

**The Snell Memorial Foundation, Past and Present**

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The Science of Crash Helmetry seems to have begun in the early 1940's when an English medical doctor, Hugh Cairns, observed that there was a significant difference in the injuries and outcomes for hospitalized Royal Army motorcyclists depending on whether they crashed wearing headgear. To be sure, a lot was already known about protective gear and protective structures. There was already a well developed technology for shock proofing delicate mechanisms and armorers' lore predates written history. In fact, many of the motorcyclists Cairns encountered seem to have crashed wearing army issue motorcycle helmets. What Cairns and his colleague, Holbourne, began were formal, scientific inquiries into the effectiveness of crash helmets and into the mechanisms by which they prevent injury.

As a result, the English seem to have been the first with performance standards for crash helmets. Standards, that is, that describe what a helmet must do rather than dictate helmet designs and materials. In the 1950's, British Standards Institute began enforcing standards for crash helmets sold in England while, in the US, the only requirements set were military specifications. As a result, William "Pete" Snell was wearing an English auto racing helmet on that day in August 1956 when he crashed in an amateur racing event in Arcata, California, sustaining head injuries that would prove fatal shortly thereafter.

Dr. George Snively, a medical doctor with a degree in chemical engineering, was also active in amateur auto racing then and had been investigating head impact injury and head protection. With the support of the Sports Car Club of America (SCCA) and the family and friends of Pete Snell, he intensified his investigation. To house this more formal effort, the Snell Memorial Foundation came into being in 1957, as a private, not for profit, corporation. The Foundation was then and is now dedicated to promoting the development and use of protective crash headgear.

Snively's first efforts were devoted to assessing the merits of currently available helmets and, incidently, the current means of assessment. He drew on the methods developed in England and began a public campaign with a magazine article "Skull Busting for Safety" in Sports Cars Illustrated. Although he later published many scientific papers, this article seems to have had the greatest effect. The article discussed head impact injury and the performance of then available racing helmets. Snively's assessments were uniformly dismal but, remarkably, there was little or no industry backlash. Instead most helmet manufacturers seem to welcome the intrusion and the criticism. It may have been the support of the SCCA or the fact that the US was much less litigious then but the helmet industry seemed to join Snell and Snively's campaign for better headgear almost without reservation.

This support enabled the Foundation to promulgate helmet standards and programs without a government mandate. This independence from government enabled an approach to standards development that was completely unavailable to writers of mandatory requirements. Snively could set performance levels well beyond those met by most commonly accepted helmets. A mandatory standard setting such levels would draw loud protests from manufacturers whose helmets were

excluded and from the public who preferred those helmets to others. Democratic governments would be unable to ignore these protests or to proceed with such programs. Unburdened by such concern, Snively developed a novel approach to standards and standards programs to push the development of better headgear.

The basic problem with protective helmets, then and now, is that while people buy them for protection, their protective capabilities are virtually invisible. People can go into a store and look through the headgear and judge for themselves whether a headgear fits well, is sufficiently cool and comfortable, whether they'll be able to see and hear and, just as important, whether they can stand to be seen wearing it. However, unless they've got the time and equipment and budget to buy and wreck a few identical headgear, they're going to have to take someone's word for it that the helmet will actually perform its first function, save their heads in a crash. Accepting someone else's assessment of quality, however, raises other questions such as: what's their idea of good enough and, in the case of US standards, just whose word is being taken. Snively set out to identify a premium of protective capability and determined to do all the testing himself. When Snell certified helmets became available, people could take the Foundation's and Snively's word that the helmet was as protective as the best headgear available anywhere.

The first Snell standard in 1959 was set to eliminate all but the top ten percent of the then available racing helmets. Manufacturers who wished could still make and market them and people could still buy and wear them but all without the Snell certification. In fact, there would be little interest in helmets that were not Snell certified, SCCA would require Snell certification for helmets used in their racing events. The result was a sudden jump in protective performance and a corresponding jump in Snell requirements setting off another round of developments and so on. The process set off a series of revisions and increases in Snell requirements and a general stampede toward better helmets throughout the 1960's and 70's.

Snively's efforts also lead to advances in helmet testing. English helmet test methods in the 1950's and 60's were limited to impacts in the crown area of the headgear. However, most crashes produce head impacts well away from the crown. Real world thumps fall at the brow, at the right and left sides and, less often, at the rear of the helmet. The English were surely aware of the problem but once a mandatory requirement is in place, it is difficult to effect any changes, particularly, improvements. However, this may explain why Pete Snell's helmet, with its suspension system, was able to withstand the crown impacts necessary for BSI qualification and still prove so inadequate against the lateral blow that killed Pete.

