

Sydney's Opera House

Sydney's new Opera House belongs to a select group of buildings that become immediate popular symbols. It *is* Sydney, just as Big Ben is London, the Arc de Triomphe is Paris and the Empire State Building is New York City. It could thus be argued that it put the city on some sort of mental map of great world cities. Furthermore, though residents and visitors disagree on its aesthetic merits, no one would question that it is a highly memorable building. Whether seen by day in the crisp Sydney sunlight, or at night against the reflected lights in the great harbour, its unusual sailing-ship form is a sight that no one forgets. And, despite the disagreement, there are many, both professional architects and lay critics, who think it one of the twentieth century's great buildings.

Yet, even if the Sydney Opera House is a great architectural triumph, it is without doubt a planning disaster. It sets some kind of world record, against strong competition from other projects in this book and elsewhere, for time delay in completion and for cost escalation. Originally estimated in 1957 to cost just over \$A7,000,000 and to be completed by January 1963, it was in fact finished in October 1973 at a cost of \$A102,000,000. In the meantime its total internal design had to be changed in order to avoid even greater delays and cost increases, so that it does not even function as the major opera house that was its principal *raison d'être*. The story is an extraordinary one involving classic ingredients of inadequate cost estimates, major problems of engineering design and inadequate technical control. It has been well documented in Australian sources, on which this account freely draws.

THE BEGINNINGS: COMPETITION AND COMMITMENT

Bennelong Point is Australia's Plymouth Rock. It was one of the two points enclosing Sydney Cove, where Captain Phillip landed in 1788. (The other forms one end of the Harbour Bridge, Sydney's other symbol.) It was small wonder that imaginative individuals saw it as a logical place to put a unique cultural monument. One of these was Eugene Goossens, director of the New South Wales Conservatorium of Music and resident conductor of the Sydney Symphony Orchestra, who campaigned from 1947 onwards for an opera house and concert hall worthy of a great metropolitan city. The other was John Joseph Cahill, in the 1950s Labour Prime Minister of New South Wales, who saw this as a political opportunity for a great imaginative gesture.

So, in November 1954, a committee was set up to consider how to build an opera house. It recommended, and the government of New South Wales accepted, that for such a prestigious building an international competition would be appropriate. In September 1955 the government announced the terms. There was to be a large hall, housing between 3,000 and 3,500 people, for grand opera, symphony concerts, choral works, ballet and large meetings; and a smaller hall, seating 1,200, for drama, intimate opera, chamber music, smaller concerts and recitals. The international jury consisted of Eero Saarinen, from the United States, Leslie Martin from Great Britain and Henry Ashworth and Cobden Parkes from Australia.

In January 1957 Cahill announced that out of 233 entries the jury of assessors had chosen that of a relatively unknown thirty-eight-year-old Danish architect, Jørn Utzon, who had submitted a highly unusual design consisting of two sets of interlocking concrete shells, or half-domes, placed side by side. The assessors commented:

The drawings submitted for this scheme are simple to the point of being diagrammatic. Nevertheless, as we have returned again and again to the study of these drawings, we are convinced that they present a concept of an opera house which is capable of becoming one of the great buildings of the world. We consider this scheme to

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be the most original and creative submission. Because of its originality, it is clearly a controversial design. We are, however, absolutely convinced about its merits.¹

The statement that the drawings were 'diagrammatic' was almost an understatement. In the words of Ove Arup, who became structural engineer for the scheme:

It certainly required great courage to back a scheme like this which contained hardly any details or any evidence of its structural feasibility. Had the panel of Assessors included an engineer it might have meant the loss of one of the great buildings of the world – but I suspect it was reassured by the then prevailing faith amongst architects of the omnipotence of shells.²

Equally elementary was the consideration of cost. The assessors' report stated that they had required cost estimates to be made of all the schemes placed in their final list, and that Urzon's was actually the most economic. Arup's subsequent comment was: 'This estimate of three and a half million [pounds], prepared, I believe, by some unfortunate Quantity Surveyors under duress in a few hours, was of course hopelessly out.'³

So, remarkably, the competition was won on the basis of an expert judgement by a jury that lacked hard evidence either of the structural soundness of the design or of its eventual cost. It was said that Eero Saarinen, then at the height of his prestige, persuaded his fellow jurors to go for an adventurous solution. Whatever the case, they certainly left the state of New South Wales with a major problem of decision-making in uncertainty.

