**OBJECTIVES**

1) Adapt DC HELM to realistic DC networks, taking a single channel of the ISS power system as the target platform.
2) Demonstrate how this technology provides advantages versus the state of the art (i.e. iterative methods), which stem from its independence of the choice of initial point and the mathematical guarantees on the solution.
3) V/V review to provide confidence the developed software does what it was designed to do.

**ACCOMPLISHMENTS**

**NOTABLE DELIVERABLES PROVIDED**

1) Matlab-based software, developed for:
   - Adapted DC HELM to ISS models (from PC Krause).
   - Developed HELMLAB DC, a MATLAB power flow solver.
   - Covered a single channel of the ISS.
   - Device regimes and control limits via exploration loop approach.
   - Completed model for the DC-DC converter (DCCU).
   - Developed HELMLAB PWDC, a MATLAB prototype.
   - Demonstrated the new PW method on two devices of interest for NASA:
     - the SSU and the DC-DC converter.

2) Mathematical disclosure of the HELM to DC systems.

3) V/V report on technology.

4) A New Technology Report filed to NASA on these innovations.

**KEY MILESTONES MET**

- Iterative power flows in DC microgrids.
- Show the same kind of erratic and nonreliable behavior as in terrestrial AC grids.
- The HELM method has been successfully shown to be free of these issues.
- Is adaptable to relevant DC microgrids.
- V/V analysis that verifies the performance.
- Opportunities to transfer technology developed in terrestrial AC transmission grids.

**FUTURE PLANNED DEVELOPMENTS**

**PLANNED POST-PHASE II PARTNERS**

1) Elequant, Inc.
2) Battelle Memorial Institute.
3) PC Krause and Associates.

**PLANNED/POSSIBLE MISSION INFUSION**

True autonomicity cannot be built upon iterative power flow solvers because of their inherent unreliable behavior. Thus, it is expected that all analysis/control software relying on power flow calculations will make use of HELM if reliable autonomous operation is needed. All deep space and SEP missions are expected to benefit.

**PLANNED/POSSIBLE COMMERCIALIZATION**

Future developments and extensions of the technology for NASA grids and to terrestrial Smart Grids. Target large transmission utilities with technology extensions with the two existing commercial products HELM-based products: AGORA, an EMS suite for real-time network analysis and decision support for control operators; and HELM-Flow, an application for analysts and planners.

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