Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Roll-back planning for a compact fusion system SIMON WOODRUFF, Woodruff Scientific Inc, RONALD MILLER, Decysive Systems, JAMES STUBER, NATE HICKS, Woodruff Scientific Inc — The development path for a compact (<100MWe) fusion power core is examined by use of advanced modeling to assess performance metrics at each step towards first commercial reactor. To guide the modeling, a new systems code is used to roll back from reactor, parameterizing and costing intermediate steps, such as Proof of Principle and fusion neutron source. Necessary performance metrics for current ramp, plasma beta, confinement scaling and profile control defined at each stage are assessed with physics models (CORSICA, NIMROD, DCON), constrained also by recent experimental results. A compact system such as a spheromak reduces operational and maintenance complexity, thereby increasing availability and reducing costs. Currents flowing the in the spheromak plasma produce toroidal field, so external windings are not necessary. Absent the TF, OH coil, inner shield and blanket, the power core becomes compact with small poloidal coils, and substantially lower cost than GW-scale systems. Our patent-pending quasi steady-state concept [1] includes an adiabatic compression of the plasma between short current drive periods to reach ignition conditions with converges, C (=a0/af) = 3. Compression allows the fusion island to become even more compact so that some technological issues, such as instantaneously high heat loads, can be avoided.

[1] S. Woodruff US Patent # 12/706,963

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Date submitted: 17 Jul 2012 Electronic form version 1.4