Remote Radio Control of Insect Flight

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Despite major advances, performance of fully synthetic micro air vehicles (MAV's), tiny flying robots, is still limited in terms of size, payload capacity, endurance, and controllability. Various species of insects have as-yet unmatched flight capabilities and increasingly well understood neuromuscular systems. Additionally, as microsystem technology has advanced, integrated radio and microprocessing unit (MPU) chips have recently come into the market, and it is possible to develop electrical systems tiny enough to mount on an insect. Our goal is to create a bio-interface between a man-made microsystem and living insect to wirelessly control flight. Our current choice of insect platform is a beetle because of its large payload capacity. The beetle we currently use is a giant flower beetle, *Mecynorrhina torquata*, which can carry up to a 3 gram load in free flight. We have designed and fabricated a miniaturized radio communication backpack system that weighs 1.3 grams and electrically stimulates certain neuromuscular sites of the beetle via implanted electrodes. We have then successfully demonstrated fully wireless radio control of untethered beetle flight including initiation, cessation, elevation and turns.