

## **Freefall: A Rational Approach to Delight**

Good evening ladies, gentlemen and special guests.

Thank you for welcoming me to Canberra.

It is a great honour to have been asked to be the guest orator for the 2014 Sir John Butters Memorial Oration and speak about the journey that is the Freefall Experience. It was a privilege to be named the Winner of the Freefall Experience Design Ideas Competition, run by Engineers Australia. The opportunity to design a sculptural installation for the Engineer's Australia Pin Oak forest is one that I value significantly; not only as it will mark the centenary of Engineers Australia in 2019 and provide an enduring celebration of the contribution of engineers to society; but to participate more broadly in the growth and life of our nation's capital. I am certainly keen to help maintain momentum in the process that was initiated by the Canberra division of Engineers Australia in November last year. It is my hope that this speech helps to achieve that aim.

In researching the legacy of Sir John Butters I have been struck by the pride that is held by the current engineering community in the group of Engineers that were instrumental in the creation of our capital city and in particular their forthright demeanour. They are regarded for more than their considerable ability to design the infrastructure necessary to convert a sheep station into a city, but also respected as key collaborators at the planning and decision table. Indeed Sir John was appointed as Chief Commissioner of Canberra in 1925. I will try to take some cue from Sir John Butters and his colleagues to speak broadly about my experiences in participating in the competition.

The Freefall Design competition continues a rich tradition in Canberra of opening up design opportunities to a wide field of participants. From the 1913 international competition for the city plan won by Walter Burley Griffin and Marion Mahony Griffin, and the 1979 competition for Parliament House; to the design for the National Arboretum following the 2003 bushfires, Canberra has benefitted from the enthusiasm inspired by the opportunity to contribute to a nation's capital. One of the many well-considered aspects of the Freefall Experience Design Ideas competition was the requirement that all entries were to be made by a Member of Engineers Australia. While enabling collaboration with other artists and design professionals, this format naturally put the Engineer front and centre, with the challenge to lead the team in the interpretation and realisation of the design aspirations for the installation. I would like to commend Engineers Australia for a very professional approach to the competition including strong and clear design aspirations and parameters, well designed information, the drawing of a highly respected jury including the designers of the Arboretum and a substantial prize recognising the effort that is required to achieve a worthy outcome. As a Member of our organisation, I have in the past expressed my frustration that we do not project ourselves in a progressive professional manner. An organisation with over 100,000 members involved in complex, highly responsible and important work seemed to me to be falling well short of what was possible. From a personal perspective the Freefall

competition was one of the best initiatives I have come across to both engage Members in the life of the organisation and also to project the Institution in a progressive manner to the broader community. The Design competition is a real manifestation of the current EA StrENGth campaign, which is focussed on active participation of Members and engaging with community with a unified voice. We are all aware that engineering is generally a background force in society, which generally only comes to the fore at times of disaster and failure like the Christchurch earthquakes or Brisbane floods. It is tantalising to consider the opportunity for a place of deeper reflection on engineers' contribution to the nation.

Before I come to the title and primary topic of this address I would like to speak a little further on Canberra and The National Arboretum. The process of deriving concepts for the Freefall sculpture involved much discovery. Possibly the first discovery was how enjoyable the process of researching and developing concepts for a public sculpture is – for example, the nature of Pin Oaks and indeed the Australian Freefall cultivar; the extraordinary complexity of the ear. The second discovery was how difficult it is to arrive at a concept that can be translated into a meaningful built form. The third discovery was the realisation of the significance of Canberra as a city that is effectively a place that we all belong to. It is common ground for all Australians and one that we have all heavily invested in. It is certainly a fitting location for a place to celebrate 100 years of our organisation and as stated in the competition Design Aspirations, a 'framework for recognition of engineers' contribution to the nation'. Involvement in the National Arboretum as a special place away from city office headquarters was an inspired decision by Engineers Australia. Our nation's capital was intended from its beginning to be a place that utilised the beauty and power of the natural world to create a sense of grandness at the seat of government. As a brand new city, the drama of the surrounding mountains created a presence that couldn't be achieved in a short time span with buildings and infrastructure. The National Arboretum on the undulating hills above Lake Burley Griffin is both an integral part of the city landscape as well as a magnificent viewing platform back to the city's commercial and political heart. It would be difficult to think of a better place to achieve another of the Design Aspirations – an engaging setting for celebration and events.

