The Moving Root Versus Dynamic Sheeting

The use of a moving root is very important to Project Sea Tree. The faster it goes, the more air is encountered, and the more energy is available to be harvested. Some systems under consideration employ an air vehicle that moves around a circuit relative to the tether root in order to achieve air speed. In 1996, Dave Culp referred to that technique as "dynamic sheeting". He was referring to dynamic sheeting of a kite anchored to a moving boat. But, now some kite-power systems use dynamic sheeting with a kite anchored to a fixed root. Such systems contain some point on the ground that does not move relative to the surface of the earth. That technique does increase the air speed and the concomitant propulsive tether tension compared to a kite with fixed azimuth and angular altitude.

However, the fixed root has problems. Firstly, to increase air speed, either the frequency of circuits about the root must increase, or the length of the tether must increase, or both. The former increases undesirable inertial loads resulting from changes in the velocity vector, and the latter increases tether weight, drag and possible difficulty in transmission of electrical power from an air born turbine. The moving-root system does not rely on tether length to achieve air speed. In the absence of wind gradients, the minimum possible tether length would be best for the moving root. The fixed root puts a cap on air speed which is absent from the moving-root system. (The moving-root system, by definition, moves in a straight line.) The second problem with dynamic sheeting above a fixed root is that the air vehicle disrupts air flow during the up-wind portion of its loop. Then the more-turbulent, lower-speed air is encountered by the same or some other air vehicle in the lee portion of the circuit. The moving root always encounters fresh, "clean" air. Thirdly, power delivered by dynamic sheeting is pulsating, passing through maxima and minima, as the air speed pulsates. The moving-root system moves with maximum efficiency constantly. If necessary dynamic sheeting could be added to the moving-root system, thus increasing air speed without the concomitant increase in the loss of energy to friction and drag in the ground vehicle. (The sinusoidal motion would not result in retrograde motion.)

Note that attaching the tether to the outer portion of a rotating lever or carousel does not produce a "moving root", because all three fixed-root problems ensue.

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