A novel hybrid UAV that may change the way people operate drones

Two PhD students in the ***Department of Electrical and Computer Engineering (ECE Department) at the National University of Singapore (NUS)***, Wang Kangli and Ke Yijie, supervised by Professor Ben M. Chen, spent four years in developing a novel hybrid unmanned aerial vehicle (UAV), U-Lion, which is a hybrid UAV capable of taking-off and landing vertically like helicopters, and transiting to cruise flight like normal airplanes.

The wings can be fully retracted or expended, to favor the stability in VTOL mode or provide efficient lift in cruise flight. U-Lion is also able to fly autonomously includes vertical take-off and landing, cruise flight and autonomous transitions. The developed technology brings the application of hybrid UAVs one step closer. Their research result which was published in *Science China Information Sciences*, Volume 60, March 2017, have appeared in various news and professional societies media including:

- American Association for the Advancement of Science (AAAS) EurekAlert
- Association for Computing Machinery (ACM)
- Phys.Org
- sUAS News
- Institute of Mechanical Engineering
- AZoRobotics

Hybrid UAV U-Lion with three flying modes. Credit: ©Science China Press

Watch the video

Over the last decades, hybrid UAVs have attracted worldwide interest for their potential applications in military and civilian operations, especially where there are severe constraints in operating environments, for example, sea surveillance and forest mapping. The VTOL capability minimizes the dependency of the take-off and landing facilities and cruise flying capability allows hybrid UAVs to perform long range and duration tasks.

The hybrid UAV is a hot research topic not only academically, but also commercially. Many companies, such as Google, have devoted resources in developing similar platforms. However, due to the difference in structures between the VTOL and fixed-wing UAVs, it is a huge challenge to combine the two functionalities into one single UAV platform. Previous attempts of hybrid UAVs tend to focus on either one of the flying modes, but not optimal on both. Besides, due to the high uncertain aerodynamic forces in the transition process, the transition process is difficult to automate.

To achieve optimal performance in both flying modes, U-Lion is designed in tail-sitter configurations with reconfigurable wings and vectoring thrust. It could adopt different flying modes based on mission requirements, and adjust the wings to achieve optimal performance. The ability allows U-Lion to fly much longer than typical VTOL drones and possess greater maneuverability compared to normal fixed wing ones. Being optimal in both flying modes, U-Lion could bring a new way people operates drones. The fast reaction and static hovering capabilities bring U-Lion great potential in many applications, the VTOL capability allows it to operate in almost anywhere, including on vehicles on the sea.

For information, please visit the Unmanned Systems Research Group website at: http://uav.ece.nus.edu.sg/