# Successful Startup Request

**Title:** Mixing and Dynamics of Dense Multiphase Mixtures
**Primary Field Of Science:** Volcanology and Mantle Geochemistry
**Resources Request Information:**

- What percentage of the work you expect to do in this allocation will be the following types:
  - Production (actually doing research): 80%
  - Exploration/porting (preparing to do research): 20%
  - Education (teaching others to do research): 0%
- What percentage of the jobs you expect to run in this allocation will be the following types:
  - Submitted through command line/script: 100%
  - Submitted using Grid tools (such as GRAM): 0%
  - Submitted through a meta-scheduler: 0%
- Please estimate what percentage of the science runs you expect to perform in this allocation will be the following types:
  - Independent (a job that is not immediately connected to any other job - a job that is artificially broken into chunks by queue limits should still be placed this category): 100%
  - Independent but related (such as jobs that make up an ensemble or parameter sweeps): 0%
  - Tightly-coupled (multiple jobs that will run simultaneously): 0%
  - Dependent (multiple jobs such as in a workflow): 0%

**Resource Requested:** TACC Dell PowerEdge Westmere Linux Cluster (Lonestar)
**Resource Requested Amount:** 50,000 SUs
**Resource Awarded Amount:** 50,000 SUs

**Abstract:** The fluid dynamics of particle-rich systems has been very challenging to generalize. The local Lagrangian behavior produces emergent length scales that arise and dissipate through local stochastic coupling. For example understanding how local particle-fluid couplings control the propagation of vorticity and the dynamics of mixing requires working across multiple scales. Given that lab experiments are unable to provide the hierarchical observational data required to understand how the multiscale couplings, HPC provides one way to explore which degrees of freedom control particular outcomes. Our specific research focus is trying to illuminate the controls on the dynamics fo particle rich systems in a viscous fluid. The application is to better understand how the crystals and liquids in magmas- large volumes of molten rock- can efficiently mix (or not mix) and create domains of distinct chemical and physical character. This is important in that much of the chemical diversity and eruptive behavior in volcanic systems is governed by this process. We are requesting a Startup account to further develop our multiphase DEM-fluid code. The code base itself is part of the NETL

MFIX project. It is an F90 code base, with both MPI and SMP (hybrid) implementations. It also includes DEM to allow for the fully coupled particle-fluid physics. This is a very compute intensive process, and beyond what can be done with the small cluster I have in house.