The same latitude that allowed Snively to set and reset performance requirements allowed him to implement newer test methods to measure helmet performance in these critical lateral and brow areas. The swing-away impact test rig appears to have been used first in Snell standards and was then taken up by the British Standards Institute and by the American Standards Institute which would become ANSI. By the end of the 1960's, however, Snively and Snell had switched over to the guided

fall rigs that we still use today. These guided fall rigs also allow testing away from the crown of the helmet and are much more mechanically simple and straightforward.

Snively and his colleagues also developed methods for standards enforcement. Snell certification programs are administered under contracts with each of the certified manufacturers. The contract entitles certified manufacturers to the use of the Snell name and logo in the marketing of their certified headgear but empowers the Foundation to acquire and test follow-on helmet samples and to take specific actions in the event of follow-on test failures.

The combined effect is a mechanism based in free-market principles that seems to counter Gresham's law. Thinkers had been watching shoddy goods take over one marketplace after another since the beginnings of the industrial revolution and, generally, bemoaning the end of quality. The Foundation's programs seem to offer a means by which more protective headgear can prevail over lesser helmets not by government fiat, which has proven disappointing, but with the active support of, at the very least, an appreciable segment of the helmet wearing public. The organization Snively set up serves at the will of the people and, by its nature, must be more responsive to that will than many politicians currently holding office. Manufacturers participate voluntarily but the only reason they do is that Snell certification may help to sell their helmets. If the Foundation ever broke faith with the public to the point that people would no longer seek out and buy Snell certified helmets, manufacturers would drop out of the programs overnight. In very short order, the Foundation would dry up and blow away. We would probably deserve to. However, before very long, there would be a new organization living up to our ideals and continuing our effort. The ideas are too good and the purpose too important. I believe that as long as people need crash helmets there will be a Foundation. If that Foundation is not this one, I and my coworkers will, at the very least, owe the public and Pete Snell, a deep apology.

George Snively died in 1983 and the effort necessary to run the helmet certification programs began to grow beyond the capacity of the then all volunteer organization. In 1988, the directors brought in a salaried staff to turn the crank on the Foundation's helmet programs. The board continues to set all policies and standards and maintains close oversight of the staff. All revenues go through an accounting company in Texas and there are annual audits. The directors also retain direct control over standards enforcement. Helmet models and manufacturers cannot be removed from Snell programs unless authorized by a the Foundation's board.

There has also been a general tightening of test procedures. Snively, to a great extent, had embodied Snell testing and procedures. The standards themselves were general descriptions of the techniques but Snively himself was the final authority. Similarly, there was a single test lab. Manufacturers needn't worry about calibrations or the idiosyncracies of the test technician or the test stand. Everyone could count on being tested by Dr. Snively in his garage lab in California.

When the salaried staff began testing, however, they realized quite quickly that there was sufficient latitude in the written procedures for them to pass, or fail, any helmet that came in the door. Since their mission was to fail helmets, there was no end of protests from manufacturers and no end of helpful advice about the proper way to interpret the standards and perform the tests. Without Dr. Snively to act as arbiter, the Foundation felt obliged to rewrite test methods and procedures to describe, more completely, what the test technicians could and could not impose on a helmet sample. These days, the test techs test right up to the very letter of the requirements and we answer any protest with the page and paragraph of the applicable document. I doubt that this is an improvement on Snively's time but its the best we can do without him.

The Foundation has also standardized their equipment and undertaken extensive efforts to calibrate test instrumentation. The issue is more than performing the tests carefully and correctly. The Foundation must always be ready to demonstrate that the tests are fairly applied and that the results represent accurate assessments of protective performance. To this end, the Foundation's lab participates in an international lab quality program administered by the American Association for Laboratory Accreditation (A2LA). The A2LA program is taken from the International Standards Organization Guide 25 and 17025-1999 documents. The quality lab program can be the basis of a system that will enable a laboratory to perform all the functions necessary to develop and maintain competence in their particular area of interest. The A2LA implementation applies the audits, internal and external, that demonstrate that the quality system is in place and that it is having its desired effect. The effect is that, in addition to the oversight and review of the Foundation's directors and the regular financial audits of our books, we've invited regular review of our technical operations by qualified professionals.

