



## Dr Daniel Bongers

Dr Daniel Bongers is the inventor of the SmartCap, a wearable fatigue monitoring technology that uses a modified baseball cap to read an individual's EEG to determine their level of alertness. This level is used to notify the operator/management of their elevated risk of having a micro-sleep/fatigue event. Bongers, now Chief Technology Officer of SmartCap Technologies Pty Ltd, is passionate about safety, and has worked tirelessly over the last more than a decade to ensure the success and widespread adoption of the SmartCap technology. Having been involved in all aspects of the SmartCap evolution and delivery since inception, he has worked with thousands of operators as well as supervisors, mine managers and CEOs around the globe to help sites achieve genuine safety improvements. Though the SmartCap journey has been a long and bumpy one, Bongers has maintained an integrity of purpose and commitment to success.

His strive for technical excellence and commercial exclusivity saw him pursue and achieve the world's first independent validation of a fatigue monitoring tool, cementing the SmartCap as the new golden standard. This achievement was the catalyst for increased transparency and validation efforts amongst all related technologies, giving mining operations more informed choice and driving innovation in the field.

Perhaps unusually, he chose to formally train as a chef while studying for his PhD in mechanical and space engineering at the University of Queensland. His PhD was in Artificial Intelligence. He'd worked in the kitchens of a number of restaurants throughout his uni career, and gained Recognition for Prior Learning, so that he only had to complete some final units of study to gain formal qualifications as a chef. He is still very passionate about cooking and hopes one day to retire from engineering and open a restaurant.

### Background and technology in detail

Each baseball cap contains electroencephalogram (EEG) brain monitoring sensors concealed in the cap lining and uses an operator's brain wave information to calculate a measure of drowsiness. This calculation is wirelessly communicated to a

display in-cab, or to any Bluetooth enabled device to alert the driver or operator of fatigue. Such fatigue is most pervasive in long-haul transport and heavy industries such as construction and mining, where it is responsible for hundreds of fatalities and injuries each year as well as millions of dollars in lost productivity. In the absence of appropriate fatigue management strategies and technologies, this problem is exacerbated by the combination of an aging workforce and increasing demands on operators to achieve production quota.



SmartCap "represents the most accurate fatigue monitoring technology available," which has seen its widespread adoption in both heavy and light mobile mining equipment. This technology has made an impact in operations in Australia, Southern Africa, and South America. SmartCap has become integrated into daily operations, and is an integral part of fatigue risk management systems and employee assistance programs. A New South Wales, Australia group of coal mining operations has celebrated a milestone of 1,000,000 hours of SmartCap use, over which time there were zero fatigue incidents. This unprecedented result is being attributed to the detection capabilities and subsequent culture change associated with the SmartCap technology.

At an individual level, a number of operators have been able to identify previously undiagnosed sleep conditions or other fatigue-related health issues using SmartCap. With treatment and ongoing management, these operators are now more alert, making their workplace safer for themselves and their colleagues. Furthermore, these operators are enjoying a dramatically improved quality of life since the change. The most pronounced effect of SmartCap to date is its ability to facilitate cultural change on-site, by giving a language to the previously vague concept of fatigue. SmartCap has become a household name in the mining industry, and continues to help thousands of mine workers get home safely each day.

SmartCap began as a spin-off from CRCMining, which formed SmartCap Technologies (originally as Edansafe) in order to commercialise SmartCap, the technology which remains the key invention behind SmartCap Technologies; with the inventor Daniel Bongers then as Project Manager. Supported at the time by CRCMining member Anglo American Metallurgical Coal (AAMC), the SmartCap evolved from a field-proven prototype in 2008 to commercial trials in 2010. Anglo American then deployed the driver headwear to its heavy vehicle drivers and heavy machine operators at its coal mine sites across Australia, and to other Anglo sites worldwide. Its use then took off in the wider industry and major users now include BHP Billiton, Rio Tinto, Newcrest, Assmang and many others.

Assmang's Beeshoek iron ore operation deployed SmartCap in 2014 on 54 haul trucks to assist in gauging the fatigue risk on-site and empowering the workforce to proactively self-manage. Leading up to the deployment, the site had suffered from a number of incidents involving operators returning to work after extended periods of leave. Beeshoek has seen a significant reduction in fatigue incidents on-site.



Workforce engagement has greatly improved as a result of the inclusive change management process.

The technology allowed the mine to overcome key challenges such as limited literacy amongst the workforce that required a heavy emphasis on training via demonstration; as well as a high staff turnover making long-term improvements difficult to gauge.

Clear trends have emerged in companies where the device is used on large numbers of staff, and Bongers stated in an interview with *The Sydney Morning Herald* in 2015 that those companies have been able to adapt working conditions in line with those trends. "As you would expect we see shift



workforces most fatigued between 2 am to 5 am. We are also starting to see patterns based on rosters where we have noticed the first nightshift after a break period is the most difficult to deal with; that transition from day-work to night-work. That [information] can be fused with other information, such as positions on the road, to learn about other factors that influence fatigue like road design. Hopefully people with this information can do something about it to prepare better for work."

On worker concerns on being monitored, he stated: "The idea of monitoring fatigue for people in the workplace can be a confronting notion at times and I think the comfort that our users feel is that it's an initiative from their workplace to help them get through the day and get home safe each day. It's all about safety. SmartCap is not recording brainwave information, it is using it to determine a level and then discarding the brainwave information."

Also in 2015, SmartCap Technologies released a Cloud-based version of SmartCap that allows remote operations to use data storage and access without fixed infrastructure. The company says it "has joined the cloud based revolution offering a cloud version of the award winning SmartCap solution. The cloud version provides enormous amounts of functionality that previously required expensive server installations and management. SmartCap is a predictive technology that provides operators fatigue monitoring alerting operators when they are at risk of a micro sleep."

SmartCap's range of products provide numerous options for individual operators to manage their own fatigue all the way to large organisations managing multiple vehicles in real time. Advances in technology including cloud technologies provide multiple advantages such as the ability to store fatigue data in one central location regardless of where vehicles are operating.