The PEGASUS Toroidal Experiment program\textsuperscript{1} A.J. REDD, J. BARR, M.W. BONGARD, M.G. BURKE, R.J. FONCK, E.T. HINSON, D.J. SCHLOSSBERG, K.E. THOME, University of Wisconsin - Madison — The PEGASUS program is developing nonsolenoidal startup and growth techniques for tokamaks, and exploring plasma stability at near-unity aspect ratio. Helicity injection from localized current sources (plasma guns) in the plasma periphery have produced $I_p \geq 0.17\text{MA}$ to date, consistent with helicity balance and Taylor relaxation constraints. Compact passive electrodes can also be used for helicity injection and $I_p$ growth, given a tokamak discharge already formed by the plasma guns. During helicity injection, the plasma edge exhibits bursty low-$n$ MHD activity and ion spectroscopy shows strong ion heating, consistent with turbulent magnetic relaxation processes. After gun shutoff, the plasmas are MHD quiescent, and $I_p$ can be grown and sustained above 0.20 MA, due to formation of sheared magnetic profiles in the core region. Efficient handoff from helicity injection to inductive drive requires relatively slow $I_p$ rampup during helicity injection, to build up significant core current density. Plasma stability is dominated by peeling-like modes at large jedge/B, and large-scale low-$m/n=1$ core activity. Probe-measured edge profiles constrain equilibrium fits, and allow direct tests of peeling-balloonning theory.

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