NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Planning Committee Strategic Plan - Next Steps and Future Work Plan

to ensure the reliability of the bulk power system

July 2011

116-390 Village Blvd., Princeton, NJ 08540
609.452.8060 | 609.452.9550 fax
www.nerc.com

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Introduction

This tactical planning document supports the Planning Committee's (PC) 2011-2016 Strategic Plan. As with most tactical plans, it is a living document, meant to address the current strategic issues. The landscape that the entire electric industry operates within is a dynamic and rapidly changing one. Therefore, an annual review should take place to update the plan to ensure it remains current. Quarterly updates of the subgroup tactical plans will be provided to the PC, along with status reports.

Further, if there are key tactical changes that emerge, the PC will revisit the Work Plan to ensure alignment with the NERC Electric Reliability Organization (ERO) enterprise. This work plan addresses all activities, interests, and concerns of the NERC Enterprise related to planning the interconnected Bulk Electric System.

This planning document builds on the PC 2011-2016 Strategic Plan, emphasizing the alignment of PC activities from several perspectives, including:

- Conforming with priorities of the NERC ERO enterprise, Federal, state/provincial regulators, and the Electricity Sub-Sector Coordinating Council (ESCC);
- Providing a technical foundation for reliability issues;
- Matching PC resources with priorities; and
- Efficiently using PC resources.

Key Recommendations from the Strategic Plan

Based on review of the Strategic Plan, the following work plan activities will be undertaken:

1. The *ad hoc* team assigned to develop the PC Strategic Plan (Appendix 1) comprehensively reviewed the existing PC and subgroups work plan by looking at the detailed work activities for each group and what firm deliverables are being produced. The team also weighed other factors in the review and consideration of the need to reorganize the groups that included redundancy, responsibility, efficiency, activity level, etc. The factors also included firsthand knowledge of group activity, discussion with individual group participants, deliverables produced by each group, and who actually performs analysis and produces reports. Based upon that effort, and on comments received from the current subgroup chairs and the POC members, the team has the following recommendations :

   - Change the Transmission Issues Subcommittee (TIS) to the System Analysis and Modeling Subcommittee (SAMS), and the Model Validation Task Force (MVTF) to the Model Validation Working Group (MVWG), to better match the groups' status and responsibilities. Have the MVWG report to the SAMS. Both groups are working on modeling improvement and validation. The SAMS would need to work closely with the interconnection modeling groups and coordinate those efforts to share best practices and ensure quality interconnection power flow and dynamic models. The SAMS would focus on improvement of power flow and dynamic simulation models in North America through process improvement and model validation. Additionally, SAMS would address planning issues related to power flow and dynamic stability, such as frequency response, reactive requirements, etc.

   - Merge the Reliability Metrics Working Group (RMWG) and Data Coordination Subcommittee (DCS) into one group, titled the Performance Analysis Subcommittee (PAS). The Transmission Availability Data System Working Group (TADSWG), Event Analysis Working Group (EAWG), Generating Availability Data System Task Force (GADSTF), and Demand Response Data Task Force (DRDTF) would report to the PAS. The GADSTF and DRDTF would become working groups. Development and analysis from data and information from the Transmission, Generator, and Demand response availability data systems (TADS, GADS and DADS) would be transferred to the PAS and would coordinate the current RMWG activities that use portions of these data to calculate metrics.

   - Based on the Strategic Plan priorities, the following groups would be retired , with certain expertise transferred to the remaining groups:

     a) RIS - The RIS has no recurring tasks or reports to produce. The current activities can be more effectively performed by RAS and ERO-RAPA, with expertise in RIS transferred to RAS.

     b) LFWG - The main deliverable assigned to this group is to produce the load forecast bandwidths for the Long- Term Reliability Assessment (LTRA) report. The load forecast bandwidths are currently produced by NERC staff and they can continue to perform

that function. Certain expertise would now be included in the RAS activities (such as the former chair of the LFWG). The RAS would maintain a list of subject matter experts to assist as needed.

c) DCWG – The main task of this group is to collect and process Energy Information Administration (EIA)-411 data used in NERC's assessment reports. This effort is currently being handled by NERC and Regional Entity staff. Other activities primarily involve meeting with EIA staff, which can be effectively transferred to NERC staff and ERO-RAPA.

d) Loss-of-Load Expectation Working Group (LOLEWG) – This group is not currently assigned any deliverables. Activities of the group have been primarily to provide a discussion forum. Transferring these activities to another forum group should be more effective.

