Wing Dynamics

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The HIVE 2 vehicle will use 360 servos to enable the variable sweep for each of the 4 wings. This will allow the vehicle to change its shape in flight, which will improve its maneuverability and efficiency. The servos will be controlled by the Sierra Flight Computer, which will be able to adjust the sweep angle of each wing independently. This will allow the vehicle to fly in a variety of different configurations, depending on the needs of the mission.

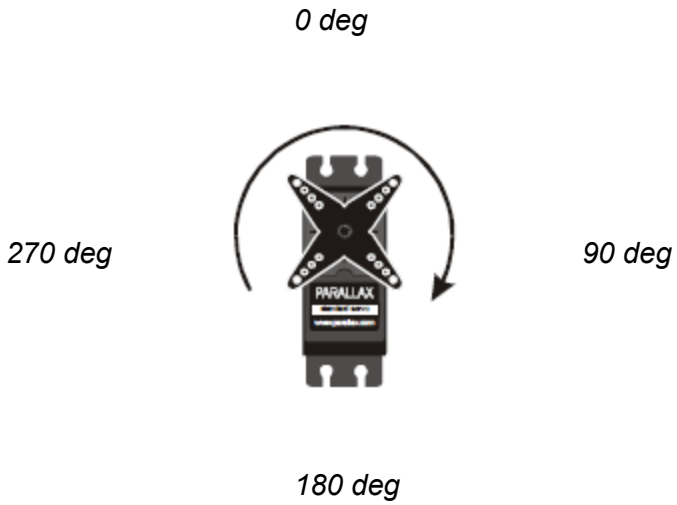


Fig 1.0. Servo Rotation Angles

Servo Rotational Map for Vehicle Wings:

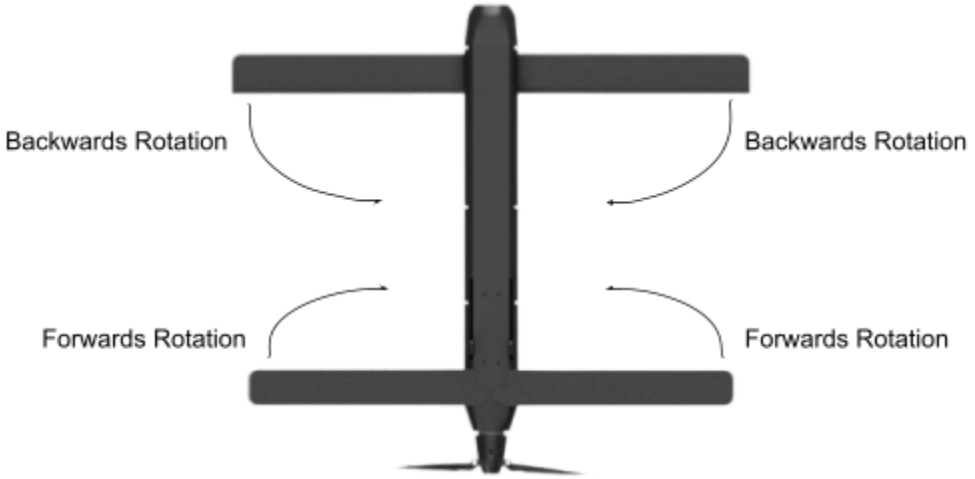
The servo rotational map represents the servo angle range in which the wings can operate. They range from the stowed position when the vehicle is not in flight and is stored to the deployed position where each wing is at its deployed neutral position.

Wing	**Stowed (Servo Angle)**	**Deployed (Servo Angle)**	**Wing Range (Stowed - Deployed)**
Front Left (**FL**)	180 deg	270 deg	**180 - 270 deg**
Front Right (**FR**)	180 deg	90 deg	**180 - 90 deg**
Rear Left (**RL**)	0 deg	270 deg	**0 - 270 deg**
Rear Right (**RR**)	0 deg	90 deg	**0 - 90 deg**

Wing Control

Pitch Control:
When both of the front wings swing backward, the shift in the aerodynamic center of the canards (front wings) leads to a negative pitch moment relative to the center of mass. A positive pitch moment is generated when the rear wings sweep forward. Thus, by having the front wings sweep backward and the rear wings sweep forward, one can trim the flight state without an elevator.

Pitch Maneuver (Positive)



Roll Control:
Under the condition of asymmetric morphing, the shift in the aerodynamic center of the front left wing and the rear left wing leads to a negative roll moment relative to the center of mass and an opposite roll moment under the condition of inverse morphing.

Roll Maneuver (Negative)