There has been at least one other important change since Dr. Snively's death. The Snell standards have begun to reach the limits of current helmet materials. In the early 60's, helmets moved quickly beyond the technologies that had gone into Pete Snell's last helmet. The pressed paper, leather and cork configurations then, many relying on simple suspension systems as did Pete Snell's, disappeared and were replaced with the stiff shell and expanded polystyrene structures comparable to those being produced today. To be sure there have been many refinements, shells have gotten stiffer and, for some mass produced helmets, ABS plastic and polycarbonates have replaced fiberglass. The EPS inner liner has gotten thicker and its densities have been tuned to match the properties of the outer shell. However, there was only so much improvement that could be wrung from simple material substitutions and refinements of specifications.

To keep up with Snell standards, these helmets have also gotten bigger and heavier. User acceptance had placed some limits on helmet weight and size but those limits are flexible. If a reasonable case can be made, the public seems ready to revise their opinions and their tastes about what constitutes headgear. However, there are also anatomical and physiological limits to what a motorcyclist or a race car driver can reasonably be expected to carry on his head. Since 1985, Snell standards and current helmet technology have been bumping up against those limits.

Sadly, even that much helmet may not be enough. Snell certification labels have traditionally carried the phrase “Some reasonably foreseeable impacts may exceed this helmet’s capability to protect against severe injury or death.” An auto racer or motorcyclist cannot find and probably could not lift, all the helmet he might reasonably expect to need. The most he might do would be to wear all the helmet he could reasonably get on his head. Since the 1985 standards, Snell has been certifying just about all the helmet a racer or a motorcyclist could reasonably be expected to wear.

Although at first the Foundation was primarily concerned with auto racing helmets, motorcyclists began to wear these same Snell certified helmets almost from the very beginning. In fact, the needs of auto racers and motorcyclists were so similar that the same general Snell standard was used for both until 1985 when the standard was split into “M” and “SA” types. The differences remained slight: SA called out requirements for flame resistance and for impact testing against a cylindrical “roll-bar” anvil while “M” called for a slightly larger visual field. In fact, these days, the critical difference seems to be flame resistance. Flame resistant gear may allow an uninjured driver to escape a burning vehicle or allow emergency crews to rescue him. But motorcyclists are at much less risk of fire and the exotic, fire resistant materials that go into helmets add appreciably to the costs. The “M”/“SA” split allowed much less costly units to be produced for motorcyclists.

Since then, the ‘90, ‘95 and 2000 standards have imposed only the slightest increases in demands for additional protective capacity. The current state of the art will not allow much more. In 1990, we lowered the test line at the sides of the helmet. In 1995 we switched to ISO headforms and, subsequently, standardized our drop masses at 5 kilograms. These moves effectively tightened the impact test requirements by at least 10% for all sizes and by as much as 30% for some of the larger sizes. For the 2000 standards, we’ve lowered the test line in the brow area by one centimeter or slightly more than three eighths of an inch.

As slight as these increases may seem, they have proven very difficult for many manufacturers. Current helmet technology is pretty mature so it is difficult to squeeze even slight improvements into a package that is already bumping up against physiological constraints. But the point of Snell standards and programs is to focus attention on the first function of crash helmets, impact protection. We await the next breakthrough in protective helmets but there may be no such breakthrough unless the industry keeps looking for it.

In the light of all this, what does M2000 mean for motorcyclists? For those who prefer Snell Certified helmets it means business as usual. Although M2000 posed problems for many helmet manufacturers, the improvement in protection is actually pretty slight. A good M-95 helmet is, for all practical purposes, as good a helmet as can be found. In fact, there are a few M-95 models that met the new M2000 requirements with no changes at all. If I own a good M-95 helmet, I am not going to run out and buy a new hat right away. If I am shopping for a helmet and I find a new M-95 headgear, that likes my head and my budget, I’ll stop looking right there. Of course, if I have a good M-90 helmet, I may want to think about something newer. M-90 headgear are at the very least about

five years old and could be as much as ten years old. The Foundation recommends routine replacement of headgear every five years.

For those who don't like Snell Certified helmets and who maybe don't like helmets at all, M2000 has no bearing. The Snell programs are strictly voluntary. Manufacturers do not have to build Snell certified helmets and motorcyclists definitely do not have to wear them. We believe in the benefits of good crash helmets and urge everyone to use them but we cannot do much without the active, willing participation of the motorcyclist himself. Unless a motorcyclist is willing to wear a helmet because he's aware of what it can do for him on that sad day when all his best judgement, skill and luck have failed to prevent a crash, he's not likely to select a good helmet or to wear it correctly.

The Foundation has taken a neutral stance on mandatory helmet use. Officially, we neither support nor condemn such laws. Instead, we will do our best to advise those who are receptive to our message, persuade those who are kind enough to listen and to wait patiently for a change of heart and mind in anyone we cannot reach today.