SYSTEMS DIVISION

CBOEdirect
Requirement Specifications
For
Intermarket Price Protection

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Prepared by:
Gordon Evora

Revised by:
Maureen Smith

REVIEW

Requirement Specifications Distribution List

Staff

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Mark Woyna

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CBOEdirect Requirement Specifications

1. Goal

The goal of this project is to provide NBBO price protection to customer orders at CBOE.

2. Objective

The objective of this project is to implement CBOEdirect functions for handling customer orders when a better NBBO price is posted at another exchange. The following new functionality will be introduced for CBOEdirect:

- Manual trading interface - Develop a manual trading interface for the DPM/LMM, as customer agent, to address the customer order outside of the electronic trading environment.
- Introduce NBBO price edits for customer inbound orders.
- Minimum Size Commitment - Develop support for a guaranteed minimum size of n (10) contracts for customer orders.
- Allow the sender of a customer order to indicate whether he wants NBBO price protection or not.

3. Current Situation

The initial implementation of CBOEdirect did not provide support for intermarket price protection. Therefore, CBOEdirect cannot be used under a multiple listing environment in ETH or in RTH, even if competitive pressures demanded it.

4. Proposed Situation

CBOEdirect will be modified to provide the capabilities to make it usable in a multiple listing environment. It will be enabled to recognize whether CBOEdirect is the NBBO or not. If CBOE is not the NBBO, the system shall internally expose the order briefly in the book for potential execution. If the order is not filled, the system shall put the order on-hold and present the order to the DPM/LMM for exception handling. The DPM/LMM can decide whether or not to step up. If he does not step up, the DPM/LMM would send his own order to the NBBO market, using an alternative routing system. After the NBBO market responds with a fill, then the DPM/LMM would fill the original customer order.

5. Assumptions

- NBBO protection is for simple customer orders only (limit, market, or replace), not for complex or spread orders.
- A customer order may include the instruction that NBBO protection is not desired.

(This feature will not be used under the full linkage rules.)

- For multiple-listed classes, CBOEdirect will support the Linkage plan by having a guaranteed minimum size of n (10) for customer orders. The DPM/LMM will make up the difference between the guaranteed minimum size and CBOEdirect's disseminated size in a customer –to-customer trade.
- The Marketmakers will be required by rule to quote at least the minimum size. The system shall reject automatically quotes (both sides) whose size is less than the minimum. A quote side that becomes less than the minimum size, due to a partial fill or cancel, shall be cancelled automatically with an appropriate message.
- Non-marketable non-customer orders (marketmaker, firm, broker-dealer, etc.) that are less than or become less than the minimum size shall be cancelled automatically with an appropriate message.
- CBOEdirect will not have an automatic step-up function. When CBOE is not the NBBO, CBOEdirect shall briefly expose a customer order, giving traders the opportunity to step up with their own systems.
- A customer IOC or FOK order will be subjected to the exposure process only. It will not be sent to the DPM/LMM for exception handling because that would take longer than the life of the order, currently set at n (5) seconds.
- Cancel and cancel/replace requests for orders that are put on-hold shall also be put on-hold and sent to the DPM for exception handling (following the original order).
- Only one DPM/LMM trader signs on as the designated NBBO Agent for a given DPM/LMM class, e.g., trader ABC of the DPM/LMM firm signs on as the NBBO Agent for the option classes with underlying stock of IBM.
- The NBBO Agent is the DPM/LMM trader responsible for achieving the NBBO price for his customer order. Actions that the NBBO Agent is expected to do may be done manually on the CBOEdirect workstation via a new Exception Handling Window or effected programmatically through his own computer system.
- Once full linkage is in effect, P/A, P, and S orders submitted by the DPM/LMM shall be routed electronically by CBOEdirect to their destination.
- CBOEdirect shall transmit to all participants the National Best Bid and Offer for multiple-listed classes. The NBBO prices as well as the identity of the NBBO exchanges and their size for each side of the NBBO are to be provided. In CBOE's workstation, the NBBO data and market conditions (i.e. non-firm, halt, rotation) will be displayed as part of the Market Display.
- Customer orders put on-hold for exception handling may be filled out of sequence.
- There may be a rare occasion when the DPM/LMM is not available and the order cannot be sent to the NBBO Agent, e.g., DPM/LMM system failure and the backup DPM/LMM has not yet taken over. The system shall log that condition and send an alert to the Trading Floor Liaison (TFL) and Help Desk. The TFL may potentially declare a non-firm (fast market) condition. The system shall continue to expose the order.
- If the NBBO Agent becomes unavailable for some reason, after the system has sent an order to him, the system shall keep the order on hold. It is up to the NBBO Agent to re-connect and complete the exception processing of the order.
- TFL and Market Regulations are considering whether to add to their requirement the ability to enter a trade with an adjusted price. Currently, the system allows a trade to