But at this time, some politicians at least were inclined to be adventurous. It is suggested that Cahill well knew that the original estimate, which translates to \$A7,000,000 (Table 13), was hopelessly over-optimistic. But he used it to push the project through a rather apathetic Labour party caucus, which in 1958 accepted it by a narrow margin of twenty-four votes to seventeen.⁴ One reason was the need for an exciting project to put to the electorate at the forthcoming March 1959 election, where Cahill was fighting for his political life against strong Country party

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Table 13

SYDNEY OPERA HOUSE: COST AND TIME ESTIMATES

<i>Date of estimate</i>	<i>Estimated cost \$A million</i>	<i>Estimated completion date</i>
January 1957	7.20	January 1963
January 1959	9.76	
October 1961	17.94	
August 1962	25.00	Early 1965
June 1964	34.80	March 1967
August 1965	49.40	
September 1968	85.00	End-1972
November 1971	93.00	
March 1972	99.50	
May 1974	102.00*	October 1973*

* Actual figures

Sources: M. Baume, *The Sydney Opera House Affair* (Melbourne, 1967); J. Yeomans, *The Other Taj Mahal: What Happened to the Sydney Opera House* (Camberwell, Vic., 1973), and *Sydney Morning Herald*, various dates, 1969-74.

opposition. A revised estimate of \$A9,800,000 was made by a firm of surveyors, again on the basis of such information as Utzon had, and was used by Cahill to press on with a start, despite the advice of Utzon and the engineers. So a contract was actually let for the foundations in January 1959, before the structure and roof were designed. In 1960 the New South Wales parliament passed the Sydney Opera House Act, allowing the revised estimate of \$A9,760,000 (with a 10 per cent contingency) to be raised from state lotteries, without the need for tax funds – an important part of the scheme that Cahill had sold to his own party in 1958 and to the electorate in 1959.² Thus, by a snap commitment, the government and people of New South Wales embarked on the enterprise. Ironically in this same year, 1960, Cahill died.

1960-6: THE QUEST FOR STRUCTURAL SOLUTIONS

When work started in 1959 on the foundations, there were still two fundamental technical problems to be solved. The lesser (though still substantial) was the movement of stage scenery. Utzon's design put the two auditoria side by side, greatly simplifying problems of pedestrian and vehicle circulation on a restricted site, but at the expense of leaving no wing space for the big sets inseparable from grand opera. Utzon solved this by hiding towers within the wings of his domes, which could be used for vertical movement of scenery. This problem was given to a specialist engineering firm.

The bigger problem by far was how to support the shells so as to make them strong enough to withstand high winds. It arose because of the unusual shape of the shells, which, as one Australian author put it, resemble 'an elephant standing on its two front legs'.⁶ This was obviously a job for a structural engineer, and logically the advisory committee set up in 1957 to supervise the design of the building decided to bring in the firm of Ove Arup, the most experienced in Europe for this kind of work. Thus it came about that the real structure of the building, to be provided in Stages I and II of construction – the foundations, the sails and the podium – were in the hands of Arup, while Utzon was restricted to cladding and paving in Stage III. Arup were furthermore made directly responsible to the government of New South Wales. Since Utzon had had no previous experience of supervising anything bigger than a medium-sized housing project, it was obviously felt necessary to bring in Arup in effect as co-principals, with separate subcontracts to specialist consultants in acoustics, electrical engineering, mechanical engineering, heating and ventilating, air-conditioning and lighting. And this itself made it uncertain whether the sub-consultants' fees could be recovered from the budget available from the government to the main consultant.⁷

As the design work proceeded, more and more complications appeared. Enormous quantities of work had to be modified or scrapped. The Arup firm alone spent a total of 370,000

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man-hours on the job down to 1965.⁸ The root of the problem was the persistent difficulty in getting an adequate solution for the shells, plus the interrelationship of all the subcontractors. As Ove Arup himself put it:

... most of the alterations which have occurred on this job – and they are numerous – are due to the cropping up of new design considerations owing to Clients' wishes, unforeseen difficulties and especially the work of other specialists on heating, theatre techniques or acoustics, etc. impinging on the structure or *vice-versa*. The interdependence of all these 'trades' makes it impossible for any of them to go forward with a clear brief – the briefs for each have to be gradually developed through a process of trial and error. This is the central difficulty. It wouldn't be so difficult if one were only looking for a technical solution, but every possible solution has architectural or aesthetic repercussions, and all the easy ones are probably taboo on that score. Sometimes the only really satisfactory answer is to start all over again from the beginning, incorporating the new requirement.⁹

Sometimes, indeed, just that did happen. Stage I of the work, for the foundations and the concrete box over it, was contracted in February 1959 for completion by February 1961 with the notion that the whole building would be ready by January 1963, though Utzon, apparently, never agreed these dates. This first contract was started on approximate bills of quantities and without benefit of Utzon's drawings, which were supposed to be ready a few months later but were in fact much delayed. So sizeable mistakes were made, and a large part of the foundations built in 1961 had to be demolished in 1963 because the design of the shells had been changed. Stage I was eventually completed nearly two years behind schedule, at double its original estimated cost of \$A2,800,000.¹⁰

The roof design was finally ready in 1962, after five years' work by Arup, and the Stage II contract for it was let in October of that year to an Australian contractor (Hornibrook Pty Ltd) on a cost-plus basis. It was not finished until 1967. Arup was responsible for scheduling this contract in association with the contractors and the quantity surveyor. During this period relations

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between Utzon and Arup deteriorated to the point when, in 1963, there was no longer any on-site communication. Utzon objected to receiving advice from Arup, and apparently became convinced that Arup was trying to take his responsibilities for Stage III (cladding and paving) from him. The argument came to a head over the design for cladding the ceiling, where Utzon wanted pre-finished plywood components which Arup thought impractical. Eventually, asked for a report by the Minister, Arup sent a statement to this effect in January 1966.¹¹

The problem was exacerbated throughout this long period by the fact that the executive committee, a part-time body, lacked the necessary resources to evaluate the designs in detail and to provide the proper client role that such a major project needed. From the 1960 Act onward, they played a merely advisory role to the government, which was the legal client. But they still gave the vital advice about release of payments, and from 1963 onwards this precipitated a crisis. In March 1962 Utzon told the executive committee that he expected to complete the detailed Stage III drawings by March 1963. But two and a half years after that date there was still no sign of them.

1966-73: POST-UTZON

Meanwhile, in May 1965, the long-running Labour government in New South Wales had been toppled by a Liberal-Country party coalition headed by Robin Adkin. In the election, the escalating cost and delayed completion of the Opera House had naturally become a major controversy. At this time the government took the power over payments from the executive committee and transferred it to the Minister of Public Works, Davis Hughes, who had been the original Stage I engineer. It was this that precipitated the final showdown with Utzon. At the end of February 1966, goaded by Arup's roof report, he resigned on the issue of non-payment by the state government of fees for engineering work by his staff. Ten days later, he was offered the compromise post of design architect – but in a hierarchy headed by the New South Wales government Chief Architect E.H. Farmer, and

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including also Peter Hall,* D.S. Littlemore and Lionel Todd.¹² He naturally refused and disappeared from the scene, inevitably triggering further controversy. His critics claimed that he had sought to design the perfect opera house, regardless of cost, time or any other consideration; his defenders alleged that he had been frustrated by the lack of adequate briefs and by the refusal of the government to provide testing facilities for his designs.¹³

Whatever the case, the new architects immediately found themselves in the middle of a new controversy. It appeared that in direct contravention of a brief to design the Opera House for a concert capacity of 2,800, Utzon had told his acoustic consultant, Professor Cremer, to work for a total of 2,600. In June 1966, the Australian Broadcasting Corporation Symphony Orchestra, who were to be principal users, laid down their conditions for the hall. It was to have a capacity of 2,800, plus a reverberation time longer than Utzon had designed for, plus a rehearsal room three times the size of the one Utzon had designed, plus a host of detailed requirements which the new architectural team found simply impossible to satisfy. After six months of wrestling with the problem, they emerged with a drastic solution. Having consulted seating and management experts, they recommended a complete reversal of Utzon's original design. The main hall, with the original capacity of 2,800, would be reserved for concerts only; the scenery space, thus saved, would be used for a rehearsal and broadcast room, and for an enlarged small theatre to act as a cinema and a chamber music hall. The smaller auditorium would then become the opera house, with a capacity of 1,500. Since the original design had provided only 1,904 seats in the big auditorium for opera, the total redesign provided for a big increase in capacity:

Big auditorium	1,904 to 2,800
Small auditorium	1,150 to 1,500
Small theatre	350 to 6/700
Total	3,554 to 6,550

* A leading Australian architect; no relation to the Director of Britain's National Theatre or to the author of this book.

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This was an economic solution; and it would satisfy the concert interests, since the necessary reverberation times could be met. But it would mean scrapping most of the elaborate stage machinery to move the stage sets vertically in the big auditorium, already installed at a cost of \$A2,700,000. And it would mean that the Opera House could never fulfil its original purpose of housing full-scale grand opera by companies such as La Scala of Milan, since the stage sets could never be fitted in. The result was a furious controversy between the concert lobby, represented by the ABC, and the opera interest, represented by the Elizabethan Theatre Trust and the Opera House Trust, with the Australian architects falling in on the concert side. Finally, in March 1967, the Cabinet of New South Wales accepted the proposal of the Minister of Public Works that the modification should go ahead.¹⁴ Not until a year after this was a detailed brief ready, with consequent slight alterations in capacity. The redesign meant removal of the proscenium arch and the great steel stage tower.¹⁵

It was at this point, as Table 13 shows, that the major cost escalation occurred. Now costing \$A85,000,000, more than ten times the original estimate, the building was re-scheduled for completion at the end of 1972. In March 1969 the New South Wales legislature accordingly passed an Act providing for further lotteries to yield the \$A85,000,000 total. But by March 1972 it was revealed that the cost had risen to \$A99,500,000, of which no less than \$A11,200,000 represented unpredictable price rises in the building industry.

The Sydney Opera House was actually opened on 20 October 1973. Half a year later, in May 1974, the Minister of Public Works announced the final bill: \$A102,000,000. All but \$A9,300,000 had been raised from lotteries; this remainder was owed to the State Treasurer as bridging finance, to be repaid over twelve months from further lotteries. The building had actually opened without car-parking facilities, estimated to cost a further \$A7,000,000 as long before as 1969; the government attitude on that, somewhat understandably, was to wait and see.

The Opera House proved not only expensive to build, but also

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expensive to run. In 1974, its first full year of opening, its costs were running at \$A6,000,000 a year, of which more than half represented salaries; as one politician said, Utzon had designed a very labour-intensive building. Only one-third of this came from revenue; the remaining \$A4,000,000 had to be found from government subsidy, raised by continuing the lottery. But since inflation of wage costs was very rapid in Australia, the threat was of a \$A7,500,000 bill in 1975 and of an increase in Opera House rents to \$A7,000 a week plus a share of ticket revenues. This, it was suggested, might cause ticket prices to be raised above \$A10 per performance, prompting sales resistance and even causing the Australian Opera to retire in search of a cheaper building. Thus, ironically, the threat existed that the Opera House would prove too expensive for the main purpose for which it was originally designed. But part of the problem, undoubtedly, was the redesign which had given the Opera House in its final form only 1,400 seats, making it the smallest opera house in the world (except for specialist ones, like Glyndebourne).

One counter-argument was that it did not matter much. The Opera House had actually cost the taxpayer of New South Wales very little to build, because of the lottery device that had proved so popular. The possibility always existed that most of the running cost could also be paid this way. Thus, the average Australian's gambling fever could pay for the minority Australian's culture. But it remained to be seen how far that argument could run with populist politicians.

A RETROSPECTIVE VERDICT

It has sometimes seemed that there were as many views on the Sydney Opera House as there were Australians. Certainly, hardly any public project can have had more words of controversy written about it. But certain key points of agreement do perhaps emerge.

The Opera House set some kind of record in cost escalation. In this, certain key factors proved critical. The government of the day was committed to a prestige project for political reasons.

