| MONTHLY PROGRESS REPORT | |
|---|---|
| Contractor Name:<br>University of Notre Dame (Michael Lemmon) | |
| Contractor Address:<br>Office of Research, 940 Grace Hall, Notre Dame, IN 46556 | |
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| Contract/Purchase Order No.<br>W9132T-10-C-0008 (prime contract no.) | Task Order No. |
| Project Title:<br>Design and Simulation of Intelligent Control Architecture for Military Microgrids | |
| Period Covered:<br>February 1 2011 – March 1, 2011 | |
| POC/COR (Reference Paragraph 5 of the SOW): | |
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| Achievements (Describe by task. Add additional tasks, if needed.):<br>task numbers refer to tasks in Odyssian's original contract | |
| Task II: Model and Simulate Intelligent Microgrid<br><br>Developed and tested single-phase microgrid making use of UWM microsource controller and eboard prototype developed last month | |
| Task III: Distributed Control Algorithm Development<br><br>Generated interface document characterizing the interface between UWM controller and ND distributed dispatcher | |
| Task VI: Develop Wireless Communication<br><br>No activity | |
| Task VII: Develop Wireless Distributed Control<br><br>Generated report on load shedding logic for Odyssian's e-board. | |
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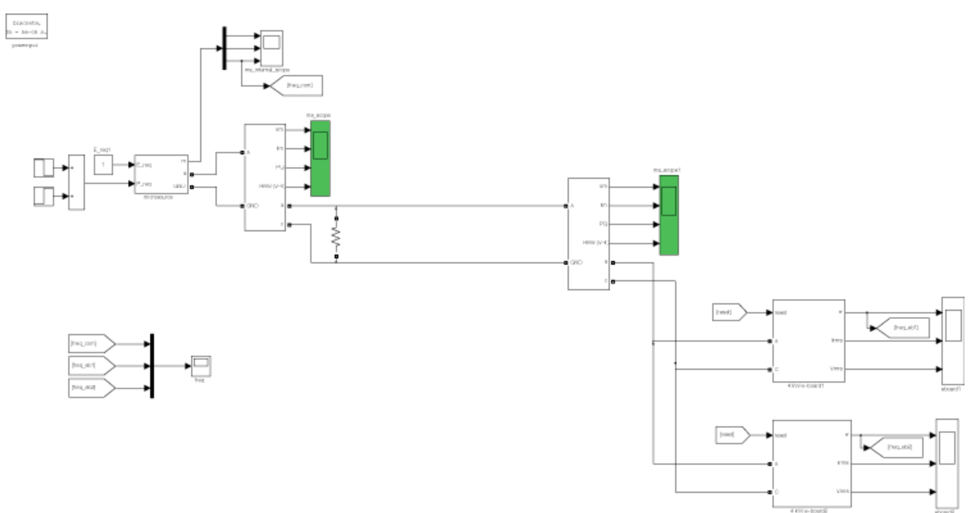
| Problems Encountered (Describe by task. Add additional tasks, if needed): | |
| Task II: None | |
| Task III: None | |
| Task VI: None | |
| Task VII: None | |
| Open Items (List items that require action by the Contractor or the Government):s<br>No open items | |

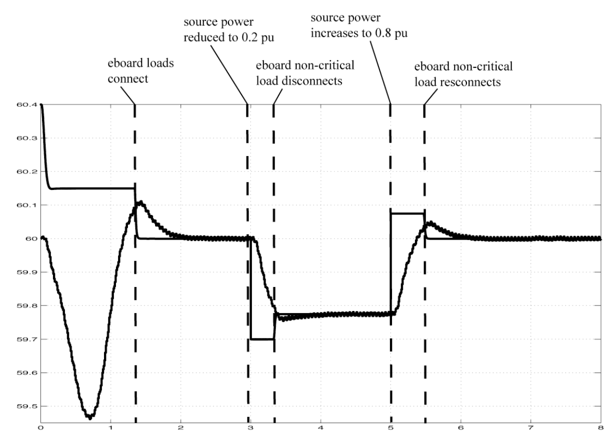
Summary Assessment and Forecast (Provide an overall assessment of the work and a forecast of contract completion):

Tested phase-locked loop estimator with 16 bit fixed point quantization and determined that 16 bit quantization with a 10 msec sampling time is sufficient.

Built a single-phase microgrid to help Odyssian size and predict how their bench demonstration will perform. The proposed microgrid has a single 2kW microsource using the UWM controller with 208 V p-p connected to a 1 kW load. This source was also connected two two e-board modules with loads of 300 watts apiece. The cable impedance between source and loads was set to zero since the demonstration will be done on a benchtop. The microsource power is initially set to .8 pu (1600W). At 3 seconds into the simulation, the source's power set point is decreased to 0.2 pu (400W). At 5 seconds, the source's power set point in increased back to 0.8 pu (1600W). The following figure shows the simPower model for the single-phase microgrid.



The frequency commands and estimates generated by this simulation are shown below. Initially the e-board loads are disconnected. Once the frequency estimate stabilizes above 60Hz, the eboards connect to the grid. The initial connection occurs at t=1.5seconds. At t=3 seconds, the power is reduced to 0.2 pu, the frequency begins dropping and this causes the non-critical e-board load to disconnect at 3.25 seconds. At t=5 seconds the source power is restored to 0.8 pu. The frequency increases above 60 Hz and a quarter of a second later the non-critical eboard



load reconnects to the grid.

E-mail from Odyssian (Peterson) indicated that the inverters to be delivered by UIUC would deliver 200 W at 240 Volts. We built a small single-phase simulation at this scale to help Odyssian predict how the system might respond. The preliminary simulation shown in the following figure uses a UWM controller (with the original gains from the UWM testbed) with a peak voltage of 339 (240 RMS) and base power of 200W. Both Preq and Ereq are initially set to 1 pu. A transformer steps this down to 120 Volts and delivers the power to a 200W load that steps up to 220 W at 2.5 seconds into the simulation. The associated plots are shown below.