- The following groups would remain as currently organized; although, consistent with the Strategic Plan, some key functional responsibilities would be enhanced:

  a) Reliability Assessment Subcommittee (RAS)

  b) System Protection and Control Subcommittee (SPCS)

  c) Smart Grid Task Force (SGTF)

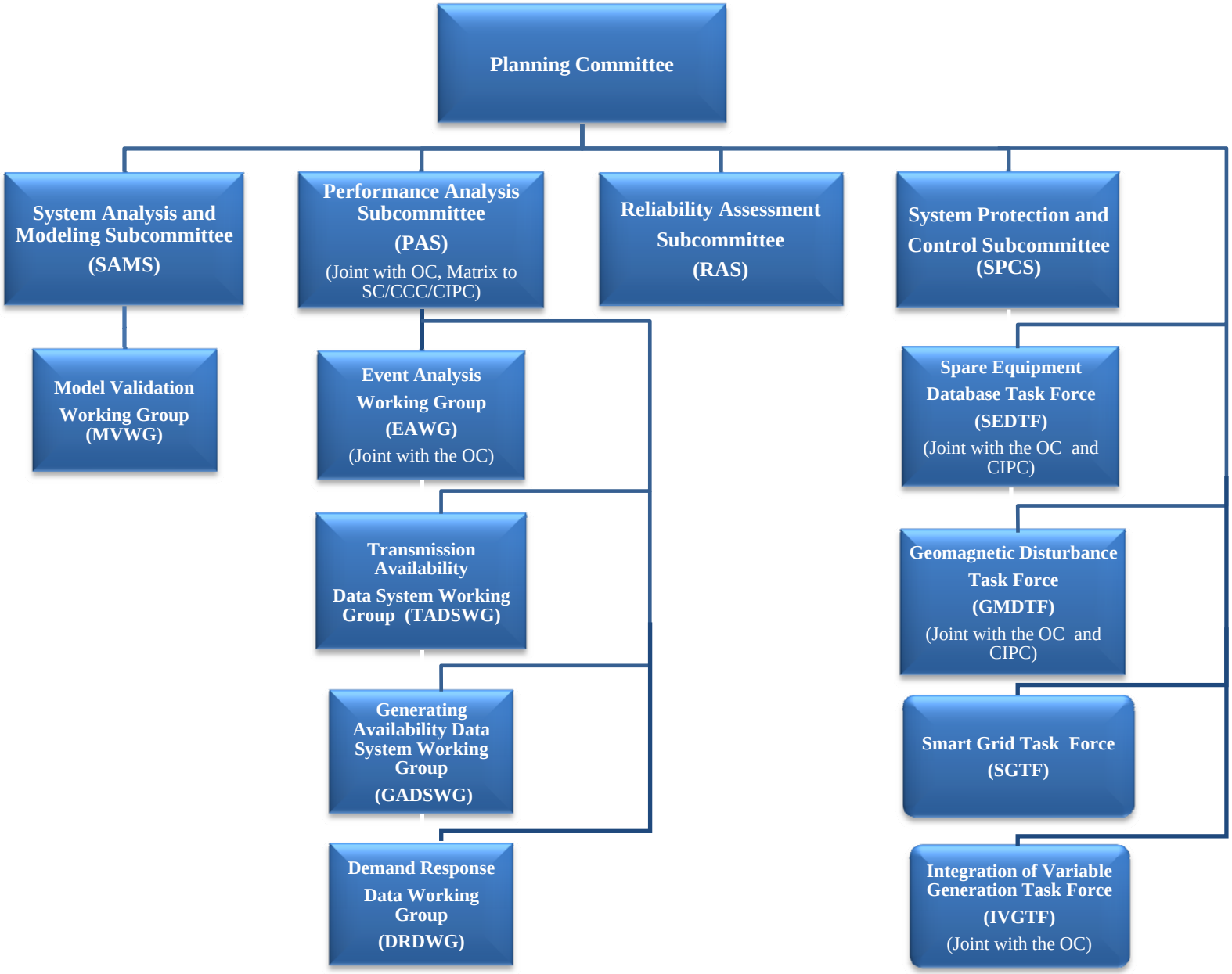
  d) Integration of Variable Generation Task Force (IVGTF)

