A greener way of conquering space?

[Nematrian website page: SolarPowerSpaceFlight, © Nematrian 2015]

In the 1960s outer space was the place to go. It still has an enduring fascination for all generations, as witnessed by the phenomenal success of films like *Star Wars*.

Suppose human space travel really takes off. It might then create a rather more pressing problem back here on earth. Scientists tell us that a significant contributor to global warming in coming years may come from jet engine exhausts. Won't the hugely larger exhaust plumes of current rocket designs only exacerbate this problem?

The Nematrian website describes a possible, if somewhat speculative, solution to this problem. This involves increased use of *solar power* for space vehicle propulsion purposes. The ideas are explored further in Kemp (2005), (for references see Solar Powered Space Flight References). An updated version of this paper is available via the following hyperlink: Solar Powered Space Flight.

Solar-powered space flight

The basic idea is that solar-powered space flight, *even prior to reaching orbit*, is less implausible than you might first think. The trick is to use a carefully designed solar power concentrator. Even with today's technology, it ought in principle to be possible to use solar power to lift a vehicle plus payload all the way into orbit, as long as atmospheric drag is limited by having the vehicle lifted in the earliest stages of its flight by more conventional chemical rocketry.

If such a vehicle could reach earth orbit then only relatively modest further improvements would be needed to take the vehicle all the way to the Moon or Mars and back, or beyond!

A killer app for graphene?

A possible material to use to make the substrate for such a concentrator is graphene, given its high tensile strength and its ultra-low mass per unit area. Peplow (2015) notes that the many possible industrial uses currently being developed for graphene has already sparked a graphene-making frenzy. This frenzy could become much bigger still if very large concentrators made partly out of graphene could be successfully developed for into orbit solar powered space flight.

Nice idea?

That's the theory! In practice there are several significant engineering challenges to solve on the way. One key requirement is to solve the problem of how to keep a large ultra-low mass optical concentrator arrangement sufficiently accurately positioned in different parts of such a trajectory. Here the point perhaps is not to think too small-scale. The ideal size for an ultra-low mass optical concentrator for use in space seems to be significantly larger than the relatively small (rigid) concentrators that are sometimes used at present. However, there appears to be a big disparity between currently available component performance and what ought theoretically to be achievable using e.g. graphene based structures.

Still, even if the ideas set out in Solar Powered Space Flight are ahead of their time and do not immediately lead to the development of a solar powered space vehicle, they will hopefully stimulate others to bring theory and practice closer together in this area. You read about it here first!