

THE RELIGHTING OF THE LUCAS CAVE – A NEW APPROACH TO CREATING ‘CAVE EXPERIENCE’

- Daniel Cove*

Jenolan electrician, Dave Rowling, working on a power box in Lucas Cave.



These are the bare facts regarding the relighting of the Lucas Cave at Jenolan.

- Over 20km of mains, sub-mains, conduits, data cable and optical fibre laid through the cave of which approximately 98% is completely concealed.
- 500 light fixtures. 3 of these are deliberately visible. The rest are entirely hidden.
- 147 separate individual circuits, controlled by programmable Clipsal C-Bus 2 technology, operated via IR remotes and receivers with unobtrusive backup switching.
- A completely uninterruptible power supply that will power the entire C-Bus network and over 50% of total lights in the cave, not restricted to track circuits, continuously for over 2 hours, regardless of the nature of the external power outage.
- A reduction by almost 2/3 in wattage compared to the previous system.
- More efficient use of an available renewable energy source.
- Removal of direct lighting from low energy, sensitive cave areas with resulting decrease in lampenflora incidence.

Taken individually does any aspect of this list, or collectively does the list itself constitute sufficient grounds for self congratulation and a claim that the Lucas Cave is now something unique or extraordinary? The answer is, of course, absolutely not. The justification for this claim lies elsewhere.

In 2001 the Jenolan Caves Reserve Trust initiated the relighting of the Lucas cave and created a team to undertake this project, consisting of our head electrician, Dave Rowling and two guides, Russell Commins and Myself. From the initial planning and design stage to completion and the official ‘re-opening’ of the cave, the project took three years, this long period of time being largely due to a variety of external and internal factors which forced us to suspend work or redirected us to

other concerns. Our discontinuous physical work on the cave actually accounts for a total of just over four months. Yet the length of time over which our labour was spread had a significant impact upon the eventual outcome in that it provided us with an interval in which our thought processes could develop and evolve.

It is this process of evolution that constitutes the most significant achievement of the redevelopment project, and central to this evolution has been a single paradigm shift in our emphasis. As time progressed we found ourselves increasingly less concerned with the technical aspects of how we were to light the cave, although I am not denigrating our technical achievements which were, as I have briefly outlined and will return to, considerable. However we came to see this as the more straightforward aspect of the project. Our focus was to turn to the far more complex question of why we were lighting the cave. In early 2001 the ‘why’ had seemed obvious; a cave is dark, people want to see it so therefore you put lights in. While you are at it you try and make the cave look as ‘pretty’ as possible. This, after all, was the way it had always been done. We had done it ourselves recently when relighting the Imperial cave. It was now brighter, people could see more! That was what lighting a cave was about. There was no secret, and no value in posing the question ‘why’.

Wrong, wrong, wrong!

What we were to come to understand was that the job of lighting the cave is not only physically difficult, but that it came with enormous responsibility, responsibility that is only truly evident when you stop to consider the layers of implications inherent in that question ‘why’. A cave is fundamentally an extraordinary natural feature. So too is a lake, a mountain range, a valley, a beach or a forest. All are wondrous parts of our world that are rightly sought out by many for contemplation and inspiration.



Gel cell batteries and inverter in Lucas Cave.
Photo: Russell Commins.

Optic fibre cable being laid in Lucas Cave
Photo: Dan Cove



Yet uniquely difficult to the management of caves is the degree of artificiality that we must introduce to the cave environment to allow this contemplation by more than a select handful. It is this unique difficulty that creates the responsibility, as our decisions concerning the artificial environment of the cave do not affect the visitor experience, our decisions in fact entirely create the visitor experience. With no other comparable natural wonder is this the case. On a guided cave tour we determine exactly where the visitor will walk, at which point they will stop, how long they will stop for and we decide exactly what they will see. Their perception will be almost entirely shaped by the artificial environment we have created, and by the way in which their guide relies upon this environment.

With this point in mind one can see the responsibility that, when realised, made our job in the Lucas Cave so much more difficult. The answer to the question “why are we lighting the cave” was no longer “so visitors can see”, the answer had become “so the visitors can see what we want them to see”.