  e) Spare Equipment Database Task Force (SEDTF)

  f) Geomagnetic Disturbance Task Force (GMDTF)

2. The PC organization chart has been reviewed and revised as shown below to reflect the aforementioned changes.

3. The initial development of new proposed PC Work Plan is summarized in Appendix 2. The Work Plan will need to be completed through a thorough review of assigned tasks by each subgroup.


Planning Committee
System Analysis and Modeling Subcommittee (SAMS)
Performance Analysis Subcommittee (PAS) (Joint with OC, Matrix to SC/CCC/CIPC)
Reliability Assessment Subcommittee (RAS)
System Protection and Control Subcommittee (SPCS)
Model Validation Working Group (MVWG)
Event Analysis Working Group (EAWG) (Joint with the OC)
Transmission Availability Data System Working Group (TADSWG)
Generating Availability Data System Working Group (GADSWG)
Demand Response Data Working Group (DRDWG)
Spare Equipment Database Task Force (SEDTF) (Joint with the OC and CIPC)
Geomagnetic Disturbance Task Force (GMDTF) (Joint with the OC and CIPC)
Smart Grid Task Force (SGTF)
Integration of Variable Generation Task Force (IVGTF) (Joint with the OC)

4. In the future, the process model for forming any subgroups would be to initially form a task force to address a certain issue (including a focused scope with specific tasks and deliverables), and utilize updates/refreshes to the PC Strategic Plan to ascertain whether the key sub-committee structure is in continued alignment with the long-range objectives. For long-standing issues of key reliability priority, task forces could transition into a subcommittee or working group. The PC would make that determination base on evaluation of the Strategic Plan, giving consideration to recommendations from the task force. An example of this process is the formation of the System Protection and Control Task Force after the 2003 blackout, which later transitioned into a subcommittee.
5. The PC charter updates to reflect the recommended changes discussed in the Strategic Plan are marked in a separate document.
6. Align the PC and respective subgroup responsibilities to address the ERO's top priority reliability issues within the PC's responsibilities (See Appendix 3 for the top priority Issues and Appendix 4 for PC subgroup assignments):

    - Assign to the SPCS the issue of *Misoperations of relay protection and control systems*. A detailed scope including specific tasks and deliverables will be developed by the SPCS. A high level description of items to be addressed by the SPCS include:

        a) Researching the details for causes of misoperations and using the cause categories developed for the common reporting format,

        b) Determining root causes for the misoperations for the top categories covering the bulk of misoperations,

        c) Develop possible solutions to address the root causes,

        d) Produce a report on the SPCS research and any recommendations that could be used by entities to reduce the number of misoperations.

    - Assign to the SPCS the issue of *Human errors by field personnel* associated with protection systems, which includes both engineering and field personnel, such as relay technicians. A detailed scope that includes specific tasks and deliverables needs to be developed by the SPCS. A high level description of items to be addressed by the SPCS include:

        a) Research misoperations caused by human error of engineering and field personnel,

        b) Develop possible solutions for errors, such as incorrect drawings, misapplied or incorrect settings, incorrect wiring, etc.

        c) Produce a report on the SPCS research and any recommendations that could be used by entities to reduce the amount of human error related to protection systems, including installation and maintenance.

    - The RAS will continue to address the *Changing resource mix* in the LTRA report.

- The IVGTF and SGTF are currently addressing *Integration of new technologies*.
- The PC's Critical Infrastructure Strategic Coordinated Action Plan[1] addresses *Preparedness for high impact, low frequency events* (the current SED TF and GMD TF).
- The PC will provide support requested from the CIPC for *Non-traditional threats via cyber-security vulnerabilities*.

