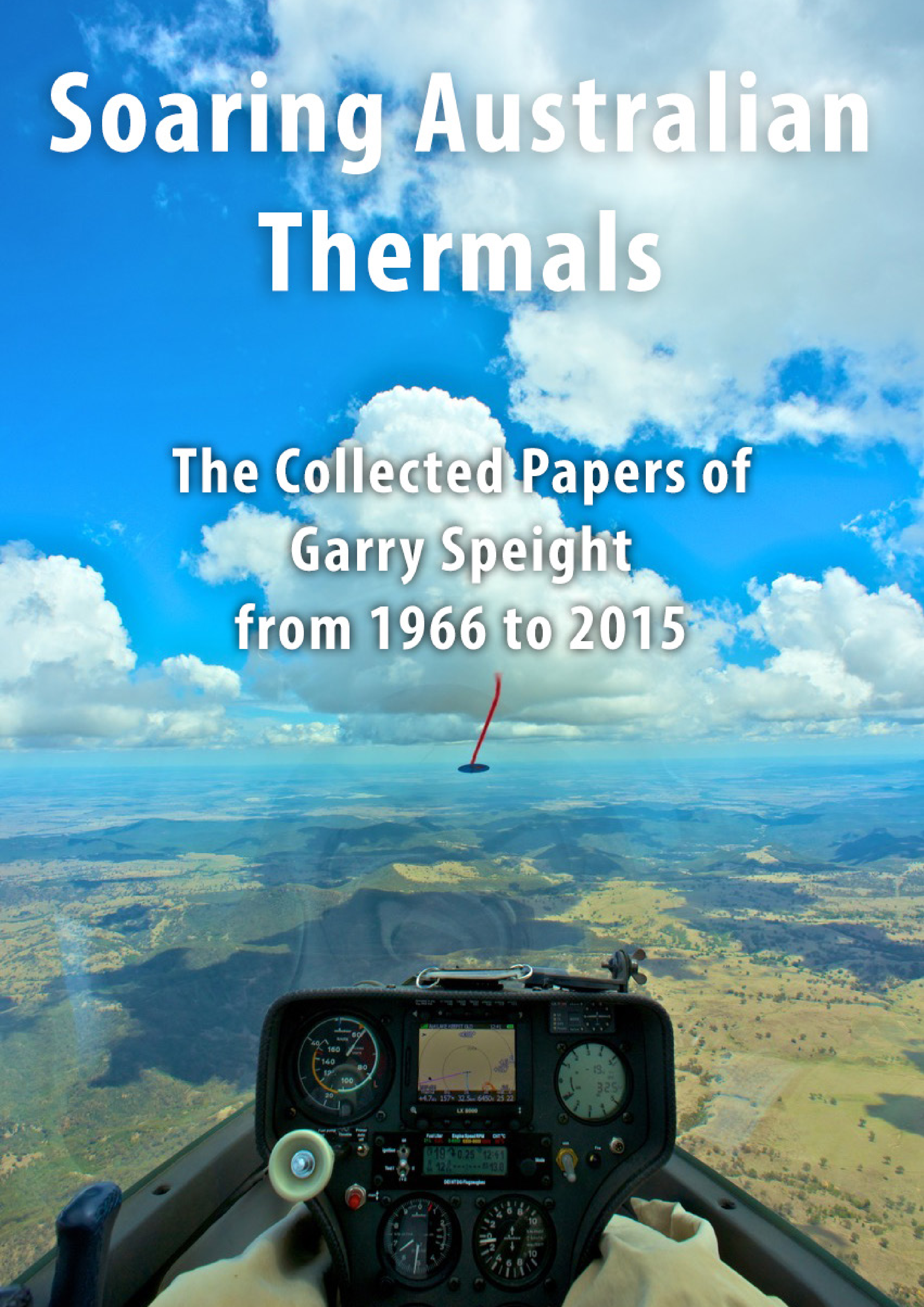
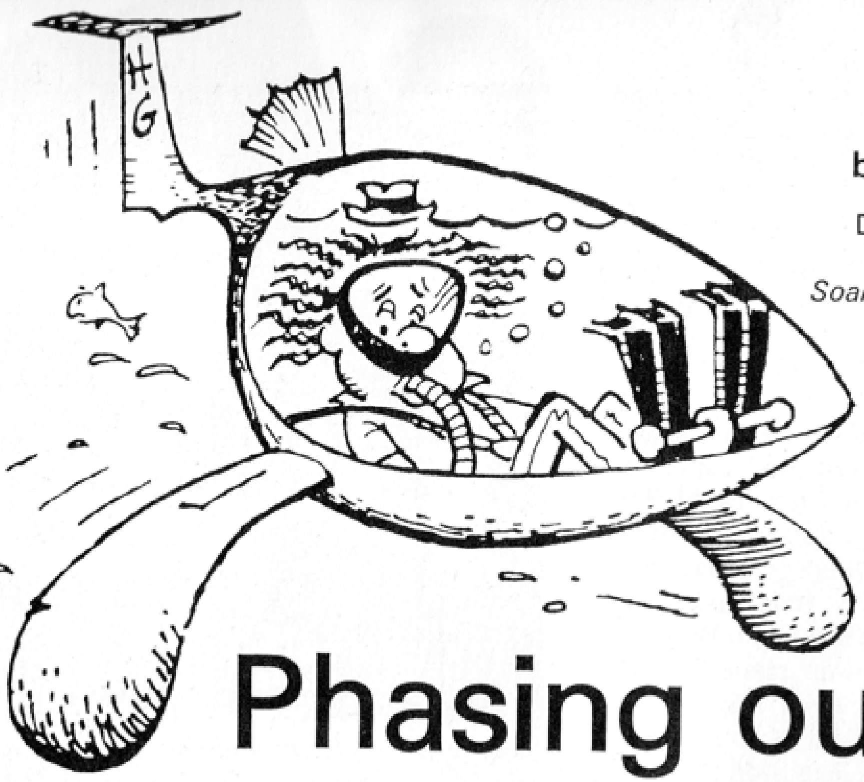
Soaring Australian Thermals