This is a much truer answer and one which can only lead us to further questions, the most obvious being ‘what do we want people to see, and why do we want them to see it?’ The answer to this required us to re-evaluate what caves and karst actually mean to people and in doing so to break away for a century old tradition of homogenising visitor expectations, the visitor experience and, as a direct consequence, the enduring message that would return home with each visitor. It was to

change not only our approach to lighting but, in the process, to begin a change in fundamental guiding practice and interpretation at Jenolan.

To return to the beginning, we should briefly take note of the prior presentation of the Lucas Cave. The Lucas is the most famous and most visited of the show-caves at Jenolan, indeed the most visited single show-cave in Australia. It is viewed by over 100 000 visitors annually. It contains the tallest and largest chambers on display at Jenolan and, at over 800m, is one of the longest tourist cave walks. There may be up to 75 visitors on each tour. There are 10 viewing platforms. Tour duration is one and a half hours. The cave is diverse, well decorated in sections and was the first discovered of the nine show-caves in 1860. Put all this disparate information together and what did we have? We had “the best general cave” at Jenolan, and this is how the cave was promoted and marketed.

Consequently it was also presented as “the best general cave”. Each of the 10 different viewing platforms was, indeed, different. The cave was presented as a series of unconnected and unrelated ‘scenes’ or ‘snapshots’. There was little to no attempt at unity of presentation, with guides giving essentially the same tour in 2000 as you may have taken in 1900. A contributing factor was unquestionably the lighting system which was installed in the 1960s as an updated copy of the system that had existed previously. In 2001 it was obvious to anyone that this old system was in urgent need of upgrade, notwithstanding the charm of the track-lighting reflectors consisting of old KB beer tins, and the wonderful fact that the Broken Column, arguable Jenolan’s most iconic formation, was revealed to the public via a lamp in an old pineapple tin!

Yet despite a general consensus that the old lighting system was past its prime, early discussion was basically along the lines of ‘the same but better’. By all means get rid of the pineapple tin, but whatever you do, light the Broken Column from exactly the same angle. In other words we had the “But it’s always been done that way” attitude.

This was understandable, as it had always been done that way, and why should the Lucas be any different? Our first draft plan for the relighting in 2001 did envisage some technical progress, reduced wattage, better luminaries, control of lampenflora, control via an automation system and the use of remote control units, but a tour of the Lucas cave in this draft plan maintained its existing format.

However 2002 saw something of an epiphany for Russell, Dave and I. A year of hard thinking while studying Karst Management through Charles Sturt University and a year of our manager, Steve Reilly, insisting that the Lucas was to be “not just another cave tour” acted as a ‘stop’ sign, provoking us to re-evaluate and to question some previously unassailable assumptions regarding ‘the way it had always been done’. It was at this point that we began to realise the importance of asking “Why”, so we return to this question and to the simple sequence that follows from it.

Q: Why are we putting lights into the cave?

A: So that people can see.

Q: What will they see?

A: Only what we want and plan for them to see.

Therefore, as stated, we must ask:

Q: So what do we want them to see, and why do we want them to see it?

The answer to this last crucial question depends entirely on what a cave actually means to an individual. What we came increasingly to accept was that there was no single answer to this question, and nor should we seek to impose one. Like any of the range of natural features mentioned previously, caves can convey a range of feelings and emotions, and who is to say which of these is any more valid than another? In each case this is what the individual is seeking in their journey into the cave, and it is, quite simply, impossible to expect to provide anything remotely resembling 'best experience' without full consideration of visitor motivations and expectations.

This led us to the task of discovering exactly what motivates visitors to see caves in general and Jenolan in particular. Studies of several recent visitor surveys conducted at Jenolan, visitor comment books and website discussion revealed an anticipated broad spectrum of visitor motivation but highlighted several recurrent themes:

- Caves as 'wild' places and the realm of the unknown and mysterious.
- Caves for adventure, exploration and personal challenge.
- Caves as objects of natural awe, timelessness and beauty.
- Caves as spiritually invigorating.

In all cases, an emotional response.

