Performance of a large-area GEM detector prototype for the upgrade of the CMS muon endcap system VALLARY BHOPATKAR, **M. Hohlmann, M. Phipps, J. Twigger, A. Zhang**, Dept. of Physics and Space Sciences, Florida Inst. of Technology (for the CMS GEM Coll.) − Gas Electron Multiplier (GEM) technology is being considered for the forward muon upgrade of the CMS experiment in Phase 2 of the CERN LHC. Its first implementation is planned for the GE1/1 system in the $1.5 < |\eta| < 2.2$ region of the muon endcap − mainly to control muon level-1 trigger rates after the second long LHC shutdown. A GE1/1 triple-GEM detector is read out by 3,072 radial strips with 453 µrad pitch arranged in eight η-sectors. We assembled a full-size GE1/1 prototype of 1m length at Florida Tech and tested it in 20-120 GeV hadron beams at Fermilab using Ar/CO_2 70:30 and the RD51 scalable readout system. Four small GEM detectors with 2-D readout and an average measured azimuthal resolution of 36 µrad provided precise reference tracks. Construction of this largest GEM detector built to-date and its track-based alignment in the test beam are described. Strip cluster parameters, detection efficiency, and spatial resolution are studied with position and high voltage scans. The plateau detection efficiency is [97.8 ± 0.2(stat)] %. The azimuthal resolution is found to be [103.3 ± 1.4(stat)] µrad when operating in the center of the efficiency plateau and using full pulse height information. Efforts at improving the resolution further by correcting positions for the bias due to discrete readout strips are described. The CMS upgrade design calls for readout electronics with binary hit output. When strip clusters are formed correspondingly without charge-weighting and with fixed hit thresholds, a position resolution of [135 ± 2(stat)] µrad is measured, consistent with the expected resolution of strip-pitch/sqrt(12) = 131 µrad. The eight η-sectors of the detector show similar response and performance.