

CASE STUDY:**DISASTER RECOVERY/BUSINESS CONTINUITY TESTING: TOTAL ELECTRICAL BLACKOUT****CLIENT DESCRIPTION:**

The Client is a large banking enterprise that services the western and central portions of the United States. One of their major facilities houses their data processing and communications center critical to the daily business operations (e.g. ATMs, credit card transactions, etc.) of the enterprise. Although this facility was well maintained, an actual test of the emergency power system had never been performed.

CTA developed a relationship with both the building owners and the property management personnel during our embedded facility Y2K testing and remediation activities. When the Client decided to perform a live Electrical Blackout Test they contacted CTA to gain our mission critical systems test and evaluation experience to support planning and execution of the test event.

PROJECT DESCRIPTION:

The project required that the commercial utility power to the facility be secured for two primary reasons: to test the proper function of the internal emergency power system and to facilitate maintenance, testing, repair, and replacement of major elements of the primary high voltage system.

The million-square-foot facility had never been taken off utility power to clean, test, maintain, and repair the utility power system. Portions of the electrical distribution network in the facility had never been test-cycled and this facility was one of the few in the area being directly fed 12,000 volts, as compared with the more usual 480 volts.

CTA personnel have extensive backgrounds in large facility electrical systems and wide-ranging experience in large project test & evaluation. This combination of background and experience directly supported the systematic planning for the Electrical Blackout Test.

The planning for the Electrical Blackout began nearly ten months before the planned event. The work was divided into three parts: the Pre-Test preparation, the Test Event, and the Post-Test recovery. The Pre-Test planning developed into an evolving Action Item list that served as a preparation guide for the Test Event. The Test Event evolved into a straightforward extension of the Pre-Test preparation, and the Post-Test recovery developed into a non-event because of the effective Pre-Test planning, testing, maintenance, repair, and cleaning.

SYSTEM ARCHITECTURE:

The utility power and the emergency power networks are linked via large transfer switches. The Uninterruptible Power System (UPS) network supports telephone, computer, and emergency lighting and life-safety systems as the generators come on line. After the power from the generators stabilizes, they support the UPS, lights, elevators, and similar building utility systems.

PROJECT APPROACH:

Although many elements of the planning proved to be important, the following are those that were most important to the success of the test event

Weekly Communications via conference calls – with Notes.

The Notes evolved into an Action Item List (see below). This action Item List drove the Test Event preparation activities and all action items were closed before the Test Event.

Action Item Listing

- **Sample**

LINE Ref #	QUESTION - COMMENT	RESOLUTION	Action Agreed Upon	Resolution Due Date	Com-pleted	RESP	Changed status from last issue
A	PRE-TEST						
A.1.0	Security - Safety						
A.1.1	Designated building entrance	4th Ave. Will be guarded 24x7	YES	29-Nov-01	*	G	
A.1.2	Plan for names, ID badges,	Plan developed; all who need access will be on the list of authorized attendees. Randy will be responsible for maintenance of the list; Have his e-mail address.	YES	17-Jan-02	*	G Randy	
A.1.3	Stairwell Doors - unlock	Via global command in the fire system. Rob responsible that global commands (unlock & unlock) are sent. Back up to be provided by security personnel on each floor.	YES	10-Jan-02	*	G Rob	
A.1.4	Tenant alarms to police - Will continue to have monthly meetings w/ tenants	G&E to Notify police & fire departments - Determine list at tenant meeting	YES	16-Jan-02	*	G Rob, Lisa	
A.1.5	Parking lot entrance	Security Guard - No vehicles except for test equipment deliveries	YES	29-Nov-01	*	G	
A.1.6	Elevators - Freight & Passenger (Tower Engine can support only two elevators)	Freight elevator for upper floors, one passenger elevator for the lower floors. Both will have an operator at all times. Plan to use radio to request elevator. - need to develop post orders for priorities. 4/11: Decided to serve on a 1st call, 1st served	YES	11-Apr-02	*	G Lisa	
A.1.7	Tenant - First Meeting - See A.1.4 above	Scheduled 1/16/02 @1400 Determine external alarms to police & fire	YES	16-Jan-02	*	G	

The Test Event was scripted early – (see below). This Script provided an initial rough time-line of the Test Event tasking and it structured the Test Event and helped to define the quantity and character of the work to be done.

Test Weekend Script: Facility and Data Processing Center Electrical Blackout Test Event Overview

Friday April 19, 2002

3:00 PM -- Begin preparations for shutting down high voltage utility power -- PacifiCorp.

5:30 PM – Facility maintenance personnel bring the Emergency Power Generators on line.

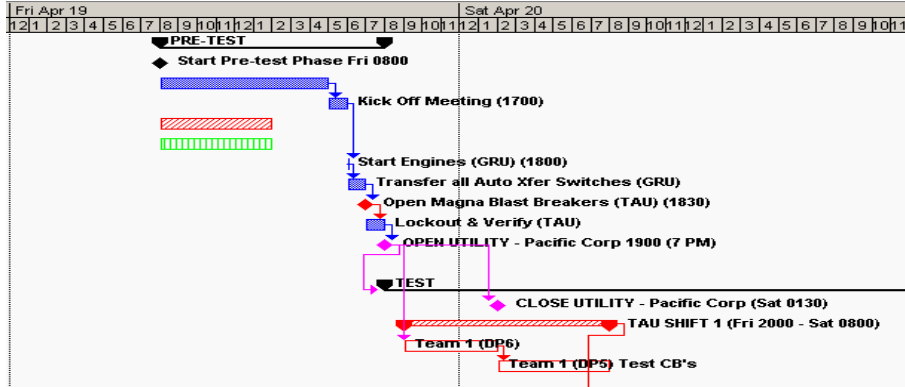
6:00 PM – The Magna Blast Breakers are taken off-line.