7. The PC will task the appropriate subgroups to support issues identified by the ERO-Enterprise groups.
8. The SAMS will address planning considerations related to frequency response issues, modeling for geomagnetic disturbances, and support the Eastern Interconnection Reliability Assessment Group Multi-Regional Modeling Working Group (ERAG MMWG).
9. To address the priority ranking of NERC Reliability Standards projects, the PC will:
   - Solicit the Standards Committee for any technical input needed from the PC for the top priority standards projects.
   - After obtaining input from the Standards Committee, direct the appropriate subgroups to develop the needed technical information to support Reliability Standards based on the Standards Committee's prioritization and schedule. The PC will review/approve reports produced by its subgroups before being submitted to NERC's standards process.
   - Provide input into the Standards Committee's prioritization process, as requested by NERC standards staff.
   - Provide input and endorsement of the Functional Model Working Group's Functional Model.
10. To support NERC's Standards and Compliance activities, the PC will:
    - As requested by NERC compliance staff, review and provide the technical foundation for NERC Compliance Application Notices (CAN) applicable to planning activities.
    - Review and assist, as requested by NERC compliance staff, in Compliance Analysis Reports
    - Support the development of standards implementation plans (adding technical information to support auditing a Reliability Standard) as requested by NERC Standards.
11. The PC will support and coordinate with appropriate industry Forums on system planning issues.

[1] http://www.nerc.com/docs/ciscap/Critical_Infrastructure_Strategic_Initiatives_Coordinated_Action_Plan_BOT_Apprd_11-2010.pdf

Plan to Implement New PC Structure

The PC is providing this document for the PC members and its subgroups for introduction and for review to provide comments before mid August to the PC leadership. Each subgroup, including the associated facilitating NERC staff, should review their respective work plans and make any recommended changes, which could change the outcome of the group for this effort. The comments will be considered by the leadership and a revised document will be presented to the PC at the September 2011 meeting for possible approval for implementation. The PC will review and possibly approve the new group scope documents at the December 2011 meeting with the goal of completing transition and implementation by the March PC meeting.

In order to implement the above changes, the PC will endeavor to complete the transition from the old structure to the new structure by the end of 2011 and request each subgroup to cooperate with NERC staff to accomplish this goal. Group chairs along with NERC staff from each retiring or merged subgroup will ensure that its activities and representation are transferred to the appropriate new or combined group before the any group is disbanded.

The specified new and merged groups should be populated with a chair and vice chair selected by the end of 2011. The PC will monitor the progress of the transition at subsequent meetings until completion.

Appendix 1: List of Contributors

Planning Committee members represented on this *ad hoc* team includes:

Tom Burgess, FirstEnergy, PC Chair

Jeff Mitchell, Reliability*First* Corporation, PC Vice Chair

Ben Crisp, Progress Energy

Teresa Mogensen, Xcel Energy

Joe Spencer, SERC

NERC Staff

Appendix 2: Proposed Work Plan

Reliability Assessment Subcommittee

Activity No.	PC Area	PC Activity	Why is the activity required?	Deliverable and Schedule
1	Develop reliability assessments	Summer Assessment	NERC Rules of Procedure Section 800	Annual Report with PC approval in May
2	Develop reliability assessments	Long-Term Reliability Assessment (LTRA) Scenario Analysis identification and work plan	NERC Rules of Procedure Section 800	Annual Report with PC approval in October
3	Develop reliability assessments	Winter Assessment	NERC Rules of Procedure Section 800	Annual Report with PC approval in November
4	Develop reliability assessments	Special Assessments	Request of PC/OC/NERC staff or FERC Order	Annual Report with PC approval by November
5	Develop reliability assessments	Winter Operational Reliability Assessment	Required by subgroup scope	Annual Report with PC approval in May
6	Develop reliability assessments	Summer Operational Reliability Assessment	Required by subgroup scope	Annual Report with PC approval in November
7	Develop reliability assessments	Provide a guidebook, for the regional entities to use in preparation of the assessments and for peer reviewers to ensure consistency in the reliability assessments, outlining NERC's expectations and forming a foundation for a sufficiently robust reliability assessment.	Required by subgroup scope	Annual review by RAS with changes as needed

