ConOp

Real-Time Dispatch – Corrective Action Mode
Concept of Operation

Author:	Reviewers:
NYISO Staff	NYISO Staff MSWG

Project Sponsor:	Point of Contact:

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Purpose & Limitations of this Document

The Concept of Operations (COO) is the first document in the lifecycle of a software system implementation or enhancement. The COO generally describes the proposed functionality in plain terms (a.k.a. White Paper). It does not attempt to provide detailed explanations of requirements or implementation details, but rather explains the functionality in conceptual terms for discussion prior to detailed design.

Changes to the functionality or appearance of software that is described in the COO may be introduced in subsequent design, implementation, testing or maintenance phases. In addition, the software system or enhancement may evolve over time as other software systems and enhancements are introduced. The COO is not updated to reflect these changes. That is, the COO is not intended to document the software system or enhancement "as built." Other documents, specifically ***Technical Bulletins*** *and* ***Manuals****, describe the "as built" software system or enhancement. In short, the COO will become obsolete at some point during the lifecycle of a software system implementation or enhancement.*

1 Introduction

This document addresses the concept of operations of the Real-Time Dispatch - Corrective Action Mode (RTD-CAM) component of the Real Time Scheduling (RTS) system at the NYISO. RTD-CAM will be the mechanism to reschedule NYISO units after unexpected, event driven emergency conditions that could not have been foreseen by the RTC and RTD component parts.

1.1 Terminology and Abbreviations

Term	Description
RTD-CAM	Real-Time Dispatch Corrective Action Mode
RPU	Reserve Pick-Up
BASAP-CAN	Basepoints as soon as possible – commit as needed
BASAP-NC	Basepoints as soon as possible – no commitments
ISO	Independent System Operator
LBMP	Locational Based Marginal Price
LRR	Local reliability rules
MIS	Market Information System
MMP	Market Monitoring and Performance unit
NYC	New York City
NYCDAM	New York City day-ahead mitigation
OOM	Out of merit
RTS	Real-Time Scheduling
SCD	Security Constrained Dispatch
SCUC	Security Constrained Unit Commitment
TO	Transmission Owner

2 Functions

2.1 Reserve Pickup

A Reserve Pickup (RPU) run of RTD-CAM will be used to re-establish the NYISO schedule after major system events caused by the loss of transmission lines or generators. A RPU run of RTD-CAM differs from a normal RTD run in that the basepoints are constrained by emergency rather than normal response rates, they may go to operating capability limits if necessary, and a 10 minute load target is used. All fast start gas turbines will be available for reserve pickup dispatch runs in CAM and will be allowed to bid synchronized reserve above their baseload (this reserve could be activated if the unit was currently running). Dispatchable load will be treated the same as generators and can be moved up to the upper limit as necessary. Interruptible load will be used as a resource of last resort in extreme conditions and will receive their instructions in a to be determined manner. A flag will be sent to each unit and dispatchable load along with the BP indicating the NYISO is in reserve pickup and that the units are receiving 10-minute basepoints. There will be two operator selectable modes for RPU runs, large event and small event. Large event mode will be run for comparatively large unit losses and small event mode will be run for smaller negative ACE excursions normally caused by units not responding to basepoints.

When a Large Event Reserve Pickup is activated the procedure for setting basepoints is:

- Crossing 0 (getting the ACE to 0) is the first priority so no generator is allowed to reduce output during a reserve pickup even if the flows on some transmission elements exceed their normal operating limits.
- Reserves are released on all units so that RTD-CAM can dispatch up into the operating ranges previous blocked off as reserves.
- RTD-CAM will run a security constrained dispatch using a load target for 10 minutes out and unit upper and lower limits set by the current actual output of the unit plus ramp.
- The basepoint for each unit is **the higher of the unit's current output or the basepoint determined by the RTD-CAM dispatch.**

