

Major Transmission Upgrade Training Using The DTS

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Overview

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Background

■ Need / Issue

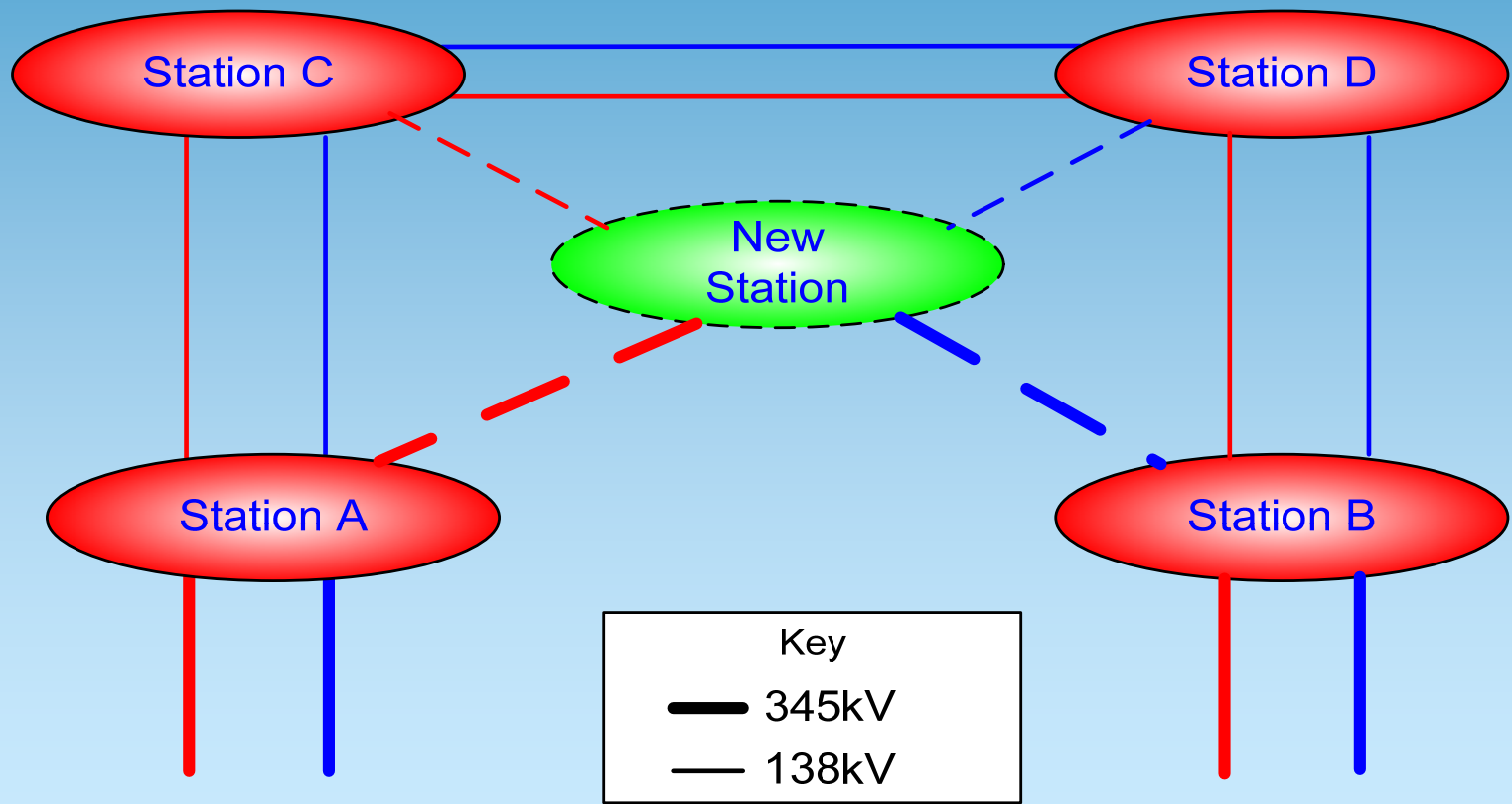
- ◆ 138 kV System was near capacity in Chicago
- ◆ The only 345 kV Transmission path into Chicago was from the South
- ◆ Needed to relieve 138 kV flows from the North

■ Solution

- ◆ New 345 kV Transmission path into Chicago from the West adding additional flow capability into Chicago
- ◆ Relieves flow from the North into the city
- ◆ Provides additional path and more flow capability to minimize system stresses during contingencies

New 345kV Path

In-Service Date
April 26, 2008



Training Need

- Adding 345 kV transmission lines and auto transformers would drastically change the operating characteristics of the transmission system in and around the City of Chicago
 - ◆ Normal operations
 - ◆ Abnormal / Emergency operations including contingency changes
 - ◆ Procedures

Training Need (cont'd)