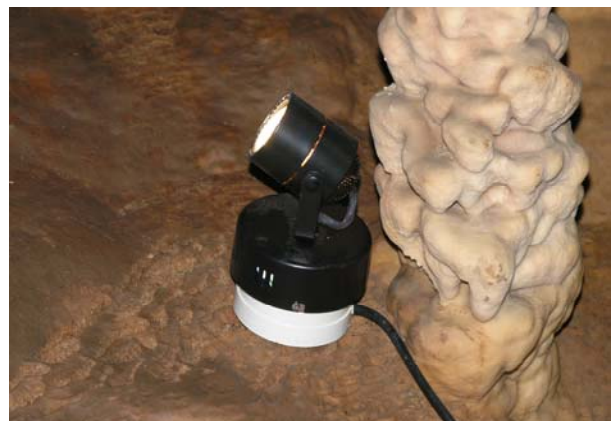
So we had our motivations. Were these being served by the functional designation and presentation of the Lucas as the "best general cave"? Not at all. And was our approach to lighting prior to 2001 conducive to satisfying these expectations and motivations, to delivering an emotional experience? Again, no.

So there we had it. We now thought that we understood the question of 'why' we were lighting the cave, and that previous approaches had homogenised visitors and were thus not delivering 'best experience'. We understood what we wanted visitors to see and why. We wanted them to see the cave lit in a way that did not attempt to change or even remove its most fundamental characteristics, those of darkness, mystery and adventure. We wanted to explore how spiritual connections could be reinforced and encouraged. We did not want discontinuity and random lighting of 'pretty' sections, we wished to genuinely create the experience of a journey rather than a tour through the cave through lighting that would allow the cave to tell many of its stories for itself and allow visitors to draw their own interpretations. More than telling a story, above all we wanted to provoke an emotional response, one that would fulfil the most poignant expectations of visitors. We also set out to light the cave in a way that

would force us all, as guides, to change, realising that to change our approach to lighting without this being within the broader framework of a revision of interpretation at Jenolan would not satisfy the new rationale we had established.

Noble sentiments, grand ideas, but utterly impossible to execute in the real world? Not if we remember, as previously stated, that **we completely control** visitor perception in a cave and continually ask ourselves how we can use lighting as a tool to manipulate this perception. Take for example, the *Cathedral* Chamber, the second of the platforms in the Lucas Cave to be viewed and the tallest chamber in the Jenolan show-cave system. The old approach in this chamber had been to give a little history, and to point out that the *Cathedral* contained all the feature of a church; the altar, the baptismal font, the organ loft and pipes etc. Our approach was to take the name of the chamber as evidence of the endurance of our identified visitor expectations. After all, why are so many cave chambers named after holy sites? Jenolan alone boasts the *Cathedral* chamber, *Chapel* cave, *Vestry* Cave, the *Church*, and *Temple of Baal* to name but a few. Caves evoke association with the divine.

Therefore we lit the *Cathedral* as a holy place and attempted through lighting to convey the feelings of reverence that must have been felt by the early explorers entering the chamber. The guide now barely needs to speak, as is appropriate for a real Cathedral. From the discovery hole, high in the chamber, we start a sequence of lights that progressively reveals, step by step, the path of the explorers. This dim illumination, as if by candles, of so small a part of the chamber serves to convey its overall immensity in a far more evocative and memorable way through what is not revealed than were we to choose to instantly illuminate the entire area. Then we have music. Not as a cheap gimmick, music in the *Cathedral* has a long history, although it had previously been used as an addition, a special effect. Now, with our theme of reverence, following the candle sequence and accompanied by the gradual fading up of chamber lights music is appropriate to create emotion. And it does. Following the climax of the lighting sequence and music one of two things generally happens, either there is complete stunned silence, even with a group of 75, or there is spontaneous applause. All the guide did was to press the button.



New light fitting in Lucas Cave
Photo: Russell Commins.

Work in progress in the
Mafeking Section, Lucas Cave



All of this is utterly and unashamedly manipulative, which is entirely the point. We have the power to so manipulate and, once the emotional response is secured we have only to sustain it for visitors to take something away from their journey through the Lucas cave that was impossible before...a genuine sense of ownership and personal experience. The importance of this cannot be overstated if we truly wish to promote conservation and protection of karst. People may possibly support a good cause to which they feel a sense of abstract obligation, but they will fight tooth and nail for something that they feel has a personal connection for them, a personal connection being precisely our intent in creating the experience now available in the Lucas Cave.

There is no need to describe in detail each of the ten platforms, nor the functions of the 147 individual circuits. What should be emphasised however is the importance of creating a journey rather than a tour. There would be little point in generating an emotional response at the outset and then reverting to a standard tour format. To sustain the experience requires (a) continuity, and (b) eliminating any periods of frustration and boredom.