System Analysis and Modeling Subcommittee

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
8	Develop reliability assessments	Power flow and dynamics database development and model validation	Required by previous PC action.	On-going
9	Develop reliability assessments	Modeling improvements initiative	Required by anticipated PC action.	On-going
10	Develop reliability assessments	LTRA - emerging issues and scenarios	Required by previous PC action.	On-going
11	Develop planning documents, procedures, & technical opinions	Voltage and reactive (VAR) standards support	Required by previous PC action.	On-going
12	Develop planning documents, procedures, & technical opinions	Modeling	Required by anticipated PC action.	One-time
13	Develop planning documents, procedures, & technical opinions	Phasor Measurements	Required by anticipated PC action.	One-time
14	Support standards	Voltage and Reactive (VAR) standards support	Required by previous PC action.	One-time

Transmission Availability Data System Working Group

15	Develop reliability metrics & benchmarking	TADS	Required by subgroup scope	On-going

Demand Response Data System Working Group

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
16	Develop reliability metrics & benchmarking	Develop the functional requirements for the Demand Response Availability Data System (DADS). DADS Ph I (voluntary) and Ph II (mandatory) collect event data for dispatchable and controllable demand response. DADS Ph III (voluntary) and Ph IV (mandatory) will collect data on non-dispatchable demand response programs.	Required by subgroup scope	On-going
17	Develop reliability metrics & benchmarking	Coordinate DADS metrics	Required by subgroup scope	On-going
18	Support standards	The DRDWG to participate in the NAESB standards development process by providing liaison support as appropriate. In addition, the DRDWG will seek subject-matter expertise and coordinate with other demand response-focused groups in efforts to maintain consistent language and definitions.	Required by subgroup scope	On-going

Generating Availability Data System Working Group

19	Develop reliability metrics & benchmarking	Review and recommend whether Generation Owners on the NERC Compliance Registry should report GADS data on a mandatory basis.	Required by subgroup scope	One-time

System Protection and Control Subcommittee

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
20	Develop planning documents, procedures, & technical opinions	Develop white paper on backup protection applications	Required by previous PC action.	One-time
21	Support standards	Develop power plant Generator Control Coordination Technical Reference Document	Required by previous PC action.	One-time
22	Support standards	Develop power plant control Mechanical System (Turbines and Boilers) Coordination Technical Reference Document	Required by previous PC action.	One-time
23	Support standards	Support PRC Standards Under Development: PRC-023 – Transmission Relay Loadability	Required by subgroup scope	One-time
24	Support standards	Support PRC Standards Under Development: PRC-005 -Protection System Maintenance and Testing	Required by subgroup scope	One-time

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
25	Support standards	Support PRC Standards Under Development: PRC-001 Protection System Coordination	Required by subgroup scope	One-time
26	Support standards	Support PRC Standards Under Development: PRC-024 Generator Performance during Frequency and Voltage Excursions	Required by subgroup scope	One-time
27	Support standards	Support PRC Standards Under Development: PRC-006 UFLS	Required by subgroup scope	One-time
28	Support standards	Support TPL Standards Under Development	Required by subgroup scope	One-time
29	Support standards	Support PRC Standards Under Development: PRC-002 Disturbance Monitoring Equipment	Required by subgroup scope	One-time
30	Support standards	**Assessment Of Existing PRC Standards:** PRC-013-0 Special protection System Database (Project 2010-3)	Required by subgroup scope	One-time
31	Support standards	**Assessment Of Existing PRC Standards:** PRC-015-0 Special Protection System Data and Documentation (Project 2010-3)	Required by subgroup scope	One-time
32	Support standards	**Assessment Of Existing PRC Standards:** PRC-012-0 Special Protection System Review Procedure (Project 2010-5)	Required by subgroup scope	One-time
.33	Support standards	**Assessment Of Existing PRC Standards:** PRC-020-1 Under-Voltage Load Shedding program Database (Project 2010-03)	Required by subgroup scope	One-time
34	Support standards	**Assessment Of Existing PRC Standards:** PRC-021-1 Under-Voltage Load Shedding Program data (Project 2010-3)	Required by subgroup scope	One-time
35	Support compliance	**Assessment Of Existing PRC Standards:** PRC-014-0 Special Protection System Assessment (Project 2010-5)	Required by subgroup scope	One-time