- Key training concerns
 - ◆ Operators need to learn system configuration changes
 - ◆ Operators need to fully understand impact of these system modifications
 - ◆ Normal operations / flows
 - ◆ Contingencies
 - ◆ Procedure changes
 - ◆ Complete training prior to in-service date

Training Need (cont'd)

- Simulator training needed to be a major part of the training solution
 - ◆ Operators would “operate” the transmission system with all the modifications in final state
 - *Before the project completed in the field*
 - ◆ Operate at various system load levels
 - ◆ Experience transients and deal with contingencies at various load levels
 - ◆ Scenarios include events that train / exercise new / changed procedures

Training Challenges

- Great desire to train operators in the simulator
 - ◆ DTS is normally modeled on the production system
 - ◆ The simulator training needed to model a future state
 - ◆ Needed to model DTS on the development database
 - ◆ Needed final state data well before live date

Training Challenges (cont'd)

- Very aggressive time line
 - ◆ Early October 2007, IT was tasked with changing DTS to include all final state changes
 - ◆ Training staff had 1 month to develop DTS scenarios
 - ◆ Training scheduled to beginning on January 7, 2008

IT Challenges

- First-time evolution
 - ◆ Normally export production database to DTS
 - ◆ Network model normally updated to reflect field changes just-in-time
 - ◆ Need to build network model and create one-line SCADA displays in various future states
- Short lead time

IT Process

- Reviewed project documents from Transmission Planning showing project implementation phases
- Operations personnel provided final state SCADA one-line drawings
- IT developed current and future state drawings

IT Process (cont'd)

- Database generation
 - ◆ Production database modified in CIM to reflect future state
 - ◆ Exported to test environment
 - ◆ Database cleanup performed
 - ◆ After several iterations, database exported to DTS
- Future state Network Model made available to Reliability Dispatchers and Transmission Planners to perform studies

IT Keys to Success

- IT personnel's in-depth knowledge of project changes and transmission system
- Development of SCADA One-line drawings and future model diagrams
- Teamwork between Operations Support, Transmissions Planning, and IT

Training Implementation

- One full day in classroom (8 hours total)
 - ◆ Need for transmission system improvements and how the project satisfies those needs
 - ◆ System modification details
 - ◆ Including thorough time-line for actual transmission system modifications
 - ◆ Operating procedure change details
 - ◆ Including basis of the changes

Training Implementation (cont'd)

■ Classroom

- ◆ Transmission system operational changes
 - ◆ Included flow diagrams at various system load levels with varying equipment status
- ◆ Exam

Training Implementation (cont'd)

- One full day in simulator (8 hours total)
 - ◆ Three scenarios
 - ◆ One at minimum load levels
 - ◆ One at middle (Spring/Fall peak) load levels
 - ◆ One at peak (Summer peak) load levels

Training Implementation (cont'd)

- Scenarios emphasized abnormal procedure implementation
 - ◆ ALL abnormal procedure changes due to system modifications exercised
 - ◆ ALL relay/auto action changes due to system modifications exercised
- One major multiple contingency transient
 - ◆ Actually simulated design basis event at peak system load levels

Training Implementation (cont'd)

- Used simulator to “drive home” operational characteristic changes
 - ◆ “Froze” simulation to thoroughly review and discuss system operating characteristics and concerns for current system state
 - ◆ At the beginning of each scenario
 - ◆ At critical points of each scenario

Additional Benefits

- IT efforts lead to:
 - ◆ Reliability studies being available to Transmission Planners and Reliability Dispatchers early
 - ◆ Reliability Dispatchers were able to practice running studies with system in final state well ahead of in-service date

Training Results

- Operator feedback
 - ◆ Immediate feedback – very good and valuable training
 - ◆ Configuration changes and timelines
 - ◆ Operators felt knowledgeable and able to deal with operations during phased in implementation and construction outages

Training Results (cont'd)

- Operator feedback (cont'd)
 - ◆ Review procedure changes and reasons the changes were needed
 - ◆ Operators had a better understanding of how to implement the changing procedures
 - ◆ Excellent use of the simulator
 - ◆ Model showing final state was tremendously beneficial

Training Results (cont'd)

- Operator feedback (cont'd)
 - ◆ After all changes went live – operators continued to state the training was very beneficial
 - ◆ Very comfortable with the changed system operating characteristics
 - ◆ The simulator model and reliability studies were a very good indicator of actual system operating characteristics

Impacts to Training Program Going Forward

- Every summer training will meet with Transmission Planning to discuss system changes for the coming year
- Decide training content for the classroom / simulator for the first training session of the next year
- Meet with IT and discuss simulator training needs to support the first training session of the next year.

Summary

- Major transmission infrastructure change
 - ◆ Significant operational impact
 - ◆ Created a great training need
- DTS was the most valuable training tool for solidifying operator understanding of operational impact
- Operator feedback was and continues to be very positive
- Led to changes in how we approach system modification training