be busted but there is no function for reporting a trade adjustment for equity options. A function called block trading, which is available for futures, has been suggested as a starting point for this new function.

Since this is an intermediate stage project, preliminary to the Full Linkage project, manual trade correction practices in CTM and TSS price reporting will be used

6. System Risk/Exposure

The new functions that are proposed for this project will generate a moderate level of system risk. But following current procedures and guidelines, including quality assurance testing and CBOEdirect failure/recovery procedures will help in minimizing this risk.

7. Functional Requirements

7.1. Handling of Quotes and Non-customer Orders that are Less than Minimum Size

For multiple-listed classes for which a minimum size guarantee is specified:

- The system shall reject a quote (both sides) or a non-marketable, non-customer order when its size is less than the minimum size. An error code or text message will be provided in the reject report.
- The system shall cancel a quote bid, quote offer, or a non-customer order when its size becomes less than the minimum size. An error code or text message will be provided with the reject report.

7.2. Incoming Customer Order Procedure – CBOE is the NBBO

- This procedure applies when the NBBO is normal as well as when the NBBO is locked (bid equals offer) or crossed (offer lower than bid).
- CBOEdirect shall match the incoming customer order with the resting orders or quotes on the opposite side of the CBOEdirect Book:
  - If the incoming order is not marketable, then the system books the order.
  - If the incoming order is marketable, the system trades it against the resting orders.
    - If the incoming order has a remainder after the trade, the system shall process the remainder from the top of the procedure, e.g., test whether CBOE is still the NBBO or not at the new price.
    - If it is filled for less than the minimum guaranteed size, CBOEdirect shall create an order automatically for the DPM/LMM to make up the difference.

Example:

CBOE BBO	4 - 4.30	3 x 100, where the bid is a customer order
NBBO	4 – 4.20	3 x 50

Customer order to sell 10 @ 4 comes in. It fills the resting customer order of 3. The system determines that the customer order requires a fill up to the minimum size. The difference is 10 less 3 or 7. The system automatically creates a DPM/LMM buy order of 7 @ 4 and immediately trades it with the remaining 7. The fill report to the DPM/LMM notes that it came from an order the system automatically created for him to cover the minimum size guarantee.

If the customer order to sell was 20 @ 4, 10 would be filled in the manner described above, and the second ten lot would book, change the quote to a 4 offer for 10, and lock the NBBO.

7.3. Incoming Customer Order Procedure – CBOE is Not the NBBO

- This procedure applies when the NBBO is normal as well as when the NBBO is locked or crossed.
- When the customer order does not ask for NBBO price protection, then it may execute against the CBOE BBO. (This feature will not be supported under the full linkage plan.)
- When the customer order does not specify exemption from NBBO price protection and it is executable at the NBBO away market, the order is processed as follows.

