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Time-Resolved PIV Airwake Measurements of a Frigate Ship Model[1] ZHENG ZHANG, DHUREE SETH, EBENEZER GNANAMANICKAM, GORDON LEISHMAN, Embry-Riddle Aeronautical University — To better understand the complex, unsteady airwake structure produced on the rear deck of a ship used for helicopter operations, a ship model with standard Navy SFS2 geometry was tested in a 6 ft (W) by 4 ft (H) by 12 ft (L), closed circuit, low-speed wind tunnel. A time-resolved planar PIV system was used to measure the temporal flow field at the centerline of the deck behind the funnel and hangar structures. The measurements were conducted at Reynolds numbers up to 8 million based on the length of the ship model. The flow field was noted to be dominated by two major structures, namely the wake of the funnel and the shear layer emanating from the superstructure of the ship and top of the hangar. The recirculation behind the hangar structure induced the shear layer reattach to the surface at approximately the middle of deck, resulting in a highly energetic turbulent flow close to the surface. Dynamic model decomposition of the time-resolved flow field revealed existence of multiple dominant frequencies, indicating complex vortex flows in the vicinity of the deck. The ship model was also tested in a simulated atmospheric boundary layer, the results suggesting that the associated velocity gradient and higher turbulence weakens the shear layers produced over and near the deck.

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