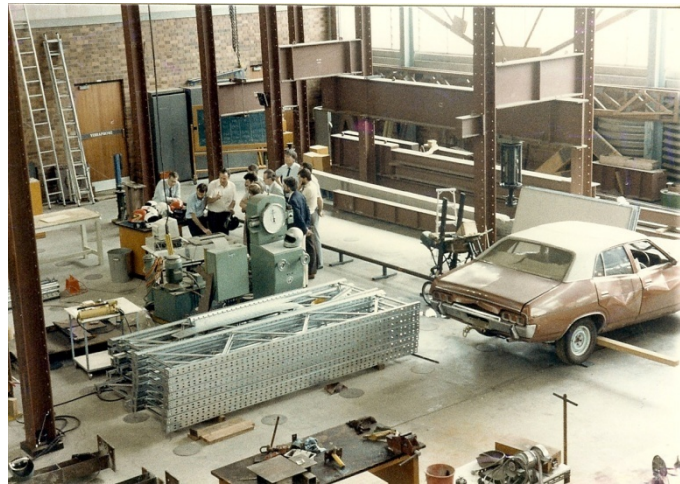


COVEHEAD TECHNOLOGY™

The most advanced helmet technology in the World

The following narrative describes Don E. Morgan's journey as the inventor of the COVEHEAD™ liner for helmets.

My journey as the inventor of the COVEHEAD™ liner for helmets began in the mid-ninety eighties when I was a member of a research team that comprehensively investigated the effectiveness of motorcycle and bicycle helmets. The project was funded by the Australian Federal Office of Road Safety (FORS) and was conducted at the Queensland Institute of Technology (now known as the Queensland University of Technology). During the four year-long project, the research team conducted tests on helmets to the Australian standards for both motorcycle and bicycle helmets. We were the first in Australia to carry out crash simulations of motorcycle accidents (see photos of test rig below). The project also tested the strengths of bones from different age groups of people. In the later stages of the project tests were carried out on a cadaver wearing helmets of different masses to determine the effects of rotational acceleration.



One of my roles as a research scientist was to attend fatal motorcycle and bicycle accidents throughout the Brisbane area with the police Traffic Accident Investigation Squad. I was to gain a better understanding of the accident and hopefully retrieve the helmet from the accident for later examination. I remember a number of the helmets that I examined, and subsequently pulled apart, as being gory objects with blood and brain fluid splattered throughout the interior of the helmet. In several other helmets there were bone fragments grinded into the jaw piece of the comfort liner of the helmet. In one helmet I found several loose teeth. These helmets and the gruesome accidents that I attended are permanently etched in my mind.

One of the more important crash features that clearly stood out with the helmets from accidents was that the foam liner showed little or no evidence of damage or crushing and yet the injury report or post mortem stated the motorcyclists or cyclists had sustained intracranial injuries. It was mainly from this information my fellow researchers and I concluded that the liners in helmets were too hard and stiff and the liners did not effectively absorb an impact force. In other words, on impact the forces are readily translated through the thickness of the hard foam liner to the skull. One of the recommendations made in the final **report** on the effectiveness of helmets was that the liner should be softened and made of low density foam.

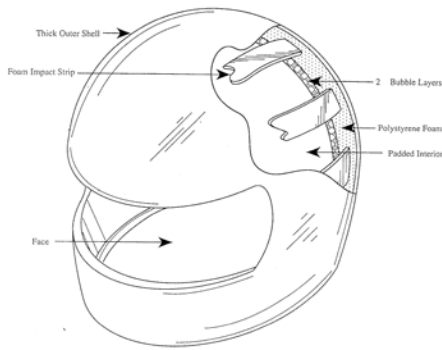
http://www.infrastructure.gov.au/roads/safety/publications/1987/Mcycle_Helm_1.aspx

In the early 1990s while I was working on another research project, my eldest daughter, who was about five at the time, was learning to ride a bicycle. When I examined her helmet and pressed my thumb against the foam liner I was shocked to find that it was hard as a brick and I couldn't leave an impression in the liner. The fact that the liner was so hard and was unable to be compressed contradicted the recommendations of the research that I had been doing, which was to make helmet foam liners softer.