Simply named 'Freefall' – our sculpture builds on the experience of monumental sculptures that are already a popular aspect of visiting the National Arboretum. Located on an axis between Wide Brown Land and Nest on Dairyfarmers Hill, Freefall will become a significant contribution to the National Arboretum, taking on a grand Sculpture Park dimension. Gibbs farm Sculpture Park outside Auckland has achieved international recognition for its collection of landscape scale sculptures, a place where human creativity interacts with nature. The opportunity for Engineers Australia to be identified as a major contributor in this creative endeavour, a process that was initiated with the planting of the Pin Oak forest is tremendous. A further thought toward building momentum in the Arboretum becoming a significant landscape sculpture destination was stimulated on a recent visit to the National Gallery sculpture garden in Canberra. Many of the larger works are cramped between the gallery and Lake Burley

Griffin. Their scale and beauty is lost in the confined and formal space. Perhaps another creative opportunity exists for our organisation to assist in relocating a number of these valuable works to the Arboretum. This could only be a rewarding activity for young engineers looking for opportunities to contribute outside their usual roles. Since writing this idea though, I have discovered that the NGA sculpture garden is listed in the Australian Heritage register and is considered to be 'a unique product of the finest aspirations' so I may not be onto a winning idea.

The title of this talk, 'Freefall: A rational Approach to Delight', while intentionally catchy, is intended to reflect an approach to a design competition that perhaps only engineers could take. The initial primary questions: What do people like to visit and what makes a sculpture delightfully successful were overlaid onto the ambitious competition Design Aspirations. The 10 Design Aspirations being:

1. A futuristic declaration demonstrating engineers' spirit of ingenuity
2. A showpiece destination within the National Arboretum
3. An inspiring journey of discovery and imagination
4. A participatory and stimulating experience for all ages
5. A framework for recognition of engineers' contribution to the nation
6. An engaging setting for celebration and events
7. An enhancement of the Arboretum environment in all of its physical and seasonal splendour
8. A demonstration of enduring materiality designed to last 100 years
9. A meaningful echo of the traditional custodians of the land
10. A contribution to the nation's capital in recognition of the Centenary of Canberra.

With the aspiration for the sculpture to be a showpiece destination, the starting point was to consider what people like to visit. So many public art installations seem to only hold momentary interest to people. I distilled this down to seven broad aspects not specifically relating to public art. In no particular order these were;

- Views
- Famous things – and the potential to be photographed beside and associated with fame
- Big things
- Contact with nature
- Performance and to be entertained
- To participate and contribute
- Culture and personal growth

The National Arboretum and Canberra naturally facilitate most of these basic criteria so for Freefall, it is a matter of enhancing the experiences that many visitors are already seeking rather than creating a separate experience. Views (to Canberra – Lake Burley Griffin, Parliament House ), the distant southern mountains , neighbouring Black Mountain; contact with nature – exploring the arboretum forest plantings; learning – including the extensive historical and

botanical information in the visitors centre; and participation – most notably kite flying when I first visited the windy site, are all integral to the Arboretum experience. The hope of course is that if successful, Engineers Australia Freefall will also be visited on the basis of fame. That may be a shallow aim, however I think that there is a real chance that if the Arboretum landscape sculpture park continues to develop as envisaged, Freefall will become an integral part of a well known landscape art experience and engineers' spirit of ingenuity will be celebrated to a wide audience.

When considering the more specific question of 'what makes a sculpture successful', I naturally thought about memorable personal experiences. Green Mountain Blue on the Monaro Highway between Canberra and Cooma has always seemed a powerful human intervention in the landscape with its sparse use of four massive steel members balancing each other as they reach into the landscape. Erected as private commission on farmland in 1978, it was donated to the National Gallery of Australia in 1981. It is perhaps precedence for future siting of NGA works in the Arboretum landscape. Peter Cole sculptures, which were commissioned for the World Expo in Brisbane 1988, have a strong humanistic appeal with their abstract connection of man and nature – a continuation of the rationalism of ancient Greece where 'man was the measure of all things' and art was grounded in observations of the patterns and order of nature. Consideration of these sculptures, along with others such as the 'kinetic' sculptures' of the American Alexander Calder which are expressive of a dynamic balance of forces, led to a collection of basic criteria that the Freefall design would strive to achieve. These would provide the sculptural underpinning of the competition Design Aspirations.