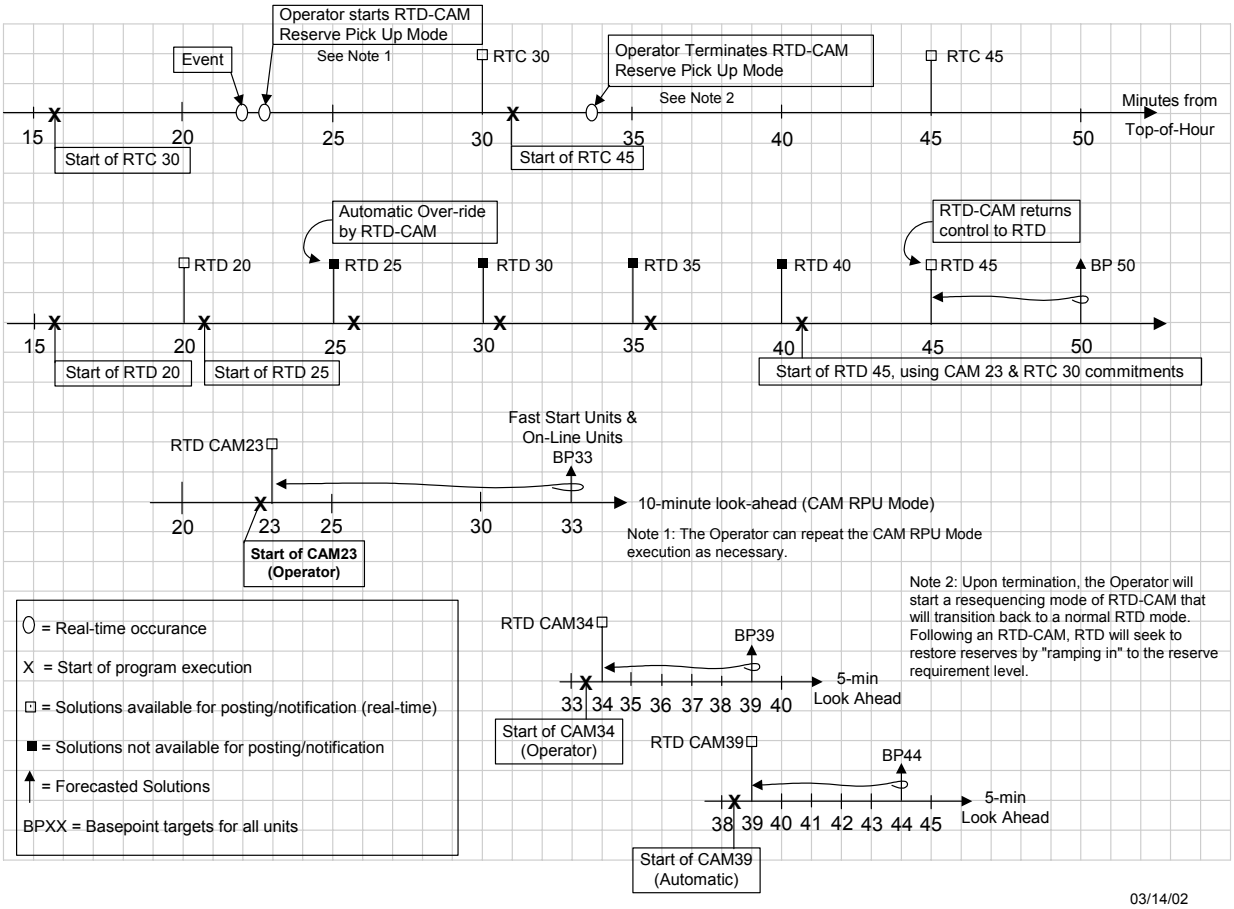
When a Small Event Reserve Pickup is activated the procedure for setting basepoints is:

- Crossing 0 (getting the ACE to 0) is still the first priority, but generators will be allowed to reduce output during a reserve pickup if the load target has been met and transmission element overloading can be reduced.
- Reserves are released on all units so that RTD-CAM can dispatch up into the operating ranges previous blocked off as reserves.
- RTD-CAM will run a security constrained dispatch using a load target for 10 minutes out and unit upper and lower limits set by the current actual output of the unit plus ramp.
- The basepoint for each unit is **the basepoint determined by the RTD-CAM dispatch.**

NYISO operations will make the determination as to what type of RPU needs to be invoked taking into consideration the size of the generation loss and the overall network security situation. When a zero ACE has been crossed the operators will start the reserve restoration procedure (described below) . The following timeline further illustrates the scheduling aspects of a Reserve Pickup event.