Performance Assessment Subcommittee

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
36	Develop reliability metrics & benchmarking	Develop metrics for measuring ALR	Required by subgroup scope	One-time
37	Develop reliability metrics & benchmarking	Produce reliability performance assessment ("state of reliability") report including IRI and associated metrics		Annual Report with approval in June
38	Develop reliability metrics & benchmarking			
39	Develop reliability metrics & benchmarking	Recommend data collection guidelines, formats, and templates used in metrics	Required by subgroup scope	On-going
40	Develop reliability metrics & benchmarking			

Integration of Variable Generation Task Force

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
41	Support standards	Consistent methods are required to represent capacity values of variable generation suitable for NERC reliability assessments. Discuss the traditional vs. current methods. Including Techniques: LOLE, LOLP & ELCC.	Required by subgroup scope	One-time
42	Support standards	Establish appropriate interconnection procedures and standards Ensure adequate communications considering COM-002-2 and registry criteria	Required by previous PC action.	One-time
43	Support standards	New tools and techniques for system planning are needed to accommodate the increased resource uncertainty and variability to complement existing deterministic approaches.	Required by subgroup scope	One-time

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
44	Develop reliability assessments	Engage the IEEE Standards coordinating Committee # 21 (SCC21) on Fuel Cells, Photovoltaics, Dispersed Generation and Energy Storage to reconcile voltage ride-through requirements of distributed generation and the IEEE Standard 1547 Recommend requirements needed for low voltage and high voltage to IEEE.	Required by subgroup scope	One-time
45	Develop reliability assessments	Distributed variable generators, individually or in aggregate (e.g. small scale photovoltaic), can impact the bulk power system and need to be treated, where appropriate, in a similar manner to transmission connected variable generation. The NERC registry criteria may need to be broadened to include smaller generators not covered by the current registry criteria.	Required by subgroup scope	One-time
46	Develop reliability assessments	Produce a reference manual to support the changes required to plan and operate a bulk power and distribution system accommodating large amounts of variable generation is essential for planners and operators	Required by subgroup scope	One-time

Spare Equipment Database Task Force

47	Develop reliability assessments	The Spare Equipment Database Task Force (SEDTF) recommends a uniform approach to collecting, storing, and distributing information on long-lead time electric transmission system spare equipment that currently is voluntarily provided by registered entities	Required by HILF effort	One-time

Geomagnetic Disturbances Task Force

48	Understand potential impacts of GMD and develop mitigation strategies.	The GMDTF will address the implications of severe GMD events.This includes assessing existing GMD studies developed after the 1989 GMD storm, performing an analysis of GMD scenarios as laid out in the HILF report, and reporting on the engineering impacts that a GMD event would have on the bulk power system. The GMDTF will also focus on enhancing and improving existing prevention, mitigation and restoration approaches.	Required by HILF effort	One-time

Smart Grid Task Force

Activity No.	PC Area	PC Activity	Why is the activity required?	Is the activity on-going or one-time?
49	Develop planning documents, procedures, & technical opinions	Evaluate the reliability considerations of integrating smart grid technologies	Required by subgroup scope	One-time and produce a final report due ??