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Cost was almost a secondary consideration. Thus the jury of assessors was encouraged to look at designs on their merits. Though the jury did do a costing exercise, it was elementary, certainly in view of the originality and complexity of the design. Such a design was by definition extremely difficult, if not impossible, to cost in advance. Normal contingency allowances were almost bound to be inappropriate, even wildly so. Arup's comment is perhaps the best verdict:

... the thing we wanted built was Utzon's Opera House, not some botch up of it. And that Opera House costs that amount of money – approximately – and would from the beginning have cost that amount of money, only nobody knew it then ... if these facts had been known to begin with, the Opera House would probably never have been built. And the fact that it wasn't known, and that clients and public were completely misled by the first so-called estimate, was one of the unusual circumstances that made this miracle possible.¹⁶

This is perhaps slightly disingenuous. Those most concerned to get the Opera House certainly understood how delicate was the political balance at its start. As Arup himself admits, '... it was explained to me that if a *fait accompli* were not established whilst Mr Cahill was Premier the job would probably not go forward at all. And nobody knew for certain whether Mr Cahill and his party would be re-elected in March '59.'¹⁷

So the Stage I works were let deliberately in order to establish a commitment on which the Country party, if elected, could not readily renege. It has been suggested that at this point Cahill must have been doubtful that the estimate was at all realistic. It was later estimated by David Hughes that the premature start added \$A12,000,000 in stop-go procedures and demolition of wrong structures. But probably it saved the Opera House – for, had there been time for a more sober assessment, the political commitment might have evaporated.

The next point is the personalities of the chief professionals. Utzon was a perfectionist who, understandably, regarded this as his master work; he evidently refused to compromise for the sake of time or cost. Since he was inexperienced, the responsibility

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was split equally between him and Arup, leading to personality clashes, over technical details, that were eventually to lead to Utzon's departure. The point of difference, which finally escalated into the resignation controversy, concerned payment of fees. Utzon refused to deliver any drawings until he was paid; the government finally refused to pay until it saw the drawings. When the Stage III drawings finally appeared in May 1966, four months after Utzon's departure, the new architectural team found that none of them dimensioned a room, identified a material or described a building component. Behind this was a complete lack of knowledge of user requirements, including such vital technical standards as acoustics, equipment and catering, which could lead the principal prospective user, after nine years of design work, to reject the planned accommodation as unsuitable.¹⁸

Part of the explanation for this could have simply been long lines of communication. Utzon first visited Sydney six months after the competition result was announced. Thereafter he worked in Denmark, with occasional visits to Arup in London and to the site in Sydney, until 1963 when he moved to Sydney. The main engineering design work was done from Arup's London office where much of the expertise was necessarily concentrated. There may therefore have been a failure to maintain regular contact with the clients, whose requirements in a building of this kind were very exacting. All this was exacerbated by the executive committee's part-time role and by their consequent lack of detailed supervision, as witnessed by the fact that they did not even know of Utzon's deviation from the seating plan.

Where to place final blame, if blame in such a case is appropriate at all, will depend to some degree on personal predilections. Conspiracy theory is certainly appropriate for the role of some of the politicians. But a conspiracy was possible only because of the basic uncertainties over costs and timing which were inseparable from such a project. If the government and people of New South Wales had wanted an opera house with firmer cost limits, they should have accepted a simpler and entirely more conventional design. But they surrendered that job in effect to the

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experts, and they clearly felt they had to respect the resulting verdict. And given that, they had to go along, at least for a minimal number of years, with the working methods of the architect, including his constant search for perfection and his unwillingness to delegate details.

The final point might be phrased in Melvin Webber's questions, originally asked about San Francisco's BART system. Who pays? Who benefits? Who decides? In the case of Sydney Opera House, the gamblers paid. A minority of people, mainly but not exclusively in the upper income bracket of Sydney society, gained directly, though it might be claimed that there was a psychic income, as the economists put it, to all the people of Sydney and to the visitors who see it. Those who decided, ironically, were politicians, and behind them the electorate, who voted for an elitist project in a highly populist society. The irony is that the decision taken in 1958-9 might have been rejected with hindsight in 1965-6 but, just possibly, reaffirmed with further hindsight in 1979.