2.1.1 Reserve Pickup Timeline

Figure 1: Reserve Pick Up (RPU) - Real-Time Scheduling (RTS) - Time Line Sequence



2.2 Reserve Restoration

The Reserve Restoration function will be accomplished by a sequence of RTD-CAM, RTD and RTC runs. Reserve Restoration is designed to smoothly reestablish reserves over a time frame that is in accordance with FERC rules, while resolving the issues that could occur if all reserve requirements were attempted to be restored in one interval.. The following describes the amount of reserve recaptured each 5 minutes following the termination of a reserve pickup. For this example our worst-case generator loss is 1200 MW setting 10 minute total requirement at 1200 and 30 minute requirement at 1800 MWs.

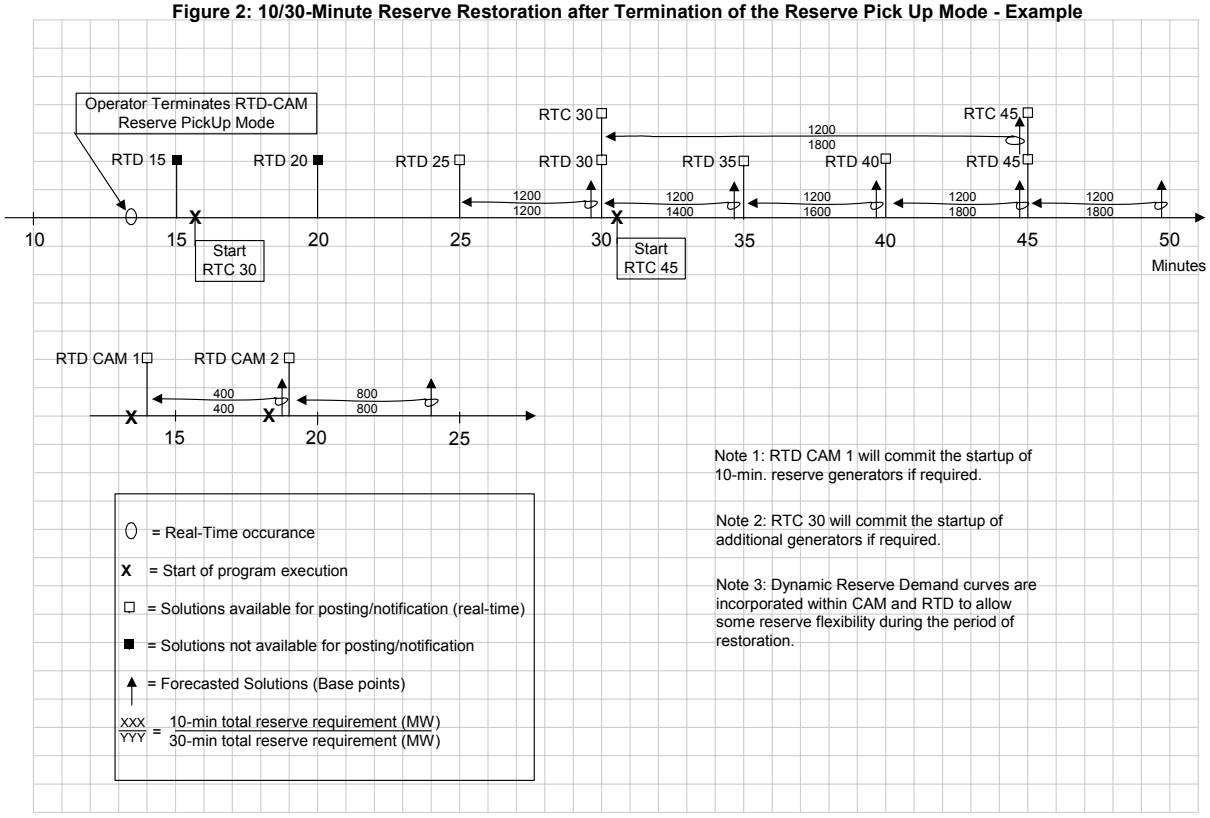
1. 10 minute restoration - example
   - CAM-1: 400 (After 5 minutes)
   - CAM-2: 800 (After 10 minutes)
   - RTD-1: 800 (After 10 minutes – runs concurrently with CAM-2)
   - RTD-2: 1200 (After 15 minutes)
   - RTD-3: 1200 (After 20 minutes)
   - RTD-4: 1200 (After 25 minutes)
   - RTD-5: 1200 (After 30 minutes)

