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## Even without wings, V-formations save energy **FREE**

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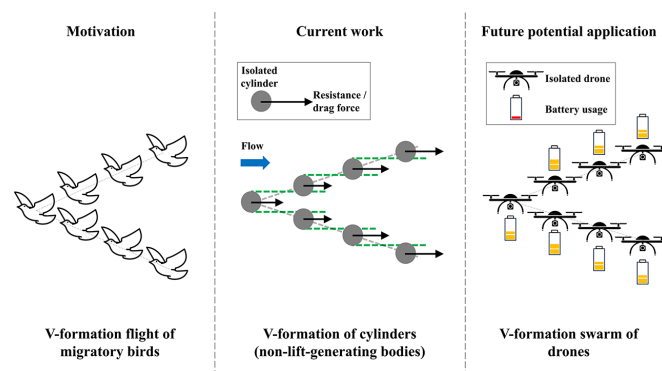


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**A laser-based technique reveals the flow around formations of non-lifting objects, which could inform vehicle swarming and flood mitigation strategies.**



The iconic V-formation of birds in flight allows its members to reduce drag and save energy. While previous research has studied how this formation affects groups of objects sporting fixed wings, such as planes, its effect on groups of objects without fixed wings, such as frames of unmanned aerial drones or underwater vehicles, is less understood.

To help develop swarming strategies independent of wings, Suchandra and Raayai-Ardakani studied the flow around V-formations of non-lifting objects. They found that wingless bodies arranged in V-formations experienced much less resistive drag force than a solo body, especially when the bodies overlap streamwise. In such formations, members of the second row experienced the largest reduction with up to 45 percent less drag.

In addition to developing energy-saving swarming formations for autonomous aerial or underwater vehicles, the reported flow dynamics could be used to engineer marine structures that mitigate flooding.

“We believe this work is very important for understanding the dynamics of a variety of natural systems, such as group motion or arrangements of vegetation in river and coastal areas,” said author Shabnam Raayai-Ardakani.

In this work, the authors used a cost-effective imaging technique involving a single laser and multiple light sheets that allowed them to illuminate shadows and visualize flow between cylinder-shaped objects in a water tunnel. They plan to expand this technique to other types of flows and objects.

“In the future, we need to consider other flow regimes and the 3D nature of the flow field,” Raayai-Ardakani said. “We also want to study the combination of lift-generating bodies, such as airfoils and propellers, or combinations of non-identical bodies.”

**Source:** “Impact of bio-inspired V-formation on flow past arrangements of non-lifting objects,” by Prasoon Suchandra and Shabnam Raayai-Ardakani, *Physics of Fluids* (2024). The article can be accessed at <https://doi.org/10.1063/5.0186287>.

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