Firstly and most significantly – the sculpture had to be **meaningful** with the sense of understanding readily accessible. Along with the stunning site, this is a key strength of the Freefall competition – as a framework for recognition of engineers' contribution to the nation and a declaration demonstrating engineers' spirit of ingenuity - there is abundant opportunity to infuse the sculpture with meaning. When the architect, Nick Flutter joined our team, he commented that although he had always been attracted to the idea of creating public art, he had never had an idea that he thought was sufficiently meaningful to warrant bringing to fruition. This sentiment probably explains why so much art, which is commissioned to activate a public space, holds only passing interest. An aspect of meaning that was included in the competition design aspirations was to have a tangible link with traditional custodians of the land. I spoke at length with Brisbane architect Kevin O'Brien who created the Finding Country exhibition at the 2012 Venice Architecture Biennale about how this may successfully be approached. Kevin strives to illuminate the ground on which Australian architects and engineers draw and build as being 'full of what can't be seen' rather than a blank sheet of white paper. His clear guidance with respect to Freefall was that fire is a tool that has been used with knowledge and expertise on a continuous basis for 40,000 years to modify the Australian landscape and references in this respect would be valid for a sculpture celebrating scientific endeavour. I found this to be an interesting perspective and one that would need

to be handled sensitively in the context of the Arboretum being born out of the ashes and memories of the 2003 Canberra wild fire.

Secondly, the sculpture had to be a **beautiful object in the landscape** of scale sufficient to be viewed from surrounding arboretum ridges and from the Visitors Centre. Even if laden with function and meaning, if not beautiful and enhancing of the Arboretum environment, the installation would not be successful in sustaining attraction. Observations of other successful landscape sculptures indicated that along with composition, proportion and balance as so ably achieved by the likes of Peter Cole and Alexander Calder; a combination of strong connection to the earth and openness against the sky and surrounding landscape can create a powerful response. Rather than creating a solid object like a statue held up for viewing, the landscape is incorporated into the sculpture with captured views through. Part of the success of the Wide Brown Land sculpture at the Arboretum is its openness – when visiting this sculpture it was interesting to observe visitors photographing views through and sitting and climbing within the spaces made by the cursive script form. Another very successful aspect of Wide Brown Land is the way it can be observed and read from distant ridges but due its scale, becomes a different experience when viewed up close with the surface texture of the steel and the sinuous twisted elements expressive of the force required to form the letters.

Thirdly, the sculpture needed to be an unashamedly **human intervention in the landscape**. Continuing the tradition of Renaissance humanism, the sculpture, although deriving from observation of nature and fitting into the landscape, needed to celebrate human endeavour. Observation of some nature-based works was that mimicry of natural elements is generally not successful- for instance a sculpture depicting a leaf or tree within a park setting can never compete for beauty with the surrounding trees. In our FreeFall sculpture the use of the horizontal height datum, which started at the uphill end and continued over the length of the spiral as it fell off over the edge of the swale to create height and drama, was specifically used in juxtaposition to the natural contours of the land and the organic spiralling form. The steel stick elements, which create the form, are able to emphasise the natural landform through their variable length from the imposed horizontal datum. The successful Wide Brown Land and Nest3 sculptures both have humanistic elements at their core – Wide Brown Land most obviously with the cursive script of Dorothea Mackellar wrought above the ridge; and Nest with its aerie of farm tools.

The fourth criterion was for the sculpture to be **optimally sited**. Another appealing aspect of the Freefall competition was the flexibility of location within the Pin Oak forest plot – the option of spreading between locations was also possible. A conventional approach would probably have been to position the sculpture at the entrance to the plot on the flat Events Terrace. This would have missed the opportunity to elevate the work above the Terrace to enhance the important aspect from the visitors centre and allow it to be viewed against the backdrop of the southern mountains. Our preferred site on a prow of land above the junction of the two stormwater swales is approached via the future circuit route which contours around the inner arboretum at relatively accessible grades,