2. 30 minute restoration - example
   CAM-1: 400 (After 5 minutes)
   CAM-2: 800 (After 10 minutes)
   RTD-1: 800 (After 10 minutes – runs concurrently with CAM-2)
   RTD-2: 1200 (After 15 minutes)
   RTD-3: 1400 (After 20 minutes)
   RTD-4: 1600 (After 25 minutes)
   RTD-5: 1800 (After 30 minutes)

RTD-CAM 1 will be able to commit fast start gas turbines if required to meet the reserve requirement. The 10-minute requirements will be considered hard to 400 and a reserve demand curve will be used to recapture more 10 minute. Similarly the 30 minute requirement will be considered soft until the RTD-5 run. The following time line depicts a Reserve Restoration sequence commencing at 14 minutes after the hour.

2.2.1 Reserve Restoration Time Line

Figure 2: 10/30-Minute Reserve Restoration after Termination of the Reserve Pick Up Mode - Example



2.3 Max Gen Pickup

Maximum generation Pickup will be a sub function of RTD-CAM. The dispatcher will be able to select one or more of the following zones, or other combinations of subzones as deemed necessary. The program would move all of the generators (including slow start GTs) in one or more of the selected area(s):

a. LI
b. SENY
c. East of Total East
d. Entire State

at their emergency response rates to their DMNC limit while attempting to balance load with the remaining units. Solving for Security and load would not be of primary importance, although the ability to do Max Gen pickup on a zonal basis will by definition incorporate security considerations. Units in the selected zones will most likely just be sent their OPCAPs while units in the unselected area will receive normal 5 minute and six second basepoints. Max Gen Pickups will also send an alarm flag with dispatch instructions similar to the reserve pickup flag. Basepoints will be issued for tracking purposes and all affected resources will be considered Out-Of-Merit for the Max Gen period. A Max Gen Pickup run of RTD-CAM will repeat itself every 5 minutes until canceled by the operators.

2.4 Basepoints ASAP – No Commitments

The 'Basepoints ASAP – No Commitments' (BASAP-NC) function of RTD-CAM will be used at the discretion of the system operators when new basepoints are needed as soon as possible. A BASAP-NC run can be initiated on demand at any time and will be used primarily to correct line, contingency or transfer overloads and/or voltage problems caused by unexpected system events. A BASAP-NC run of RTD-CAM will be similar to a normal RTD run in that it will produce five minute basepoints using normal response rates and limits. Due to the requirement of a short execution time (less than 30 seconds) the look ahead for BASAP-NC runs will be reduced to 15 minutes. The initiation of a BASAP-NC will cause a currently executing RTD run to end. The next regular scheduled RTD run which starts after the BASAP-NC run has ended will be used to resynchronize base points to the even 5 minute norm.

2.5 Basepoints ASAP - Commit as Needed

The 'Basepoints ASAP – Commit as Needed' (BASAP-CAN) function of RTD-CAM is exactly similar to the BASAP-NC function except that 10 minute fast start units will be able to be committed on. This function could be used instead of BASAP-NC if it is apparent to the system operators that gas turbines will likely be required, or it could be run immediately after a BASAP-NC which was not able to correct the existing problem(s).