7.3.1. Derived Order Exposure

- If the customer order is marketable at the NBBO price, CBOEdirect puts the customer order temporarily in the book with the NBBO price. When CBOEdirect puts the customer buy order in the book, the system stores it with a buy price equal to the NBBO offer. A customer sell order is stored at a sell price equal to the NBBO bid.
- The resulting BBO update is disseminated internally but not to OPRA, to avoid disseminating a market that would lock with the NBBO.
- The point of this exercise is to expose the order to CBOE traders for a very short period of time, e.g., n (2) seconds or less. The time will be calibrated to be long enough for rapid execution systems (“electronic eyes”) to react to it. If it is not filled, the system pulls the order out of the book, recalculates and re-disseminates the BBO. (Note that while these derived orders are in the book, any BBO calculation for transmission to OPRA should not include these orders.)

Limit order example:	CBOE BBO	3.80 – 4.00
	NBBO	3.80 – 3.90

Customer limit order comes to buy at 4.00, executable against NBBO offer 3.90. System exposes briefly the customer order at derived bid of 3.90 for take-out.

The CBOE BBO becomes 3.90 – 4.00 internally during the take-out period. The CBOE BBO to OPRA is unchanged at 3.80 – 4.00.

If not filled, system pulls order from book and presents it to the NBBO Agent for exception handling.

The internal CBOE BBO then reverts to 3.80 – 4.00.

The market order example works exactly as the limit order example.

Note: If the limit order has a bid price of 3.90, a derived price is not needed, but it still requires the same NBBO protection described below.

- If the derived order is not filled fully, the original customer order or remainder is then put on-hold and presented to the NBBO Agent for exception handling. The system records this event in the order's activity. An IOC or FOK order is exposed for the IOC period and allowed to expire. It is not presented to the NBBO Agent.
- There may be the rare occasion when the DPM/LMM is not available and the order cannot be sent to the NBBO Agent, e.g., DPM/LMM system failure and the backup DPM/LMM has not yet taken over.
  - For customer orders that come in when the NBBO Agent is not available, the system records that event on the order activity and sends an alert to the Trading Floor Liaison (TFL) and Help Desk. The TFL may declare a non-firm (fast market) condition. The system shall continue to expose the order.

7.3.2. Exception Handling

Exception handling is envisioned to be as follows.

- The customer order is presented to the NBBO Agent for action. It appears in a display of orders sent to the NBBO Agent for exception handling. Each line shows the order details listed below and status. The unfiltered display lists all the orders in chronological sequence, from the most recent to the oldest. The display can be filtered to show orders by class, by orders that are currently on-hold or orders that have been fully processed, i.e., no longer on-hold, or a combination of the filters. The NBBO Agent selects one for entering his action and the system presents the data for the selected order and his action choices. The data presented includes:
  - Order details:
    - Timestamp (date, mm/dd/yy, and time , hh:mm:ss, of entry)
    - Order ID of customer order
    - Product (series)
    - Buy or sell
    - Price
    - Size
    - Contingency, discretion
    - Time-In-Force
    - Origin type – customer assumed
    - Cxl or CX/RE indicators if following customer order to Exception Handling window
    - The CBOE quote (bid and ask prices and sizes) Show CBOE "stop" price and size when the order entered our system.
    - NBBO market at time of entry (if tied, show all tied exchanges)
      - Exchange ID of bid and ask sides
      - Bid and ask prices and sizes and market indicators
  - Exception handling status

- The NBBO Agent has a number of action choices.
  - Step-up to the NBBO price and fill the order partially or completely.
  - Manually fill the customer order.
  - Re-send the customer order through the routing edit logic WITHOUT checking NBBO. This situation would exist if an away market failed to provide the DPM a fill at the NBBO price, and the DPM now wants to fill the customer order at the CBOE BBO, which is better than the DPM's best price.
  - OPRA Last sale reports for trades of orders in exception handling are marked OSEQ.
- CBOEdirect will assist the NBBO Agent by sending him an alert when he has not posted an action for a held order in n (30) seconds. The system sends this alert at the same time that the same alert is sent to the TFL.
- The capability by the NBBO Agent to display, on request, the current quotes, sizes, and market condition for all exchanges is also desired to assist him in determining what he should do with a held order.

