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Mosquitos Fail at Flight in Heavy Fog

San Diego, Calif., Nov. 19 – Mosquitos have the remarkable ability to fly in clear skies as well as in rain, shrugging off impacts from raindrops more than 50 times their body mass. But just like modern aircraft, mosquitos also are grounded when the fog thickens. Researchers from the Georgia Institute of Technology present their findings at the meeting of the American Physical Society's (APS) Division of Fluid Dynamics (DFD), held Nov. 18 - 20, in San Diego, Calif.

"Raindrop and fog impacts affect mosquitoes quite differently," said Georgia Tech researcher Andrew Dickerson. "From a mosquito's perspective, a falling raindrop is like us being struck by a small car. A fog particle – weighing 20 million times less than a mosquito – is like being struck by a crumb. Thus, fog is to a mosquito as rain is to a human."

On average during a rainstorm, mosquitos get struck by a drop once every 20 seconds, but fog particles surround the mosquito continuously as it flies. A mosquito's interaction with a raindrop is therefore brief, but the interaction with fog particles is continuous and inescapable once the mosquito is in a fog cloud.

Regardless of their abundance, water droplets in a fog cloud are so small that they should not weigh down a mosquito enough to affect its ability to fly.

To explore this puzzle, Dickerson and his colleague David Hu used high-speed videography. They observed that mosquitoes have a reduced wing-beat frequency in heavy fog, but retain the ability to generate sufficient force to lift their bodies, even after significant dew deposition. They are unable, however, to maintain an upright position required for sustainable flight.

The reason for this is the impact that fog has on a mosquito's primary flight control mechanism. Known as halteres, these small knobbed structures evolved from the hind wings and flap anti-phase with the wings and provide gyroscopic feedback through Coriolis forces (the perpendicular force generated by a rotating object).

These halteres are on a comparable size to the fog droplets and they flap approximately 400 times each second, striking thousands of drops per second. Though the halteres can normally repel water, repeated collisions with 5-micron fog particles hinders flight control, leading to flight failure.

"Thus the halteres cannot sense their position correctly and malfunction, similarly to how windshield wipers fail to work well when the rain is very heavy or if there is snow on the windshield," said Dickerson. "This study shows us that insect flight is similar to human flight in aircraft in that flight is not possible when the insects cannot sense their surroundings. "For humans, visibility hinders flight; whereas for insects it is their gyroscopic flight sensors."

Presentation: "Mosquito Flight Failure in Heavy Fog," is at 5:06 p.m. on Monday, Nov. 19, in Room 28A.

Abstract: http://meeting.aps.org/Meeting/DFD12/Event/178572

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MORE MEETING INFORMATION
The 65th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics will take place from November 18-20, 2012, in San Diego, Calif. It will bring together researchers from across the globe to address some of the most important questions in modern astronomy, engineering, alternative energy, biology, and medicine. All meeting information, including directions to the Convention Center, is at: http://apsdfd2012.ucsd.edu/

USEFUL LINKS
Main Meeting Web Site: http://apsdfd2012.ucsd.edu/
Searchable Abstracts: http://meeting.aps.org/Meeting/DFD12/APS_epitome
Directions and Maps: http://apsdfd2012.ucsd.edu/?page=Venue_and_Maps

PRESS REGISTRATION
Credentialed full-time journalists and professional freelance journalists working on assignment for major publications or media outlets are invited to attend the conference free of charge. If you are a reporter and would like to attend, please contact Charles Blue (dfdmedia@aps.org, 301-209-3091).

SUPPORT DESK FOR REPORTERS
A media-support desk will be available. Press announcements and other news will be available in the Virtual Press Room (see below).

VIRTUAL PRESS ROOM
The APS Division of Fluid Dynamics Virtual Press Room will be launched in mid-November and will feature news releases, graphics, videos, and other information to aid in covering the meeting on site and remotely. See: http://www.aps.org/units/dfd/pressroom/index.cfm

GALLERY OF FLUID MOTION
Every year, the APS Division of Fluid Dynamics hosts posters and videos that show evocative images and graphics from either computational or experimental studies of flow phenomena. The outstanding entries are selected for their artistic content, originality, and ability to convey information. They will be honored during the meeting, placed on display at the 2013 APS March Meeting, and appear in the annual Gallery of Fluid Motion article in the American Institute of Physics' journal, Physics of Fluids.

Selected entries from the Gallery of Fluid Motion will be hosted as part of the Fluid Dynamics Virtual Press Room. In mid-November, when the Virtual Press Room is launched, another announcement will be sent out.

This release was prepared by the American Institute of Physics (AIP) on behalf of the American Physical Society's (APS) Division of Fluid Dynamics (DFD).

ABOUT THE APS DIVISION OF FLUID DYNAMICS
The Division of Fluid Dynamics of the American Physical Society (APS) exists for the advancement and diffusion of knowledge of the physics of fluids with special emphasis on the dynamical theories of the liquid, plastic and gaseous states of matter under all conditions of temperature and pressure. See: http://www.aps.org/units/dfd/