North American Transmission FORUM

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Bulk Electric Systems Operations Absent Energy Management System and Supervisory Control and Data Acquisition Capabilities—a Spare Tire Approach

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Versioning

Version History

Date	Version	Notes
07/13/2017	1.0	Initial version
11/3/2023	2.0	Updated format and removed reference to retired document

Review and Update Requirements

- Review: every 5 years
- Update: as necessary

Contents

1. Purpose

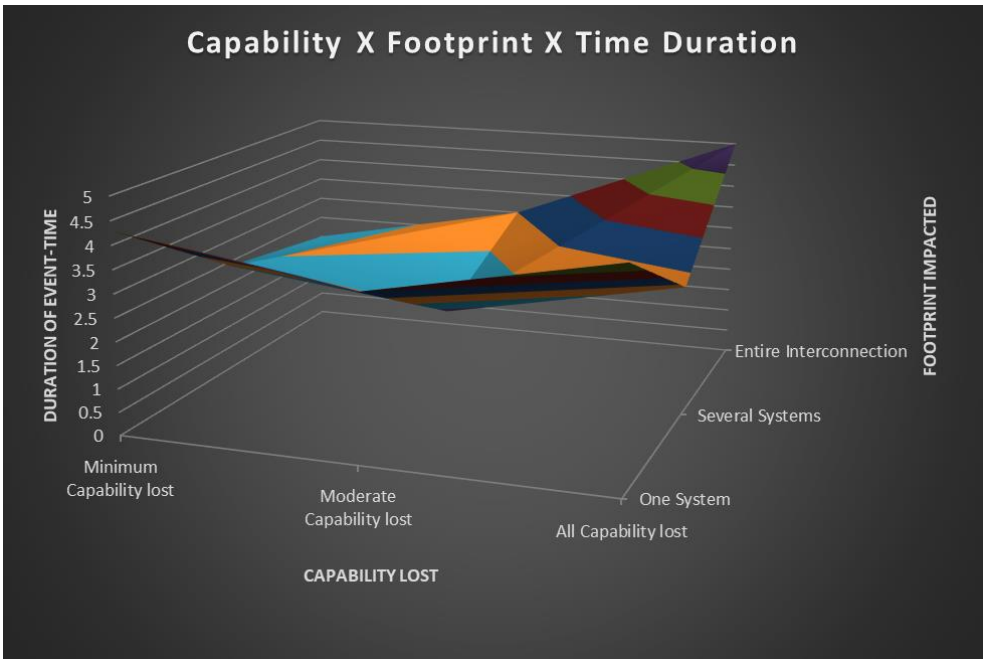
This NATF reference document, representing research performed by industry personnel who have in excess of 200 years of cumulative experience, is in response to a question originally raised by the Electric Subsector Coordinating Council (ESCC) in 2016 regarding how electric utilities would continue to operate during an event causing loss of both primary and backup control systems (i.e., total loss of the Energy Management System [EMS]/Supervisory Control and Data Acquisition [SCADA]). This concept was subsequently characterized as a "spare tire" approach to ensure continued system operations following the loss of critical applications. As such, this document:

- captures the results of an assessment of what operating strategies and reliability tools are present today for Bulk Electric System (BES) operations during times when traditional tools for situational awareness, system control, balancing and communications are unavailable, both internally and coupled with external loss of capabilities;
- identifies future areas of industry work and research to better enable operations during scenarios where there is a total loss of all EMS/SCADA capability.

This document does not create, replace, or change any requirements in the NERC Reliability Standards or other applicable criteria, nor does it create binding norms by which compliance with NERC Reliability Standards is monitored or enforced. Implementation of NATF practices does not ensure compliance with the NERC Reliability Standards. In addition, this document is not intended to take precedence over any company or regional procedure. It is recognized that individual companies may use alternative and/or more specific approaches that they deem more appropriate.

2. Method of Assessment

The scope of the event assessed was a complete loss of EMS/SCADA, where the extent of condition expanded across multiple regions for multiple days. This approach (capability x footprint x timeframe) was necessary to evaluate the impacts on operations and industry readiness. The concept of this approach is shown in the figure below.



3. Conclusions

In performing the assessment, the team identified 11 key capabilities needed for system operations in the event of loss of EMS/SCADA. These capabilities were included in a limited industry survey to (1) determine their rank in priority for spare tire operations, and (2) understand the levels of redundancy generally associated with each. The results indicated the following priority rank:

Priority Rank Order
1. **External voice communications**
2. **Internal voice communications**
3. **Area Control Error calculation**
4. **Frequency telemetry**
5. **Transmission system monitoring and control**
6. **Generation dispatch and Automatic Generation Control**
7. **Personnel deployment (human remote terminal unit)**
8. **State estimation / real-time contingency analysis**
9. **Interchange Scheduling**
10. **Off-line power flow analysis**
11. **Load and wind forecasting**

