Lord of the Wings

By Mico Tatalovic

THE dragonfly is an aerial acrobat. It's able to fly fast and slow, backward and forward, and even stay aloft while copulating. Where does the energy for all of these stunts come from? A new report in today's issue of the Journal of the Royal Society Interface suggests that the answer has to do with the insect's four independently moving wings.

Most flying insects use only a single pair of wings. Some, like butterflies and bees, use two pairs but synchronize their motion so that the effect is akin to having just two wings. Dragonflies and damselflies stand apart: Unusual musculature allows them to move each of their four wings independently. Computer modeling has shown that such out-of-phase flapping comes at a cost, however, reducing the amount of lift the insect is able to generate.

To see if these computer models hold up in the tangible world, James Usherwood, a biologist at the Royal Veterinary College in London, and Fritz-Olaf Lehmann, a biologist at the University of Ulm in Germany, built a



robotic version of a dragonfly. They immersed the robot in mineral oil seeded with air bubbles to allow them to visualize the movement of the fluid around the flapping wings. Sensors at the base of the robot's wings recorded lift and drag forces, which allowed the team to calculate its aerodynamic efficiency.

Flapping four wings actually achieved lift with more efficiency than flapping just two wings. When the robot's hind wings flapped one-quarter of a wing beat ahead of the front wings, the team reports, the hind wings were able to capture the rush of air sent by the front wings and produce lift with 22% less power than two-winged insects require. Flapping in phase has benefits, too: When real dragonflies synchronize their wing beats, they are able to lift off and accelerate better than if they used only two wings or four out-of-sync wings, the authors say. Engineers may be able to apply these findings to building the next generation of flapping micro air vehicles, says Lehmann.

Source: Science NOW Daily News

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