- MAN-POWERED FLIGHT -
OBSERVATIONS ABOUT FLIGHT UNDER HUMAN POWER

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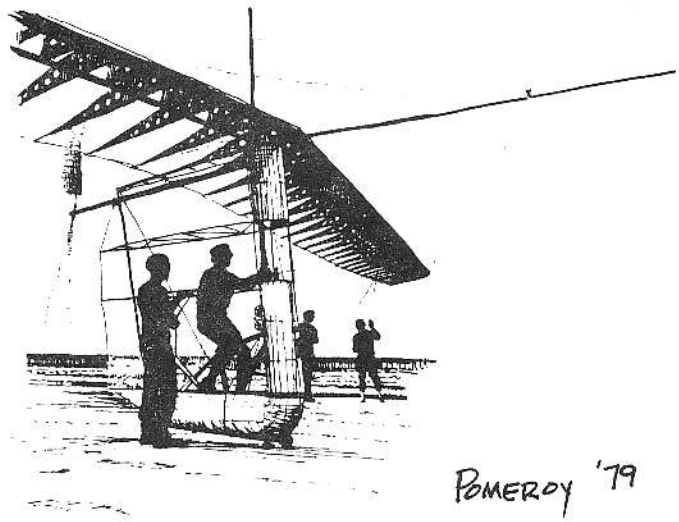
Until now, the greatest technical difficulty encounted in all human-powered aircraft projects has been the realization of an extremely light monoplane wing of large area and aspect ratio.

The greatest practical difficulty is one of maneuvering the aircraft in flight; the extremely large span does not allow banking to the most efficient angle in a turn.



The winners of the Kremer Prize have reached an absolutely remarkable compromise between wing area, aspect ratio, lightness, vertical surface area, and appropriate flying technique.

One may wonder if it would not be advantageous, for this particular form of extremely low power flight, to consider a multiplane formula (for example, at least 5 elements) with canard elevator, itself monoplane or multiplane. A conventional elevator configuration could be considered also, noting however the effect of the strong wing downwash.

This configuration should permit the realization of large area wings with good aspect ratio and low structural weight. It would allow optimum bank in turns without the risk of a wing tip hitting the ground, and would significantly lessen the power required in this maneuver. It should be noted that, in the performance required for the Kremer Prize, a major part of the flight must be carried out in a turning maneuver.

The design of such a multiplane wing would require relatively large gaps and appropriate decalage and stagger. The fuselage should be designed to act as a fence for the wings directly attached to it. It is also possible to increase somewhat the effective aspect ratio by using vertical surfaces to link the wing tips, provided the drag of these surfaces does not exceed the gain in wing induced drag, and provided their construction remains very light.

It is understood that the airfoils used on these multiplane wings would be selected or designed to meet the requirements of the appropriate Reynolds Number.

From a structural and control standpoint, it is conceivable that the wings could pivot in incidence about tubular spars made either from aluminum tubing or composite material. They could then be operated differentially for roll control, and simultaneously for pitch control.

It should be noted that some of the most advanced hang gliders are biplanes. It is quite likely that they could benefit from the development of multiplane wings for reasons somewhat similar to those of the man-powered aircraft.