig. 5 Dovey Dome, Aquarius Festival, Nimbin, 1973. Kim Dovey private collection.

Dovey's structure for the Aquarius Festival marks the end of the era of significant geodesic dome projects by architecture students in WA. Significantly, this paper has documented the geodesic domes and other experimental structures undertaken by WA architecture students in the period following the 1966 AASA Convention. These projects are some of the earliest known examples of student experimental structures of this type and suggest a shift in pedagogy in WA that provided scope for more holistic and idiosyncratic approaches to architectural education. While architectural education has continued to change, perhaps, in architectural education and higher education generally, there is something these projects can help us remember. As Dovey points out, "there was a sense I had, [and] I may be wrong, that many people teaching us were as confused as we were about what architecture was, and where it was going that in a strange way was an extraordinarily liberating thing."³¹

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- 1 Beatriz Colomina, "Radical Pedagogies," <http://radical-pedagogies.com> (accessed April 17, 2015).
 - 2 Works such as Glen Hill and Lee Stickells, "Pig Architecture: The Architecture Student Strike of 1972 Ushered in a New Era of Architectural Education," *Architecture Australia* 101, no.2 (March/April 2012): 75-76; Lee Stickells, "Other Australian Architecture: Excavating Alternative Practices of the 1960s and 1970s," in *Fabulation: Myth, Nature, Heritage: The 29th Annual Conference of the Society of Architectural Historians, Australia and New Zealand*, ed. Stuart King, Anuradha Chatterjee and Stephen Loo (Launceston, Tasmania: SAHANZ, 2012); Elizabeth Musgrave, "What's 'out' ... what's 'in': Revolution versus Evolution: John Dalton Architect as Pamphleteer," in *Proceedings of the Society of Architectural Historians, Australia and New Zealand: 30, Open*, ed. Alexandra Brown and Andrew Leach (Gold Coast, Qld: SAHANZ, 2013), vol. 2, 461-471.
 - 3 Lee Stickells, "'And Everywhere Those Strange Polygonal Igloos': Framing a History of Australian Countercultural Architecture," in *Proceedings of the Society of Architectural Historians, Australia and New Zealand: 30, Open*, ed. Alexandra Brown and Andrew Leach (Gold Coast, Qld: SAHANZ, 2013), 557.
 - 4 Duncan Richards and Barbara van Bronswijk both mention the 1966 convention in their essays: Duncan Richards, "Recollections of the Department of Architecture (1953-1994)," in *Visions and Voices: Curtin University Celebrates 50 Years of Architectural Education 1946-1996*, ed. Barbara van Bronswijk (Bentley, WA: School of Architecture Construction and Planning, Curtin University of Technology, 1996), 26; Barbara van Bronswijk, "Recapping the Past – Fifty Years of the Teaching of Architecture at Perth Technical College, The Western Australian Institute of Technology and Curtin University of Technology, 1946-1996," in *Visions and Voices*, 18, 19.
 - 5 Special Issue: Students Convention, *The Architect WA* 9, no. 85 (1966).
 - 6 Martin Grounds and John (Jack) Kent, "Martin Grounds and John (Jack) Kent interview, 9 January 2015," *UWA Historical Society: UWA Histories*, <http://oralhistories.arts.uwa.edu.au/items/show/87> (accessed April 17, 2015).
 - 7 A series of essays titled 'A Symposium of Seven Architects' published in September 1961 in *Architecture in Australia* is a good example of this discussion. See also the UQ and QIT student publications *Scarab* and *ASM*, and the John Dalton publications *diametrix* and *Broadside*.
 - 8 Graham Harler, "For the Critics," *The Architect WA* 7, no. 77 (1964): 50-51.
 - 9 Preamble, Special Issue: Students Convention, *The Architect WA* 9, no. 85 (1966): 37.
 - 10 Paul Ritter, *Educreation* (Oxford: Pergamon, 1966).
 - 11 Barnaby Bennet and Byron Kinniard, *Congress* (Christchurch: Freerange Press, 2011).
 - 12 Sarah Bonnemaïson and Christine Macy, *Architecture and Nature: Creating the American Landscape* (New York: Routledge, 2003), 293-294.
 - 13 Duncan Richards, "Recollections of the Department of Architecture (1953-1994)," in *Visions and Voices*, 27.
 - 14 For further discussion of this shift, see Sarah Bonnemaïson and Christine Macy, *Architecture and Nature: Creating the American Landscape* (New York: Routledge, 2003), 330-331.

- 15 Marcus Collins commenced practice shortly after graduating and has made a significant contribution to West Australian architecture since, most notably his work for the University of Notre Dame. He was recently awarded the 2014 Architects Board of WA Board Award, and is still in practice.
- 16 Marcus Collins, "Geodesic Principles and Design" (Unpublished design studio booklet, Perth Technical College, 1966).
- 17 Marcus Collins, interview with Andrew Murray and Leonie Matthews, April 20, 2012.
- 18 Marcus Collins, interview with Andrew Murray and Leonie Matthews, April 20, 2012.
- 19 Marcus Collins, email to Andrew Murray, April 23, 2013.
- 20 Martin Grounds, email to Andrew Murray, May 1, 2013.
- 21 Marcus Collins, interview with Andrew Murray and Leonie Matthews, April 20, 2012.
- 22 "Dome to be Art Studio," *The West Australian*, January 25, 1968, 4.
- 23 In particular Roy Grounds' 'Barn at Penders' dome project of the same period.
- 24 Marcus Collins, "Yabble Dabble Supacomic" (Final project, School of Architecture, University of Western Australia, 1969).
- 25 Marcus Collins, email to Andrew Murray, April 23, 2013.
- 26 R. M. Wilson et al., Untitled booklet (Department of Architecture, Perth Technical College, 1967).
- 27 Wilson et al., Untitled booklet.
- 28 Kim Dovey completed a doctorate at the University of California, Berkeley. He is currently Professor of Architecture and Urban Design at The University of Melbourne and his ongoing research focuses on social issues in architecture and urban design.
- 29 Kim Dovey, "An Introduction to Geodesic Dome Building" (Thesis project, Department of Architecture, Western Australian Institute of Technology, 1973).
- 30 Stickells, "And Everywhere Those Strange Polygonal Igloos", 556.
- 31 Kim Dovey, interview with Andrew Murray, November 14, 2014.