The Collected Papers of Garry Speight from 1966 to 2015





by Garry Speight

Drawing by Gil Parcell, used by courtesy of *Soaring* magazine, U.S.A.

Phasing out water-ballast

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The June 1984 issue of Soaring carried an article by Wil Schuemann proposing that water-ballast should be eliminated from gliding contests. It was reprinted in January AG.

Schuemann's knowledge of water- ballast may be judged from the fact that he flies a clipped-wing ASW12 that has the highest wing loading of any 15-metre sailplane, 55 kp/m^2, with water-ballast making up 38% of the all-up weight.*1

Schuemann gives many good reasons why water-ballast has outlived its usefulness and is not worth the various dangers that it brings.

I agree with him. However, I don't agree with his solution, which is also being tried in Australia: to fly contests in existing gliders without their water ballast. Gliders are to be raced at the very low wing loadings intended only for desperate saves when the sky falls in!

I expressed my view in the following letter sent to Soaring magazine:

Dear Sir,

I support Wil Schuemann's brave statement about water ballast. The value of water ballast in competition gliders no longer justifies its many dangers and technical and administrative problems. We should stop using it.

How can we do this without hurting glider owners or manufacturers? So far as possible, existing gliders should not be devalued as competition aircraft.

Wil Schuemann's idea of promoting unballasted competitions using existing gliders is not the answer. These gliders were not designed to race against each other without their ballast.

Some of the most expensive ones are too lightly loaded, whereas Hornets and LS-1's, with unballasted wing loadings exceeding 34 kp/m^2 (7 lb/sq ft), have an unforeseen advantage.1

Since the heyday of the Sisu it has been clear that competition success seldom depends on being able to reduce the wing loading below that value.

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The performance benefit of a high wing loading is not even closely related to thermal strength, but is mainly due to an increase in thermal search range at the appropriate MacCready speed. I doubt that pilots will be happy to forego the flat glide angles that they are now accustomed to.

