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Reduced Order Modeling for Beam Propagation through a Shear Layer JURGEN SEIDEL, CASEY FAGLEY, STEFAN SIEGEL, THOMAS MCLAUGHLIN, US Air Force Academy — The performance of airborne platforms emitting or receiving light beams is severely hampered by the flow field around the turret mounted on the air vehicle. From a fluid dynamics point of view, the flow separating from the turret develops large, coherent structures. The goal of this research is to improve system performance by mitigating these structures using feedback flow control. While developing a feedback flow control system is a multi-step process, the most important step is the design of a Reduced Order Model of the flow field under consideration. A blowing and suction slot is used to actuate the flow field. Three dimensional simulations have been resolved and show a large amount of controllability of the optical path difference (OPD). Proper orthogonal decomposition techniques are then applied to open loop simulation data. A low dimensional model is realized by non linear system identification techniques. The accurate model of the flow field is then utilized to develop control strategies to mitigate the optically detrimental coherent structures and simulate closed loop behavior of the flow field. The chosen control algorithm will be simulated in a CFD environment for verification.

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