3 Scheduling

3.1 RPU Function

All units will receive only the 10-minute basepoints. If Gas Turbines are committed for a RPU, these schedules will be passed to the RTC and RTD components for the next execution.

3.2 Basepoints ASAP- (NC and Commit as Needed)

RTD-CAM will produce 5-minute basepoints for all units for these functions. These units will be sent the next 2-5 minute advisory schedules for all units to produce a profile of expected generation for the periods over which it optimizes.

3.3 Maximum Generation Pickup

RTD-CAM will produce 'go there as quickly as possible and hold' basepoints for all units for this function. No advisory schedules will be produced.

3.4 External Transaction Scheduling in RTD-CAM

External unit schedules are passed to RTD-CAM by RTC. Neither RTD nor RTD-CAM requires any specific functionality to handle external transactions. IS+ will be used to manage transaction curtailments in RT and the RTD package must be able to accept DNI changes produced by the IS+ package.

4 Pricing

4.1 RPU Function

Pricing during the reserve pickup will be handled by a combination of the dispatches used to create basepoints. If a large event RPU was run, units that have their basepoints set by the security constrained dispatch will have pricing limits determined by the ex post pricing logic module consistent with the security constrained dispatch. Units that have their basepoints set by their current output level will have the pricing set by the previous (pre-RPU) RTD dispatch. Ex ante prices will be sent out immediately after the RPU for the units that were asked to move up, prices for the units held at their actual will receive the prices from the last RTD dispatch. The rational for this is to create ex-ante prices, which will accurately represent the direction units are desired to move when there are security constraints present. It also assures that all generating resources will be paid the LBMP consistent with their scheduled RPU basepoints. Small event RPU runs will have pricing limits determined by the ex post pricing module consistent with the security constrained dispatch run.

4.2 All other RTD-CAM Functions

Pricing during Reserve Restoration, BASAP, and max Gen Pickup runs will be determined by the ex post pricing module consistent with the security constrained dispatch.

5 Generation

5.1 Bid Representation

The same generator bids will be used in RTD-CAM as in RTC and RTD for steam units. Off line GT bids will be modified by their start up costs that will be amortized over the 1 hour min run time (note: This may not precisely

minimize total costs if the GT is held on for longer than 1 hour but is necessary for the short look ahead time horizon).

5.2 Commitment

5.2.1 Start-up

The RTD-CAM functions RPU and BASAP-CAN will be able to commit quick start GTs as well as move all non-self scheduled fixed generation.. The Max Gen Pickup function will start all units in the selected area(s) that could include both quick and slow start GTs. During a Reserve Restore sequence, the initial RTD-CAM runs will be able to commit fast-start GTs. Once committed, these GTs schedules will be passed to the RTC and RTD components for the next execution. All GT commitments produced by any RTD-CAM function will be considered essential and will not be subject to the normal operations approval of the Gas Turbine Management System.

5.2.2 Shut Down

No function of RTD-CAM will have the ability to turn off quick start GTs, although all will produce messages indicating when a Gas Turbine is no longer economically loaded. All gas turbine shut downs will be initiated through the Gas Turbine Management System.

5.3 Self Scheduled Fixed Units

Self-Scheduled Fixed units will not be expected to move in any RTD-CAM function except for Max Gen Pickup. They will be sent their expected generation schedule as a basepoint but the RTD-CAM run will not expect these units to move and dispatch other resources to make up the difference.

6 Demand Side Resources

6.1 Dispatchable Load

Load that has demonstrated that it meets all metering and deliverability requirements to respond to a 5-minute dispatch signal may be scheduled in all RTD-CAM functions and will be treated as any other dispatchable generator.

6.2 Interruptible Load

Load that has demonstrated that it meets all metering and deliverability requirements to respond to a 5-minute dispatch signal may be scheduled during RPU and Max Gen Pickup events at the direction of the system operators. Notification of these load curtailments and restoration thereof needs to be further defined.