making for a journey of discovery on the edge of the forest above the swale. The organic form of the sculpture responds to and extends the geometry of the swale and future gallery of gardens along the edge of the Events terrace. Our Freefall sculpture is of a scale sufficient to flow down between and around the forest trees and then to launch out over the swale edge such that it reaches out towards Canberra and by extension, the nation. By locating the sculpture over the swale edge, equitable access is made possible into the core of the spiral even as the height of the work increases as the land falls away. Optimally locating the site for the sculpture with an understanding of the possibilities it enabled, felt like the task was half complete as it was then a matter of just realising the potential. A further appeal of the location was the opportunity to include improvement of the stormwater swales as part of the installation. A competition parameter was for water sensitive design enhancing the site drainage and overland flow paths. Initial thinking prior to visiting the site was that one of the primary design aspects would be incorporation of water in the sculpture. Used simply, water offers the potential for reflection and movement and evokes life and sustenance. This thought was quickly dispensed upon arrival at the site and observation of the dry hillsides in which permanent water would be a foreign inclusion. Working with the drama of the hilly landscape was clearly the right approach compared to a quiet meditative approach based on water reflections. Managing overland stormwater flow and erosion is however important for the Arboretum. I understand that the ground cover that is currently in use until the forest matures is a weed species, so an effort to develop native species that can successfully inhabit the swales and slow down stormwater flows with better site retention will be of great value.

The fifth and final primary criterion was that the sculpture would have elements of **participation and interaction** – one of my seven reasons that people visit things and also one of the competition design aspirations. Although the clambering and photographic opportunities of Wide Brown Land are successful, the intent was that FreeFall would enable a more complex experience, which built on the experience of the forest and was aligned to the aspiration for discovery and imagination. As introduced later, we have envisaged some technological activation of the work, however the success of the sculpture at a passive level such as being able to walk up into the spiral remains of greater importance.

Having spoken at length about the rational approach to understanding the fundamental aspects that both satisfy the competition aspirations and potentially lead to the creation of a successful and enduring design, I will now discuss the response of the team and the ideas behind our Freefall sculpture.

Returning to the earlier discussion about the personal journey of discovery in designing Freefall, a large part of this journey was researching significant Australian inventions and engineering developments. This was a rich vein of inspiration and potential source of meaning for the sculpture in relation to Engineers Australia. One realisation was the vital importance of scientific research to Australian industry. Science has very often been the initiator of areas that then lead to engineering support and development, from the invention of

WiFi enabling technology by CSIRO when improving interpretation of radio signals from space, to their current research and development of titanium powder and 3D forming technology to help realise the potential of Australia's titanium resource. Another technology that was considered for inspiration was the hypersonic scramjet being developed at the University of Queensland – with its wonderfully aerodynamic inlets that compress air to enable combustion at supersonic velocity, it had wonderful sculptural and wind response potential. However the technology that was most inspirational for Freefall was the bionic ear invented in Australia by ENT surgeon Professor Graeme Clark. I was pleased to find a portrait of Graeme Clark hanging in the National Portrait Gallery here in Canberra. Development of the functioning cochlea implant required extraordinary advances in material and electronic technology and bioengineering. For instance, the electrode bundle, which is inserted into the cochlea, has graded stiffness to enable insertion without damage to the hearing nerves and shape memory such that it returns to its original spiral shape prior to insertion. Our Freefall walkway which threads through the spiral is akin to the blade of grass that Graeme Clark was said to have inserted into a shell on the beach when conceiving the idea of how to create a functional bionic ear.

At a physical level, the spiral form of the human cochlea is related to many other spiral forms found in nature, including shells with geometry approximating the Fibonacci golden ratio. As a celebration of engineering mathematics and with the powerful link to nature, this geometry was used in the development of our sculptural form. Probably of greater influence though was the concept of sensory enhancement and enablement that the bionic ear achieves. The bionic ear transmits digital signals from the external receiver through the skull to electrodes that are inserted into the cochlea. The electrodes are placed to stimulate the hearing nerves, which activate at different frequencies. Although the hearing nerves have a large gradation of frequencies, it has been determined that a combination of only eight frequencies are required to cover the array of sounds in human speech and this is typically the number of electrodes activated in a multi-channel cochlea implant. Nodes of experience within the Freefall spiral relating to the eight Colleges of Engineers Australia are intended to be reflective of the eight synchronised electrodes working together to create the sound of speech. Engineering has always been a team endeavour and it is important that the sculpture evokes that sense. Future inclusion of Engineers Australia and its Colleges in the development of the FreeFall sculpture subsequent to the design competition is purposeful. It is hoped that skills and ideas may be drawn from across the organisation, to enable a representation of our profession that is inspiring.