6:10 – 7:00 PM – The transfer switches are checked for correct function.

7:00 PM – Proceed with shutting down and locking out utility power. The Pre-Test, Test Event, and Post-Test Milestone Chart were developed early—(see below). The Milestone Chart provided a solid basis for defining the character so the tasking for the Test Event. It defined, for example, how many work crews would be required to complete the Test Event in the time allotted.

Shutdown Overview

- **Sample**



The Scripted Test Event and the Milestone Chart helped shape and define the Electrical Contractor Statements of Work.

The Statements of Work were used as a basis for generating the detailed Task Lists and the Crew Lists and the Equipment lists for the Test Event, and also as a basis for developing the Safety Plans for the Electrical Contractor teams.

Key to the overall evolution of the planning for the Test Event was the communications among all participants. Two meetings were held just prior to the beginning of the Test Event; each of these resulted in significant changes to the Test Event Planning. This close coordination continued throughout the Test Event weekend.

As the Action Items were completed and the Script for the Test event evolved, the Method of Procedure for the Test Weekend was produced. This Method of Procedure was used to guide the Test Event as it proceeded – (see below). This was essential for providing feedback to the tenants on the progress being made throughout the Test Event weekend.

Master Check-Off List

- **Sample**

SEQ #	Sched Start	Time Completed	ACTIVITY	LOCATION	RESP
FRIDAY - PM, April 19, 2002					
1	1700		Kick Off Meeting	DP-3	CTA
2	1800		START of CHR Shift 1 (1800 Fri - 0530 Sat) Teams: A, B, C, D, E, F, & M	DP-3	CHR
3	2000		START of TAU Shift 1 (2000 Fri - 0800 Sat) Teams: A, B	DP-3	TAU
4	1800		Start Engines - Verify Proper Operation	DP-6, T-39	GRU
5	1830		Open Magna Blast Breakers: 52-1, 52-2, 52-3 Lock Out, Tag Out and Verify	DPLL (Vault)	TAU - Team A CHR - Team A CHR - Team B CHR - Team C CHR - Team D CHR - Team E CHR - Team F CHR - Team M
6	1830		Observe AUTO Transfer & verify (Auto Transfer Switches):	see below	GRU w/ Apogee

TEST RESULTS/LESSONS LEARNED

Many important observations were made as a result of the test. Some of these included:

- Environmental control system functioned below expectations
- Power company personnel not on access list
- Elevator hoist on emergency power, controls were not
- Major breaker rack-out motors not on emergency power
- Generator stopped momentarily by loose relay
- Four major circuit breakers failed trip tests
- Shunt trip lockout failed creating safety hazard
- Domestic water not on emergency power
 - Loss of water pressure resulted in increased elevator use by building occupants and increased recovery time to get water system operational after failure
- Large breakers would not reset because of no-load condition
- Public address system announcements useful initially, however radio communications best during test event
 - Freight elevator required card key—slowed operation
 - Limited number of card keys slowed operation

As a result of these observations, the following repair/replace recommendations were made:

- Repair/retrofit four major circuit breakers
- Rack-out of all lock-out breakers
- Elevator lighting and cameras should be on emergency power
- More card keys should be made available for future tests
- Domestic water pumps should be on emergency power
- Cooling fans should be added to transformers
- Aluminum wire should be fitted with end caps
- Environmental system should be on UPS power

- Emergency power was plentiful, but not always available –Add emergency power circuits

BENEFITS TO CLIENT:

The Test Event was made more complex by the express feed-line used by the utility company. This express feed-line supported two separately owned large office towers and the power to both had to be cut at the same time. The differences in the approach taken by the two facilities to the Electrical Blackout Test is quite revealing.

Our large facility expended nearly one-third of a million dollars to upgrade and thoroughly test their utility-power-supplied power-distribution-network and their emergency power support network. As a result, they have a high degree of confidence that if utility power ever does go down that their emergency power system will function as designed.

The other facility took a minimalist approach to communications regarding the test weekend and the benefit to be gained from the power outage. They expended less than a week's worth of planning, testing, cleaning, maintaining, and repairing prior to and during the planned power outage. Another nearby large facility in the area also took the minimalist approach during a similar test; when a real utility power outage occurred their emergency power system did not function. It took several months before the facility was again fully functional.

The Client now has complete confidence that their facility will successfully transition to the emergency power support system in the event of a utility power outage, including the fire-life-safety systems. The Test Event was conducted with an absolute minimum of disruption to the business life of the facility. The Client also now has a clear picture of which maintenance items remain to be completed to bring the facility up to full electrical functionality. Due to the success of this electrical blackout testing, the Client has decided to continue doing this type of testing every five years.