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Mechanism of drag reduction on a three-dimensional model vehicle using a passive control device[1] WOOK YI, WOONG SAGONG, HAECHEON CHOI, Seoul National University — It has been well known that the boat-tail device reduces drag on a three-dimensional vehicle. However, its detailed mechanism is not clearly known yet. To understand this mechanism, we conduct an experiment for flow over a three-dimensional model vehicle in ground proximity. We consider various lengths ($l/H = 0.1 \sim 0.5$) and slant angles ($\theta = 0^\circ \sim 40^\circ$) of the boat tail, and conduct velocity measurements near the boat tail and oil visualizations on the boat-tail surface. We find that the slant angle is an important parameter for drag reduction. The maximum drag reduction occurs at $\theta = 12.5^\circ, 15^\circ$ and 15° for $l/H = 0.1, 0.3$ and 0.5, respectively, and the amounts of maximum drag reduction are 20, 41 and 45%. For the case of $l/H = 0.3$, separation starts to occur from $\theta = 6^\circ$ at the leading edge of the boat tail. This separated flow reattaches on the boat-tail surface and forms a small secondary separation bubble, which provides strong near-wall momentum and delays main separation down to the trailing edge of boat tail. The size of secondary separation bubble increases with increasing θ. At $\theta > 16^\circ$, main separation occurs at the leading edge of boat tail, and drag increases from the minimum value and reaches that of no control at large θ's.

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