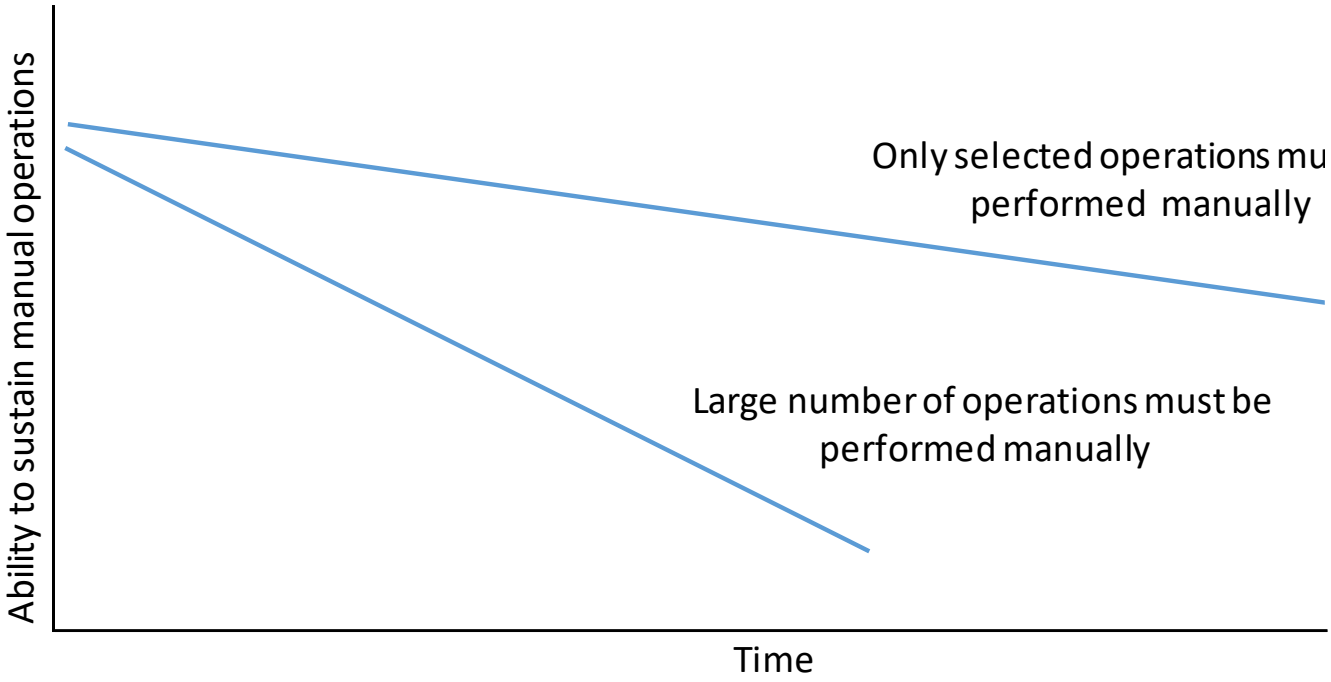
The ability to communicate was the highest ranked capability from the survey. This suggests the importance of having a robust communication network along with sufficient operating protocols available to enable effective communication with internal personnel, neighboring utilities, emergency responders, and other impacted stakeholders. The NATF survey also indicated that at least half of the respondents have implemented redundant

capabilities beyond primary and secondary redundancy for the four highest ranked capabilities. At the same time, the results highlight other primary capabilities that remain critical for spare tire operations that may not generally employ redundancy beyond secondary levels.

Another key observation of the team is that any replacement of EMS/SCADA systems with alternate methods, such as involving humans, trucks, telephones, etc. would be:

- limited in capability – the system will not function with comparable levels of efficiency and reliability;
- limited in time frame – given the personnel constraints and comparative inefficiency of this form of operation, it cannot be maintained indefinitely;
- resource-consuming – the same personnel who would be working to restore the system (along with ongoing forced outages) will be called upon for this type of operating environment;
- procedurally limited – it is possible that response and recovery procedures generally do not thoroughly define detailed responses to long-term events as described in the document.

It is of the utmost importance that utilities consider not only the availability for resource deployment but also the plans and protocol necessary across the entire enterprise to effectively execute this capability for prolonged periods. This includes the identification of critical skills needed to operate the grid in this manner, in addition to the training requirements for any personnel needed to perform tasks consistent with manual operation. This degradation of the ability to sustain manual operations is shown in the figure below.



Due to the number of possible event scenarios, it was concluded that a single recovery method is not appropriate to address all events rendering an EMS/SCADA unavailable. However, as part of the review process

for considering a spare tire strategy, consideration was given to principles that help organizations prepare for and respond to multiple types of high-impact, low-frequency events. The following operating principles were found to be common across multiple entities based on shared experiences, similarities between procedures, and ranked responses for key capabilities:

- understand impact and plan for personnel safety, training, and coordination;
- ensure availability of alternative communication capabilities;
- consider greater levels of redundancy for primary operating capabilities;
- develop ability to notify stakeholders and request (or lend) assistance;
- have comprehensive and clear logistical plans for personnel and data distribution;
- understand and plan for resource implications (field, engineering, operations, etc.);
- codify and practice concepts for spare tire operations;
- consider strategies that mitigate multiple high-impact, low-frequency threats.

Individual company practices may vary from the descriptions provided in this document.