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Noninductive startup and sustainment of ST plasmas by localized plasma sources[1] G.D. GARSTKA, N.W. EIDIETIS, R.J. FONCK, E.A. UNTERBERG, G.R. WINZ, University of Wisconsin-Madison — The development of a non-solenoidal startup and sustainment technique is crucial to the future development of the ST. Studies of plasma formation by discrete point helicity sources have been conducted on the Pegasus Toroidal Experiment. An array of these sources, which are composed of low-impurity, high-current ($>$ 2 kA) washer guns, has been installed in the lower divertor region of the vacuum vessel. Plasma is injected onto helical field lines produced by crossed toroidal and vertical fields. As the injected power and helicity are increased, individual current streams are observed to merge into a sheet plasma. If the toroidal current is large enough, the plasma poloidal field overwhelms the vacuum field and the plasma relaxes into a tokamak-like configuration. Data suggest that flux surfaces are closed in toroidal average. This technique has been used to produce plasmas with I_p >50 kA, I_p/I_{tf} >2, and I_N >12 at modest values of B_t ($<$ 0.02 T). Rotating toroidal modes are observed to coincide with flux closure, with cascades of n=1,2, and 3 being observed. Plans to expand to an array capable of producing I_p $>$ 0.1 MA are presented in anticipation of routine handoff of these plasmas to ohmic sustainment.

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