Event Analysis Working Group

50	Develop documents and procedures,	Develop an ERO enterprise-wide process for reporting disturbances and event analysis		Scheduled to be completed by end of 2011.
51	Develop reliability metrics & benchmarking	Review and tracking of reported events	Rules of Procedure section 800	On-going

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Appendix 3: NERC President's Top Priority Issues for Bulk Power System Reliability – January 7, 2011

Background

Outlined below is a preliminary set of high priority reliability issues intended to focus ERO program areas, including standards setting, compliance, and training and education. This list is based partially on experience from reviewing actual system events (topics 1 to 4) and forward looking issues (topics 5 to 8). This list is offered as a starting point for discussion with industry experts. In the next few years, it is expected that new reliability performance measures and root cause analysis methods being initiated by NERC will further reinforce the setting of reliability priorities. The goal is to develop a list of priorities to focus work in the one to three year horizon on those areas most likely to have a positive impact on bulk power system reliability. This is a list of technical issues, and does not address a number of policy matters that could be addressed in an alternative forum such as a reliability summit. The list is in rank order.

1. **Misoperations of relay protection and control systems** – Nearly all major system failures, excluding perhaps those caused by severe weather, have misoperations of relays or automatic controls as a factor contributing to the propagation of the failure. Protection systems are designed to operate reliably when needed under the presence of a fault on the system, to quickly isolate a piece of equipment or a 'zone' of the bulk power system, without allowing the fault to transfer into adjoining facilities. The greater the number of facilities involved in an event, the more severe the impact to the rest of the bulk power system, with cascading failure such as resulted from the "Zone 3 Relay" issue in the August 2003 blackout being the extreme. Relays can misoperate, either operate when not needed or fail to operate when needed, for a number of reasons. First, the device could experience an internal failure – but this is rare. Most commonly, relays fail to operate correctly due to incorrect settings, improper coordination (of timing and set points) with other devices, ineffective maintenance and testing, or failure of communications channels or power supplies. Preventable errors can be introduced by field personnel and their supervisors or more programmatically by the organization. Adding to the risk is that system protection is an extremely complex engineering field –there are many practitioners but few masters.

2. **Human errors by field personnel** – Field personnel play an important role in the maintenance and operation of the bulk power system. They often are switching equipment in and out of service and aligning alternative configurations. Risks can be introduced when field personnel operate equipment in a manner that reduces the redundancy of the bulk power system, sometimes even creating single points of failure that would not exist normally. Taking outages of equipment to conduct maintenance is a routine and necessary part of reliable bulk power system operation. However, any alterations to the configuration of the network must be carefully planned in advance to minimize loss of redundancy and avoid unintended single points of failure. It is also important that such changes and

risks be communicated to system operators and reliability coordinators in advance, so that they can make adjustments in their operating plans and reliability assessments.

3. **Ambiguous or incomplete voice communications** – Out of longstanding tradition, system operators and reliability coordinators are comfortable with informal communications with field and power plant personnel and neighboring systems. Experience from analyzing various events indicates there is often a sense of awkwardness when personnel transition from conversational discussion to issuing reliability instructions. It is also human nature to be uncomfortable in applying formal communication procedures after personnel have developed informal styles over many years. Confusion in making the transition from normal conversation to formal communications can introduce misunderstandings and possibly even incorrect actions or assumptions. Further, once the need to transition to more formal structure is recognized, the transition is often not complete or effective. Results can include unclear instructions, confusion whether an instruction is a suggestion or a directive, whether specific action is required or a set of alternative actions are permissible, and confusion over what elements of the system are being addressed.

4. **Right-of-way maintenance** – The August 14, 2003 blackout highlighted effective vegetation management programs as a key recommendation for avoiding future cascading failures. More broadly, any encroachments in the right-of-way that reduce clearances to the point of lowering facility ratings or reducing the randomness of possible contacts can be a risk to reliability. Although these impacts may not always be readily apparent, under extreme wind and temperature conditions they may become more of a risk to bulk power system reliability. There are many challenges to effective right-of-way maintenance, especially maintaining proper clearances, including interventions by private landowners, local municipalities, and federal and state landowners.

