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Solid State Aircraft

Due to recent advances in polymers, photovoltaics, and batteries, the development of a revolutionary type of unmanned aircraft may now be feasible. This flight vehicle would integrate airfoil, propulsion, energy production, energy storage, and control into one seamless design with no conventional mechanical moving parts. The integration of these components comprises the "Solid State" aircraft concept that has wide implication for terrestrial and planetary flight applications.

The most innovative aspect of this concept is the use of an ionic polymeric-metal composite (IPMC) as the source of control and propulsion. This material has the unique ability to deform in the presence of an electric field like an artificial muscle, and return to its original shape when the field is removed. Combining the IPMIC with emerging thin-film batteries and thin-film photovoltaics provides both energy source and storage in the same structure.

Combining the unique characteristics of these materials enables flapping of the aircraft wing to generate the main propulsive force. With a flight profile similar to that of a hawk or eagle, the Solid State Aircraft will be able to soar for long periods of time and utilize flapping to regain lost altitude. During Phase I work on this concept, analysis was performed on the glide duration, flap duration, wing length, and wing motion of travel. It was determined that a versatile, robust, advanced aeronautical architecture can be produced taking into account these parameters. This architecture would enable flight over a broad flight envelope comprised of a range of latitudes and times of the year on Earth, Venus, and Mars.