The journey within the sculpture, from the levelled meeting place with its ceremonial firepit, through into the core of the spiral, will afford views around and within the forest canopy – a sensory enhancement of the forest experience. We also intend to explore the potential for the space below the spiral core to offer a more sheltered experience out of the frequent wind that is present on the exposed hillside. It is our wish to incorporate an interactive system that senses the surroundings and interprets and stores data, which is available to participants. Ideally, like with the bionic ear, we would like new sensory

experiences to be enabled or at least heightened - for example the transpiration of trees is a fundamental process to life on earth, which we have no apparent sense of. Numerous other sensory concepts have been considered including the potential for relaying radio signals from the nearby Canberra Deep Space Communication complex via the adjacent Black Mountain tower, which is prominent in the view from Freefall. Vibration of the sculpture via sonic actuators akin to the vibration of the three inner ear bones and hair cells in the cochlea, could respond to thunder or other environmental stimuli.

As a structural engineer it was always important to me that our Freefall sculpture was expressive of forces at work in a dynamic composition of elements. The three-dimensional shell geometry found in nature uses its doubly curved shape for stability. This concept was perfect for our spiral form, which is created with leaning sticks of coreten steel working in unison with curved stainless steel rods. The patterns found on shells in nature were inspiration for use of the two different metals woven together - one ferrous and dull and the other with high lustre. This combination of dissimilar metals will require careful metallurgical attention, however compared to placing of electrodes inside the human cochlear to successfully stimulate hearing nerves, the challenge will be modest. As a mining nation and producer of metals, it seems fitting that the fabrication of a sculpture representing Australian engineering achievement should showcase skills in this field.

I have spoken at length today about the rational approach taken to create delight in the FreeFall sculpture installation. While this project has been a special opportunity, it has always been my belief as an engineer that everything we design should be considered from an aesthetic perspective – it should be one of our Design Limit States. For instance, why should many of the motorway signage gantries in Queensland look oppressively cumbersome and ill considered compared to relatively elegant structures spanning similar roads around Melbourne – being engineer-designed is not a valid excuse? Some of the most elegant structures I was introduced to early in my career were designed by a marine infrastructure engineer who used his expertise to create refined, efficient structures away from the attention of style magazines. Much of the built infrastructure around us is in the control of engineers who all have the opportunity to create delight and I am sure everyone here has favourite examples of such work. Of course the best work is created when individuals have the opportunity to collaborate with a team that bring different skills and experience with them. Certainly our Freefall sculpture bid was better than each of the team members could have individually produced and it was tremendous pleasure to experience that level of collaboration.

One of the other inspired decisions that the competition organisers made was to not put a budget limitation on the design, but to state that the sculpture was to be a buildable proposition. This left open the opportunity to create a work that was befitting of the scale of the Arboretum site and was sufficiently successful in its fulfilment of the Design Aspirations that funding would be achieved. I have met today with Rolfe Hartley, past president and chair of the Engineers Australia steering committee for the project and we are confident that with the support of



an organisation with over 100,000 members, that fundraising and sponsorship efforts will enable the momentum to be retained in realising this opportunity.

I would like to acknowledge the contributions and thank the efforts of our Freefall team – the Sydney based artists Susan Milne and Greg Stonehouse and Brisbane architect Nick Flutter - they will remain integrally involved in the project; also my partners and staff at Bligh Tanner who have supported my time away from the desk.

I'd also like to acknowledge the pioneering work of the late Dr Robert Boden OAM, who developed the first 'Freefall' cultivar which has been selected for the Engineers Australia Pin Oak Forest. His daughter, Susan Boden, is here this evening. Fittingly, Dr Boden also owned Cochlear shares as he was 'fascinated by the skill and human impact of the engineering of the implant'.

Finally, I would like acknowledge again the efforts and vision of the Canberra division of Engineers Australia and the National Arboretum. I look forward to working closely and collaboratively with both organisations in bringing the Freefall Sculpture project to fruition.

Thank you for listening.