To address the boredom factor first, we were concerned with the periods that follow the arrival of the first members of the group at a new platform. Obvious environmental considerations dictate that we cannot leave lights on and thus we have a problem; the tour is staged, and visitors have to wait. The negative consequences can be severe. When visitors are made to wait in the

unchanging dimness for their guide they become uncomfortable and bored, and if visitors are becoming bored then we are no longer providing 'best experience', and any emotional credit we have secured is lost. Our research in 2002 showed that by far the highest incidence of destructive tour behaviour, such as graffiti and speleothem discoloration, occurred in areas where groups were required to wait in areas of dim and unchanging illumination. As is so often the case this seems an obvious point in hindsight, but it had received little prior consideration.

Our solution to this problem was to design a series of timed fade sequences at each waiting area. The timing of these was precise, based on observations of dozens of groups and their responses at each point. We found that arriving groups responded positively to a short period of darkness up to 2 minutes duration, sustained by the anticipation and the sensation of dark and unexplored cave. Beyond this groups required relatively frequent addition of new stimuli, most effective at 45-60 second intervals. To this end we carefully choose single features, visible from all aspects of the viewing platform, to progressively fade in and out on a programmed sequence. From a guiding point of view these sequences have worked as intended, with groups noticeably more relaxed and responsive upon the arrival of the guide.

With regards to the question of continuity, we actually had to exercise a great deal of restraint in order to remain consistent to our intent of lighting in line with 'best visitor experience'. For our 'journey' concept each light had to be designed in conjunction with the rest of the cave. This was difficult owing to a temptation to over-light, for example the somewhat understandable eagerness to backlight every single shawl in the cave. However we rejected this in favour of broader brush strokes, lighting so that every sequence of lights followed logically from the last in a way that would not have visitors simply reaching for their cameras, but noticing that they had just received another piece in a large and fascinating puzzle.

For example at the *Broken Column* platform the sequence is now:

- The *Broken Column* itself is illuminated.
- A second light sequence reveals nearby a second, smaller broken column, thus we no longer have a feature in isolation.
- The rock-pile upon which both are sitting is lit from beneath to reveal the fragmentary nature of the floor and thus an explanation as to the movement.
- Finally above a particularly prominent crack are revealed the candle-soot signatures of early explorers who descended through the rock-pile to discover the River Cave below.

Once again the guide needs to provide relatively little in the way of interpretation as the lights are effectively telling the story. It is also important to note that the story is still set against the broader common themes of the tour- the fascination with discovery and exploration of the vastness of the cave, and the vastness of the cave itself, as the movement of the Broken Column is revealed in the context of the infinitesimally slow forces at work.

We have the immensity of time, of the cave and the place of people within that immensity.

But does this approach, 'the journey' really force guides to change? Realistically we can only do so much. In the past, resistance to change has been so strong that when, in the relighting of the Chifley cave, an underwater light was added to a previously unlit pool one guide, now retired, stubbornly continued to refer to it on tour as "The Invisible Pool" despite its demonstrable visibility, just as he would also point out to his bemused groups "the place where 'Katie's Heart' used to be before the electricians changed the lights".

But with the Lucas Cave we have not just moved or added lights, we have used circuits in a way that require guides to tell a story one connected piece at a time, and it forces far more emphasis to be given to the cave itself.

Also our aim was that the guides themselves would now find a trip through the Lucas to be a more emotive experience. If we have begun, as I believe we have, a reinvigoration of interpretation at Jenolan, it begins with a reinvigoration of the guides themselves.

In addition we have installed so great a diversity of lighting that no two tours of the cave should ever be truly the same. Among the 147 circuits are many that would not be used on every tour; some are designed to allow specialist interpretation, for example those displaying distinct geologic features, some are designed for special events such as concerts or weddings, some take advantage of having smaller group numbers, others are specific to the needs of a full group of 75 people.

This flexibility, which is illustrative of that foundational question 'why', is allowing guides to experiment further and, again, to break away from the old method of presenting the cave in an identical manner to each group- not 'best experience' guiding.

To make our theories into reality required technology, and the Lucas Cave was indeed a technological success. However what is to be celebrated is that we did not use technology for its own sake, rather as the means to an end.



IR Receiver/Backup switching and phone system, Lucas Cave. Photo: Russell Commins.

Uninterruptible power system – Lucas Cave.
Photo: Russell Commins.



