1. Purpose of Experiments
Include immediate goal of the experiments, scientific importance and/or programmatic relevance. Refer to any relevant program milestones.

Examine Ip rampup phase of the ITER-like discharges and its impact on volt-second consumption, li evolution, and PF coil evolution. Particular focus is the 1) effect of ICRF in L-mode rampup, 2) varying density in rampup with no/fixed ICRF injection, 3) producing H-modes in rampup and observing the “divertor” coil’s current response.

Background
Discuss Physics Basis of the proposed research. Prior results at Alcator or elsewhere, and any related work being carried out separately.

The various ITER design review exercises have produced a significant amount of simulation results of projected discharge behavior. These simulations have driven the discharge strategies for the ITER 15 MA ELMy H-mode baseline scenario, such as, 1) large bore startup plasma cross-section, 2) early divert time, 3) L-mode rampup confinement regime, 4) heating power required in rampup to save volt-seconds and control li, 5) late in the rampup H-mode transition timing to avoid excessively large divertor coil currents and 6) volt-second savings with various heating/current drive sources. Finally it also of interest to identify the minimum in volt-second consumption (lowest $C_{Ejima}$) provided by resistive MHD. It is important to confirm these physics results in existing tokamak experiments to the extent possible, clearly identifying agreement and disagreement, and developing confidence in the projections to the ITER regime.

2. Approach
Describe the methodology to be employed; explain the rationale for the choice of parameters, etc. Describe the analysis techniques to be employed in interpreting the data, if applicable. If the approach is standard or otherwise self-evident, this section may be absorbed into the Experimental Plan.
3. Resources

4.1 Machine and Plasma Parameters

Give values or range for:

- Toroidal Field: 5.4 T
- Plasma Current: 1.35 MA
- Working Gas Species: D
- Density: Target 1e20 m$^{-2}$, variable (cryopump not precluded).
- Equilibrium configuration (if possible, refer to database equilibria): Utilize MP576 resulting discharge 1090903033.

4.2 Auxiliary Systems

- ICRF Power, pulse length, phasing: up to 4 MW, 2 s duration
- LHCD Power, pulse length, phasing: none
- Pellet Injection (species): no
- Impurity blow-off injection: no
- Diagnostic Neutral Beam: Highly desirable
- Special gas puffing: NINJA (with D2) should be available.
- Non-axisymmetric Coils (Connections, Current): Yes; optimized to reduce locked modes.

Other:

4.3 Diagnostics

List required diagnostics, and any special setup or configuration, e.g. non-standard digitization rate.

Essential: Thomson, Magnetics, Hard x-rays, ECE, TCI, bolometers.
Desirable: MSE, CXRS, SOL probes.

4. Experimental Plan

Both sections must be filled in.

5.1 Run sequence Plan

Specify total number of runs required, and any special requirements, such as consecutive days, no Monday runs, extended run period – 10 hours maximum – etc.

One run day.

5.2 Shot sequence plan

For each run day, give detailed specification for proposed shot sequence: number of shots at each condition, specific parameters and auxiliary systems requirements, etc. Include contingency plans, if appropriate.

Recover discharge from MP576 Improve ITER-like Discharge Startup with any startup improvements and early divert time, 1090903033 (remove ICRF heating in ramp).

1) establish ohmic rampup baseline (5 shots)
   a. rampup Ip in 500-600 ms
b. nL targeted to $1.0 \times 10^{20}$/m\(^2\) at end of Ip ramp
c. plasma elongation in flattop is 1.8, $q_{95}$ steady in flattop $\approx 3.2$, Ip = 1.3-1.35 MA
d. flattop duration 1.0 s,
e. standard C-Mod rampdown duration 0.5 s, power termination.
f. ICRF 4 MW injected at end of rampup to produce flattop H-mode

2) utilizing density $nL \leq 1 \times 10^{20}$/m\(^2\) and remaining in L-mode, inject ICRF power during the rampup
   a. 1.0 MW fixed power beginning at or about divert time (2 shots)
   b. 2.0 MW fixed power beginning at or about divert time (2 shots)
   c. 3.0 MW fixed power beginning at or about divert time (2 shots)
   d. step ramp 1.0 to 2.0 MW, beginning at or about divert time, step $\frac{1}{2}$ way up ramp (2 shots)
   e. step ramp 1.0 to 2.0 to 3.0 MW, beginning at or about divert time, 1\(^{st}\) step1/3 way up ramp, and 2\(^{nd}\) step at 2/3 way up ramp (2 shots)

3) utilizing the density dependence for H-mode transition, raise density to value where H-mode transitions are reliable in rampup (2 shots)
   a. inject 2.0+ MW at 400 ms (2 shots)
   b. inject 2.0+ MW at 300 ms (2 shots)
   c. inject 2.0+ MW at 200 ms (2 shots)
   d. inject 2.0+ MW at or about divert time (2 shots)

4) density scan with specific ohmic and ICRF L-mode discharges provided above
   a. $nL = 0.5 \times 10^{20}$/m\(^2\), ohmic and ICRF 1-2-3 MW stepped (2 shots)
   b. $nL = 1.5 \times 10^{20}$/m\(^2\), ohmic and ICRF 1-2-3 MW stepped (2 shots)
   c. $nL = 2.0 \times 10^{20}$/m\(^2\), ohmic and ICRF 1-2-3 MW stepped (2 shots)

5. Anticipated Results
Discuss possible experimental outcomes and implications. Indicate if the program may be expected to lead to publications, milestone completions, improved operating techniques, etc. Indicate if the experiments are intended to contribute to a joint research effort, or an external database.

Results will show through the ICRF power sequencing, L and H-mode regimes, and density scans, the behavior of li, volt-second consumption, and coil current responses in the rampup phase of ITER-like discharges. This will contribute to ITPA-IOS joint experiments and activities.

6. References
Include references both to external and internal literature or communications which bear on this proposal. See Section 2.