I believe that the first step towards eliminating water ballast should be to arrange competitions at a fixed wing loading.[2] In due course, a wing loading value should be included in class definitions.[3]

It should be made mandatory to display correct weight and wing area values in each competing glider. Also, the dumping of water ballast in flight should be penalised so that the pilot derives no advantage from it.

These steps would remove the incentive for manufacturing water-ballast-carrying aircraft. However no existing aircraft would be rendered non-competitive in the process.

The Standard Class, traditionally the "no-frills" class, should be the first to move away from water ballast. I suggest that the appropriate wing loading value should be 36 kp/m^2 (7.5 lb/sq ft). A higher value than this would permit higher cross-country speeds on good days, but it would also prevent competition on weak days.

All current Standard Class gliders can achieve this loading, although the Standard Libelle and Astir CS are then at their maximum permitted weights.4

A competition between Standard Class gliders all flown at 36 kp/m^2 might reveal a remarkably small range in achieved performance.

Glider-weighing at serious competitions is with us already. At first, the only change would be to verify a common wing loading rather than a certified maximum all-up weight.

In the course of time, weighing would be replaced by a check of documentation and an inspection for unauthorised ballast. Perhaps the pilot, with his equipment and trim weights might be weighed.

While water ballast is still being carried, we will need a way to monitor the "no dumping" rule. If dump valves were modified to prevent them from being reclosed, then any pilot who could not stream ballast at the finish line could be assumed to have dumped it during the race.

Once the competitive advantage of carrying water had been removed, glider owners could decide whether to retain their hazardous water ballast systems or to carry out authorised modifications to install fixed or removable solid ballast. Perhaps this could take the form of flexible rods, to be inserted in pockets beside the spar.

Manufacturers may favour installing some form of removable ballast, so as to be able to convert a Standard Class competition glider to a training glider with a wing loading of 29 kp/m^2 (6 lb/sq ft) or less.

In the 15-metre Class, the use of flap permits the circling speed to be reduced by about 10% at a given wing loading.

If Standard Class gliders can stay aloft at 36 kp/m^2, then 15-metre Class gliders should stay aloft at a wing loading that is some 20% higher, i.e. 44 kp/m^2 (9.5 lb/sq ft). These values are put up just as a starting point for discussion.

The Open Class logically is the place for experiments aimed at improving sailplanes in general. In my opinion it should be free of all arbitrary restrictions. The people involved should take responsibility for developing safe procedures and for obtaining adequate tugs and airports.

In the case of the other two classes, I imagine that designers would welcome the opportunity to aim for the ultimate in aerodynamic efficiency at a specified wing loading. Designing for a variable wing loading must make it difficult to produce an optimal aircraft.

Including wing loading in a competition class definition would guide sailplane development according to pilots' needs. Simply banning water-ballast would give no such guidance. Without it, no two manufacturers will make comparable gliders.

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Notes:

*1 "Throughout this article we use the abbreviation kp/m². This indicates kiloponds per square metre and is the current terminology for referring to wing loading. As it happens, though, a kilopond force is the same as a kilogram mass so those who prefer can continue to think in kilograms per square metre. Wing loading should properly be expressed in Pascals."

1. I don't actually know the maximum wing loadings permitted in various types when flown without water-ballast. Perhaps some of them can carry a lot of lead (or a pilot fed like a sumo wrestler) to enhance their performance if water-ballast is banned.

2. When I say a fixed wing loading I mean no more and no less. Lightening up the aircraft on a weak day should not be allowed.

3. It has to be wing loading rather than weight that is standardized. Wing loading governs the performance, and wing areas may vary by 15%.

4. Full of water.

Since this was written, two things have changed. First, top pilots, who once disdained any glider not of the highest performance, now compete in low performance gliders in the handicapped Sports Class or Club Class. They are now happy to show their skills flying without water ballast. Second, "assigned area" tasks have become common in competitions. Because pilots flying low performance gliders are not now required to fly as far as those in higher performance gliders, they are not as prone to out-landing as they once were.