The most advanced automation software controlling lighting in a cave is meaningless without the rationale behind the programming. We used Clipsal C-Bus 2 primarily to achieve the continuity of lighting and create the sustained drama necessary for creating emotion.

The reason we went to such pains to conceal 20km of cabling and 500 lights and to choose to use unobtrusive remote control light activation was not to be clever. It was to establish, to the greatest possible extent, the feeling of the cave as a wild and natural place, of mystery and excitement.

Returning to the list of "bare facts" I stated that there were no grounds for special congratulation in creating, as we did for the Lucas Cave, an environmental system based upon low wattage, renewable energy and designed to reduce *lampenflora*.

I maintain that this is correct, as I would argue that these achievements represent no more than the very least that should have been expected of us. Creating an enhanced dramatic cave lighting experience while being ever mindful of environmental considerations was not easy to do, but there was never any question that we would light the cave in an environmentally sustainable manner, to do otherwise would have been simply irresponsible.

Therefore we did use more efficient globes and fittings, most notably 12v 45w halogen diachroics with IR coating technology, which transfer a greater percentage of electrical energy to light and reflect heat back, rather than onto cave surfaces.

Theatrical 6v pin-spot lighting, sometimes located upwards of 20m from the feature to be lit, eliminated a common problem of incandescent globes in direct contact with active crystal. In areas where dimming capacity was not required we used fluorescent globes for reduced power consumption. Lights were carefully placed to allow easy and non-destructive maintenance, for example there is now only one area in the cave requiring a ladder.

The C-Bus system was designed to reduce total lighting duration. In total we did reduce wattage in the cave by close to 2/3. A safety consequence of

this reduction was the ability to use multiple fixtures, replacing old 150w or 300w floodlights with a series of 45w halogens creating a redundancy factor. Overlapping lighting now means that the failure of any single light on a track area does not create a dark and unsafe area.

This wattage reduction, environmentally responsible in itself of course, also allowed the Lucas to take greater advantage of hydro-electricity generated at Jenolan. This required integration of renewable energy technology into the cave. Two banks of sealed gel-cell batteries have been installed which are recharged during periods of low usage via the hydro station. A high tech inverter subsequently delivers power to the main cave circuitry.

This system, in addition to its environmental credentials, is also the foundation of the uninterruptible power supply, as in the event of grid failure the inverter will draw solely from the batteries and will maintain the majority of lighting functions within the cave. Yet here too we applied our design philosophy.

It would have been easy to have the inverter deliver power only to essential track lighting, thus ensuring safe passage out of the cave. However we hoped that, even in the event of a blackout, to still be able to continue to deliver high level visitor experience. Thus all C-Bus control units and over 50% of feature circuits also draw power directly from the battery banks, allowing tour function to continue unimpeded by external outages.

So where do we go from here? The Lucas Cave has been firmly reinstated as the flagship at Jenolan but overall we are in a transitional phase. 100 years of doing things a certain way is a long time and change never comes easily but it is coming.

An Interpretation Plan has been completed which represents a genuine and singular vision for the future. Following completion of the Lucas we have had the opportunity occasioned by the installation of stainless steel handrails to go back and revise, to an extent, the lighting of the Chifley and the Imperial Caves. Over the next 12 months, simultaneous to their refurbishment with stainless steel we begin the complete relighting of the Orient, the Temple of Baal and the River Cave.

We have the opportunity to build upon what we have learnt and to deliver to visitors ever more personal versions of their expectations of caves and karst.

Through selective, deliberate and unified thematic lighting and progressive approaches to interpretation we have the opportunity to do what has never been done before and to diversify our core product, in that a trip to the Orient Cave will no longer be comparable to a trip through the Lucas Cave. They will be as different as items on a menu...both food, to be sure, but of vastly different flavour.

We are most fortunate at Jenolan to have nine show-caves. This allows us great scope for diversification. And in each case what we do will begin with the question 'why?' What do we want people to see in this cave and why do we want them to see it? The question that represents the most fundamental evolution in the way we have come to look at what we do.

*Dan Cove is a guide at Jenolan Caves. This paper was delivered at the recent 16th ACKMA Conference in New Zealand. It was widely acknowledged as one of the best papers presented.



Installation of 415V 3ø power mains into Lucas Cave. Photo: Dan Cove.