

The Emu in the Sky and Other Stories

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When Europeans arrived in Australia in 1788, their navigators probably knew less about the southern sky than many of the Aboriginal people that they drove from their land. Sadly, nobody thought to ask. The British occupying force wasn't interested in the many rich and vibrant Aboriginal cultures, each with its own customs, folklore, and language. Only recently have most of us appreciated the deep vein of astronomy threading through the Aboriginal stories and ceremonies.

For example, many Aboriginal groups have stories about the "Coalsack" – the famous dark cloud next to the Southern Cross. Some see it as the head of a lawman, or a possum in a tree, but many groups tell stories of a great emu whose head is the Coalsack, and whose neck, body, and legs are formed from dust lanes stretching across the Milky Way. It's easy to make out the emu in a dark autumn sky, and once you've seen it, the Milky Way will never look the same again. This "Emu in the Sky" has become an icon of the Australian SKA Pathfinder (ASKAP) project.

The Aboriginal Astronomy project aims to study stories like this in a systematic way, and to explore the importance of astronomy in Aboriginal cultures. The project has two parts. One is to examine the culture of Aboriginal people, such as the Yolngu people in Australia's Top End, whose culture is thriving, and who can tell us about the role that astronomy plays in their culture. For example, a few weeks ago we were privileged to be invited to visit the remote Yolngu community of Dhalunbuy. There, an elder told us a story of the evening star, whose appearance signals the time to collect Raika nuts, and showed us an "evening star rope" made of stringy vine and possum fur decorated with the nuts. It was a memorial made at the time of death of his grandmother, and is still used in modern funeral ceremonies to establish contact with ancestors. Little of this is known to western science or ethnology.

The other part of the project is to study the artefacts of those Aboriginal cultures whose culture was badly damaged by the arrival of Europeans 200 years ago. For example, we are studying a 50-metre stone circle in Victoria which appears to be aligned on the equinox and solstice sunsets, and we are trying to understand a possible lunar calendar in South Australia. Closer to home are thousands of rock engravings around Sydney, most notably in Ku-ring-gai Chase National Park, just 20 km north of Sydney. Amazingly, many Sydneysiders are unaware of this beautiful sacred art on their doorstep, showing animals, people, creator spirits, and strange symbols whose meaning is unknown. It has been suggested that some engravings may be astronomical, and may even represent constellations.

However, while many sites have been recorded, few have been reliably surveyed, and most records consist of no more than a hand-drawn sketch, inevitably reflecting the preconceptions of the recorder. For example, a crescent may be drawn by an archaeologist as a boomerang, and by an astronomer as a crescent moon. Instead, a serious study needs an unbiased photographic record. Such a record also has value for future generations who may not be able to see the real thing, as the engravings are rapidly being destroyed by acid rain,

However, photographing them is tricky. The grooves are shallow and frequently obscured by natural undulations in the rock. Received wisdom is to photograph them at sunrise or sunset, when the low angle of the Sun outlines the grooves with shadows. But we can't always wait for sunset, and even then the resulting photo is likely to be marred by shadows of nearby trees.

Instead, Barnaby Norris and I decided to replace the Sun by a 1000 Joule studio flash (emitting something like 1MW of light), together with batteries and an inverter for use at remote sites. Three telescopic pool poles were used to construct a tripod five metres high, from which we suspend a remotely-operated digital SLR camera vertically above the engraving. Further image processing, sometimes including spatial filtering, then clearly shows up the engravings.

One of the most beautiful sites in Ku-ring-gai Chase National Park, close to the Elvina Track, features a finely engraved emu. A few years ago, Hugh Cairns of Sydney University pointed out that this engraving looks more like the Emu in the Sky than a real emu. Furthermore, the Aboriginal artists oriented the engraving to line up with the Emu in the Sky just when real-life emus are laying their eggs. To illustrate this, we decided to take a photo of the engraving with the Emu in the Sky correctly positioned above it. Our low-angle flash technique took care of the engraving, but what about the sky?

Since the night sky at the Elvina Track site is now ruined by the streetlights of Sydney, we decided to photograph it from Siding Spring Mountain. A further challenge is that the emu stretches half-way across the sky, so doesn't fit in the field of view of a normal lens. A fish-eye lens on an equatorial mount would do the trick, but would distort the image, preventing a realistic comparison with the engraving. So instead we made a mosaic of smaller images that could be stitched together in software. Furthermore, by taking a series of short exposure images, we wouldn't need an equatorial drive, as we could correct for sky rotation in software.

Having taken the photos, Barnaby spent two months stitching the hundreds of images together, working out how to correct for the distortions and sky rotation while keeping the shape true to the projection seen by the human eye from the Elvina Track site. The result was magnificent (see back cover of this newsletter) and in August won Barnaby a \$2000 prize in the New Scientist Eureka science prizes.

More information on the Aboriginal Astronomy project and on the Sydney Rock Engravings can be found on www.atnf.csiro.au/research/AboriginalAstronomy/ and www.atnf.csiro.au/people/rnorris/SydneyRockArt/ respectively.