

INTERESTING PIECE ON THE GURNEY FLAP

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(PFFT Ed. Note: In the September 2006 issue of this rag, the action of the Gurney flap was described. It's a valuable trimming tool when you can't get a warp to stay out of a flying surface any other way, and is much less obvious than a trim tab.)

Few people, even the greats of motorsport, get to have their moniker attached to something they invented. Colin Chapman, perhaps the greatest innovator of them all, had only the Chapman Strut named after him, and that was hardly his finest creation. For a driver-turned-team-owner to enjoy the privilege is virtually unknown. But there is a Gurney Flap, named after Dan Gurney - a device, moreover, which has retained its currency in a way that Chapman's minimalist rear suspension never did.

If you understand anything of aerodynamics you'll know what a flap is: a (generally) hinged device at the trailing edge of a wing which can be lowered to increase lift when an aircraft is taking off or landing. The prolonged whirring you often hear a few minutes before a commercial airliner touches down is the flaps being deployed: large, hydraulically- actuated auxiliary surfaces which sprout from the rear of the wing and curl down like a crooked finger.

A Gurney Flap - often called simply a Gurney or a wickerbill in the US - is nothing like as sophisticated. Classically it's no more complex than a length of aluminum right-angle rigidly bolted or riveted to a wing's trailing edge. Usually it's a wing intended to keep a racing car on the road, although it does also see some aircraft service, on helicopter tailplanes for example. Crude as it looks, it serves essentially the same purpose as the complex flap on an aircraft wing, increasing lift or, in this instance, downforce.

Conception of the Flap was, to use Dan Gurney's own description, a classic example of necessity being the mother of invention. It happened in 1971 while his AAR team was testing its new USAC car at Phoenix, prior to the season's first race there. The car was too slow and everybody knew it. Towards the end of the third and last day of testing, driver Bobby Unser challenged 'the boss' to come up with a solution, and Gurney suggested the flap. He'd seen the success Richie Ginther had had experimenting with spoilers on Ferraris and wondered what would happen if a small spoiler was fitted along a wing's trailing edge.

In 45 minutes or so, the first Gurney Flap was fabricated and attached to the car's rear wing, and Unser went out again. Within a couple of laps it was clear he was circulating no faster than before and everyone in the pit assumed the flap was a failure. But when Unser came in he called Gurney over and quietly asked him whether anyone was around to spy on what they were doing. Once Gurney had confirmed they were alone, Unser told him the rear was now so well planted that the car was pushing (understeering) badly, hence the poor lap times.

All they needed to do was restore the aerodynamic balance by adding more front-end downforce and the car would be transformed.

For most of that first season, none of the other teams cottoned on to what Gurney had achieved. Anyone who asked was told that the flap was a purely structural feature to strengthen the wing's trailing edge. Taken in by this, some teams tried fitting Gurneys on the underside of the wing with predictable results: they lost lap time or worse. Eventually, word got around that the Flap was an Eagle secret weapon and everybody started using it, whether they understood its function or not.

Gurney, meanwhile, had allowed McDonnell Douglas in on the secret and was given access to an old wind tunnel in which to test it. Measurements on the test wing showed that fitting the Gurney Flap affected pressure across the wing's entire upper and lower surfaces, increasing lift (or downforce) and reducing flow separation on the wing's suction side. Gurney placed the patenting of the device in the hands of McDonnell Douglas and, for some years after, AAR cars used to carry 'Pat Pend' scripts on their wings. This patenting effort, however, eventually came to nothing, not least because one Edward F Zaparka had patented a similar device as far back as the early 1930's.

Dr. Bob Liebeck, the McDonnell Douglas aerodynamicist hired by AAR as a consultant to help design its cars in the 1970's, was the first to hypothesize that the Gurney Flap's effect was the result of small twin vortices generated immediately downstream of its lip. Various studies conducted since then have confirmed this. The most recent being by researchers at both Southampton and Glasgow universities.

Thirty years on from its first mysterious appearance, the Gurney Flap is still widely used in motorsport as an inexpensive and effective aerodynamic tweak. Fitting or removing a Gurney, or changing its height are quick, straightforward-to-do and repeatable ways of tuning a car's setup.

This piece was excerpted in its entirety from an article written by Keith Howard and published in the September '02 issue of *MotorSport Magazine*, England.