Compressible Dynamics of Fast Turbulent Flames\textsuperscript{1} RACHEL HYTOVICK, JONATHAN SUSA, JESSICA CHAMBERS, KAREEM AHMED, ALEXEI POLUDNENKO, VADIM GAMEZO, None — h —abstract—\textsuperscript{1}The research characterizes the dynamics of compressible flame-turbulence interactions for propagating fast flames. A Turbulent Shock Tube with a series of turbulence inducing plates has a large viewing area to capture the flame dynamics with various optical diagnostics, including high-speed PIV and schlieren. The experimental results show that the turbulent Mach number, $M_T$, within the flame increases non-linearly relative to the flame propagation Mach number, $M_f$, and grows quickly for flames propagating faster than Chapman-Jouguet deflagrations ($M_f>1$). This relationship shows that turbulence is self-generated by fast turbulent flames. Furthermore, the flames with $M_f>1$ are intrinsically unsteady. They tend to accelerate and generate shocks. This acceleration is accompanied by the fast increase of $M_T$ and continues until shocks become strong enough to ignite a detonation. Slower flames with $M_f<1$ show, little or no self-generated turbulence, and do not produce shocks. The results are highly relevant for hypersonic scramjet propulsion engines and compressible shock-laden turbulent reacting flows in rotating detonation engines.\textsuperscript{1}This work is sponsored by the Air Force Office of Scientific Research (FA9550-16-1-0403, Program Manager Dr. Chiping Li) and the American Chemical Society Petroleum Research Fund (54753-DNI9).