

## Noel Malone's Arrow 60

*Noel Malone's Arrow 60 is designed for slope flying on the sand dunes of Rainbow Beach, a couple hours drive north of Brisbane Australia. This well-designed swept wing tailless model receives a lot of positive comments from other Queensland area slope flyers.*

Noel has been working on the Arrow 60 project for several years. The model has a relatively simple planform with an aspect ratio of about nine. It has a 60 inch span and 23 degrees sweep, seven inch constant chord, and winglets. Construction consists of a foam core wing with a carbon spar system and vacuum bagged carbon fiber skins. The fuselage is of molded fiberglass and has provision for ballast on the center of gravity. Controls are elevons only and the servos are mounted in the wing.

### **Arrow 60 MK 1**

The Mark 1 version of the Arrow 60 served as the test bed for the planform and was constructed several years ago.

The Arrow 60 Mark 1 uses the MH 45 section from root to tip. A carbon fiber spar makes the wing very stiff. The overall weight for this initial version is less than 20 ounces,  $6.8 \text{ oz/ft}^2$ . Even at this low weight and resulting wing loading, the wing is fairly quick and nimble. A plug-in tail cone allows access for addition of ballast.

There were some initial stability problems with this wing, but all difficulties were eventually traced to the receiver. The design proved aerodynamically sound and a joy to fly, so it was on to Mark 2.

### **Arrow 60 MK 2**



The Mark 2 version was designed to be a bit faster than the Mark 1. It uses the MH 64 section and 2.2 degrees of twist, computed with the Panknin formula. A more robust structure increased the weight to 24 ounces, so the wing loading is noticeably higher —  $8.2 \text{ oz/ft}^2$ .

Surprisingly, Noel says that ballast is required if there is reasonable lift. Still, the basic airframe could be made an ounce or so lighter with more care during construction.



JR 331 servos are installed in the wing with direct connections to the elevons. The servos sit against the upper carbon skin and lie flush with the lower surface.

The Mark 2 Arrow 60 is a pleasant aircraft to fly. It's quite quick and, due to the large elevons, is also fairly lively, and always attracts a lot of attention on the slope.

The Mark 2 version has been flown at Laidley, about an hour west of Brisbane, with the Summerholm Sport Slope Soarers club, as well as at Rainbow Beach. Rainbow Beach is a huge area with slopes of blown sand.

Noel added as much ballast as he could, raising the weight to 37 ounces and the wing loading to 13.25 oz/ft<sup>2</sup>. The Arrow 60 remained very nice to fly at this weight, and was quicker than a couple of 60" conventional planes that were at Rainbow Beach.

Everyone who has flown the Arrow 60 seems to be very impressed with it, especially those who have previously not been flying wing fans.

### **Two meter version**

A two meter version of the Arrow, aspect ratio 10, is in the planning stages. This version will be designed for slope and flat land thermal flying and will have a three piece wing. Contrary to previous Arrow versions which utilized twist from root to tip, the two meter version will incorporate twist only in the outer 60 percent of the wing.

We're looking forward to being able to follow Noel's future progress on his Arrow project.



## References

Coordinates for the MH 45 and MH 64 are available on Martin Hepperle's web site <<http://members.tripod.de/MartinHepperle/Airfoils/>>.

The Panknin formula and associated computer applications are available on the B<sup>2</sup>Streamlines web site at <<http://www.b2streamlines.com/Panknin.html>>.