5. **Changing resource mix** – Energy and environmental policies along with energy markets are driving proposals toward unprecedented changes in the resource mix of the bulk power system. Examples include integration of significant amounts of renewable (variable such as wind and solar), natural gas, storage and demand resources to provide energy and capacity. Industry's knowledge of the characteristics of the bulk power system comes from nearly a century of operational experience with the existing resource mix. However, integration of these new resources results in operating characteristics significantly different from conventional steam production facilities. An array of reliability services must be provided over a range of time horizons from seconds to minutes to hours and days, and annually such as load following, contingency reserves, frequency response, reactive supply, capacity and voltage control, and power system stability. Continued reliable operation of the bulk power system will require an industry dialog with policymakers and regulators. Understanding the impacts on reliability will depend on accurate modeling of new resources, and development of new methods and tools for the provision of essential reliability services.

6. **Integration of new technologies** – Introduction of electric vehicles, demand-side management, variable generation, distributed resources and smart grid technologies presents tremendous opportunities but also introduces changes to the operating characteristics of the bulk power system. Integration of these new technologies requires changes in the way the bulk power system is planned and operated to maintain reliability. Further, additional tools/models are required to support their integration to meet policy and strategic goals. Without these changes, it will be challenging to maintain reliability with large-scale deployments. For example, some smart grid devices/systems increase exposure to cyber threats, while variable generation requires additional ancillary services. Integration of these new technologies must be achieved in a manner that does not undermine existing levels of stability, resilience and security of the bulk power system.

7. **Preparedness for high impact, low frequency events** – Although there is a wide range of threats labeled 'high impact, low frequency,' the greatest concern is being prepared for possible events that could debilitate the bulk power system for extended periods, such as widespread, coordinated physical/cyber attacks or geomagnetic storms. The industry must consider improving the design of the bulk power system to address these potential risks and prepare coordinated North American response plans for use during catastrophic events and be ready to deploy those plans to restore essential services in a timely manner.

8. **Non-traditional threats via cyber security vulnerabilities** – Establishment of enterprise risk-based programs, policies and processes to prepare for, react to, and recover from cyber security vulnerabilities is a high priority for the industry. The bulk power system has not yet experienced wide-spread cyber-attacks and a contributing factor has been the traditional physical separation between the industrial control system/SCADA environment and the business and administrative networks. This situation however is rapidly changing, predominantly due to the efficiencies that can be achieved by leveraging shared networks and resources so now even physically separated environments are susceptible. For example, the bulk power system could be as vulnerable to digital threats as IT systems, but with far more critical implications as the recent Stuxnet virus has shown. Disabling or turning systems off in a binary fashion is concerning enough but as illustrated by Stuxnet, industrial control system software can be changed and data can be stolen without intrusions even being detected. These injection vectors serve as a blueprint for future attackers who wish to access controllers, safety systems, and protection devices to insert malicious code targeting changes to set points and switches as well as alteration or suppression of measurements.

Appendix 4: Responsibility for NERC Top Priority Issues

(NERC President's Top Priority Issues for Bulk Power System Reliability – 01/07/11)

Top Priority Issues	Primary Lead	Supporting Role
1. *Misoperations of relay protection and control systems*	Planning Committee –Assign to SPCS	
2. *Human errors*	Planning Committee – Assign to SPCS to address errors by protection engineers for drawings, settings, etc. Operating Committee - ??	
3. *Ambiguous or incomplete voice communications*	Operating Committee	
4. *Right-of-way maintenance*	Planning Committee – a new task force comprised of transmission line design and/or maintenance experts (and possibly vegetation management experts) should be formed to address this issue.	Operating Committee
5. *Changing resource mix*	Planning Committee – Assign to RAS	Operating Committee
6. *Integration of new technologies*	Planning Committee – Assign to: • Integration of Variable Generation Task Force • Smart Grid Task Force	Operating Committee & Critical Infrastructure Protection Committee
7. *Preparedness for high impact, low frequency events*	Planning Committee– Assign to: • Spare Equipment Database Task Force • Geomagnetic Disturbance Task Force • Others as Needed	Operating Committee– • Severe Impact Resilience Task Force Critical Infrastructure Protection Committee– • Cyber Attack Task Force
8. *Non-traditional threats via cyber security vulnerabilities*	Critical Infrastructure Protection Committee	Planning Committee & Operating Committee