I was also concerned that the foam liners in helmets did not differentiate between a child's skull and an adult's skull. A child's skull is more deformable than an adult's skull and therefore is less protective of the brain. Also, the foam liners in helmets did not accommodate the variation in the different strengths and thicknesses of different sections of the human skull.

This incident involving my child's helmet motivated me to set about to design a new shock absorbing liner for helmets. I started to think of different designs to improve the ability of the hard foam liner to absorb an impact force more effectively (i.e. soften the liner of the helmet). Some of my early designs included low-density strips sandwiched within the thickness of the high density foam, and low density cylinders embedded into the thickness of the liner but I was never completely happy with these designs.

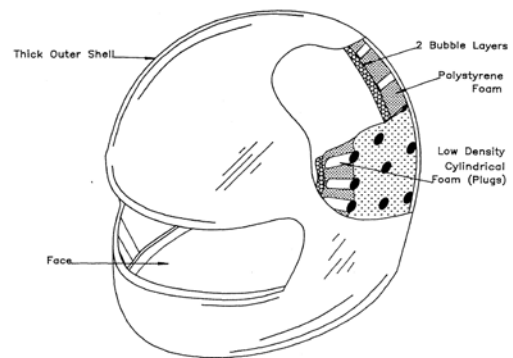
ILLUSTRATION A



INVENTOR: DON E. MORGAN

INVENTION: THE SAFETY ENHANCED MOTORCYCLE HELMET

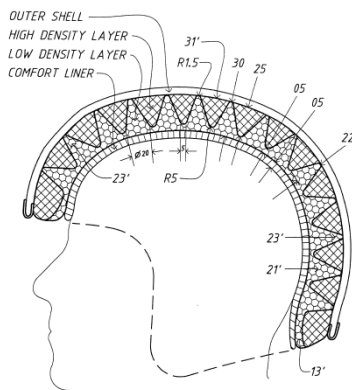
ILLUSTRATION B



INVENTOR: DON E. MORGAN

INVENTION: THE SAFETY ENHANCED MOTORCYCLE HELMET

The thought of embedding low density foam cones within the thickness of the high density foam came to me in 1993.



Cones have the wonderful unique property, when a force is applied, they will initially compress or crush and, as the force continues to be applied, they become harder to compress or crush. Cones are great shock absorbers and when crushed the energy will be spread sideways. I call them deceleration cones.

The next stage in my journey was to prove scientifically that the new liner would work so I spent several years pestering and grovelling to my local federal government member to gain funds to carry out research. In 2000 I was fortunate to receive a small research grant from the Australian Transport Safety Bureau (ATSB) which allowed me to manufacture and perform comparative tests between flat foam samples of the new **COVEHEAD™** liner and single-density foam typically found in current helmets.

The independent comparative test results clearly showed the new foam liner with cones performed better in absorbing an impact force than the single-density hard foam.

http://www.infrastructure.gov.au/roads/safety/publications/2001/helmet_liner.aspx

I thought from that time it would be all downhill, as I had scientific data supporting my new design, but I spent another three to four years desperately trying to obtain funding and a manufacturer to produce the new foam liner.

In 2004, frustrated with the lack of response in Australia to bring my invention to market, I decided I would try my luck over-seas. The Hong Kong based **Strategic Sports Limited**, one of the largest OE manufacturers of helmets in the World, responded to an email outlining my idea and that was the start of **COVEHEAD™** becoming a reality thanks to the innovative attitude of Doctor Philip Cheng (see photo below right) and his son Norman (see photo below left) who head **Strategic Sports Limited**. The quick response to my email was a good sign and I eventually signed a license agreement with **Strategic Sports Limited** in 2010.



In 2010, the first helmet, incorporating the **COVEHEAD™** liner, which was for dirt bike riders, went on sale in the United States of America. Today there are helmets with the **COVEHEAD™ TECHNOLOGY** selling world-wide. These include motorcycle, dirt bike, bicycle, skiing, skating, mountain and horse riding helmets.

Don E Morgan M.A.I.P.

Physicist, Inventor, Educator and Innovation Consultant