3.7: Timetable and Milestones

	Year 1	Year 2	Year 3
Model development	• Compare IGV stress in general ordering with drift 2-fluid model	• Clarify 2-fluid effects in reconnection: islands and 1/1 mode	• Compare two-fluid and non-local parallel closure for tokamak tearing-mode
M3D Code Development	• Implement C^1 elements in 2-fluid 2D form • Add collision effects to fast ions	• Extend C^1 elements to full 2-fluid linear 3D simulation • Field-aligned mesh and 2^{nd} order FLR for thermal ions	• Extend C^1 elements to full 2-fluid non-linear 3D simulation • Optimize matrix solves and time advance
NIMROD Code Development	• Implement anisotropic ion stress (local operators) • Semi-implicit algorithm for Hall term • Upgrade hybrid option to high-order elements	• Implement and test nonlocal stress closures and compare with local models • Evaluate semi-implicit algorithms for full 2-fluid equations	• Optimize semi-implicit algorithms for two-fluid terms
AMRMHD Code Development[1]	• Complete flux-surface grid AMR code for ideal MHD in tokamaks, including requisite mapped-grid versions of AMR hyperbolic solver • Design and test 4^{th}-order finite-volume solver for anisotropic diffusion	• Complete initial implementation of 4^{th} order anisotropic diffusion solver for AMR • Complete flux-surface grid AMR code for resistive MHD	• Design and test flux-tube coordinate version of 4^{th} order solver for anisotropic diffusion
Visualization[2]	• Enhance the joint AVS-plotting package to allow viewing of all variables relevant to extended-MHD • Develop comparative utilities to focus on differences for use in code-comparison studies	• Develop streaming utilities to depots to facilitate rapid real time data transfer • Integrate the Logistical Runtime System (Logistical networking software) into the visualization routines.	• Integrate the magnetic island and other advanced viz tools into the visualization package. • Develop AVS collaborative viz using Logistic network technology, and client-server based minimum information methods
Applications	• Calculate 3D halo currents for a ITER disruption (M3D) • Apply non-local parallel heat flow to NTMs and disruptions • Sawtooth with 2-fluid model • Investigate fundamental physics issues in instabilities induced by pellet injection with AMR code[1] • Begin discussions to integrate RF code with MHD code if applicable	• Study toroidal flow damping due to error field • Perform a burning-plasma sawtooth simulation with 2-fluid and energetic particle effects. • High-n alpha-driven TAEs: linear stability • Compare inside and outside pellet simulations with JET data (AMR)[1]	• Nonlinear resistive wall modes with flow damping in DIII-D and NSTX • Tokamak tearing and NTM mode simulations • ELM simulations • High-n alpha-driven TAEs: nonlinear saturation and alpha particle transport • Project pellet injection simulations to ITER(AMR)[1]

[1]AMR work is described in APDEC proposal; [2]Visualization work is to be funded by SAPP Program