7.4. NBBO Data

For the products traded in CBOEdirect the following NBBO data is required. The source for the quote data will be TIPS. Since TIPS will not have the NBBO calculation with volume at this time, CBOEdirect will develop the calculation to determine the NBBO.

- Best Bid Exchange ID(s)
- Best Bid Price
- Best Bid Size(s)
- Best Offer Exchange ID(s)
- Best Offer Price
- Best Offer Size(s)
- Market Indicators (exchanges that are non-firm or halted)

If two or more exchanges were tied at the NBBO price, the exchange IDs and sizes of the tied exchanges have to be available also.

7.5. Market Supervision Requirements

7.5.1. Tests for Tradethrough Violation

For orders sent to the NBBO Agent for exception handling and traded (filled by the NBBO agent), CBOEdirect shall check for two types of potential tradethrough violation: violation of the CBOE Quote and violation of the NBBO. The CBOE Quote is the same as the quote sent to OPRA. **Note that orders that are traded automatically by the system are not checked for tradethrough violation because CBOEdirect will not allow such a trade.** However, CBOEdirect shall allow the NBBO agent to fill an order at his desired price.

Trade through review process:

- CBOEdirect will keep track of the time that it receives an order. As quotes come in, CBOEdirect will compare the quote time against the order receipt time.
- Assume the timer is 30 seconds. If the order is traded in 24 seconds from the time of receipt then the time window used is 24 seconds from time of receipt to execution. If the order is traded in 44 seconds from the time of receipt then the window used is 30 seconds from time of receipt to 30 seconds later. (The trade will be selected for evaluation in the offline regulatory application because it was traded later than the time window value).
- The NBBO Agent has 30 seconds to either trade the order at the price it was received or change his quote. CBOEdirect will determine the highest CBOE offer and lowest CBOE bid based on the time described previously.
- A trade is a potential trade through violation of the CBOE Quote under the following conditions:
  1. For a buy order, if the trade price is above the CBOE Highest Offer within the time window.
  2. For a sell order, if the trade price is below the CBOE Lowest Bid within the time window.

- A trade is a potential trade through violation of the NBBO under the following conditions:
  1. For a buy order, if the trade price is above the NBBO Highest Offer within the time window.
  2. For a sell order, if the trade price is below the NBBO Lowest Bid within the time window.

Examples

Buy Executed Trade	Quote at time of receipt	Highest CBOE Offer within 30 seconds	Status
$3.40	$3 - $3.40	$3.40 / no quote change	Not a Trade Through since order was executed at highest offer without a change to the quote
$3.40	$3 - $3.30	$3.40 / Quote update within 30 seconds	Not a Trade Through since the offer was changed within 30 seconds making it the highest
$3.50	$3 - $3.40	$3.40 / no quote change	Trade Through since the trade was executed at a worse price than the highest offer.

$3.50	$3 - $3.40	$3.40 / Quote updated to $3.50 after 40 seconds	Trade Through since the trade was executed at a price worse than the highest offer within 30 seconds

Notes:

Examples shown are for Buy trades; Sell would be the opposite comparing the lowest CBOE bid.

If the trade price violates the NBBO, the system would generate an alert notifying Trading Floor Liaison (TFL) that a potential tradethrough has occurred. The alert is required to be provided as close to the time of the trade as possible in order for TFL to expedite the resolution process. For this reason the current plan is to present the TFL user with the alert on a new administrative GUI along with the display of relevant CBOE and NBBO information. The GUI shall provide TFL the capability to enter a text comment documenting the resolution and status of the tradethrough. It will be determined whether any standard resolution codes should be applied automatically by the system on behalf of TFL.

The CBOE Quote test shall be done first, NBBO Quote test second. To minimize the number of alerts, the NBBO test is not done if the CBOE Quote test generates an alert. It is assumed TFL will manually monitor if an NBBO violation occurred as well. The capability to turn on/off the NBBO tradethrough test by class and by series is required.

The CBOE Quote and NBBO tests are not performed if the product is in non-firm (fast market) or in rotation. However, offline processing requires that the data for the tests are still recorded and provided to the Consolidated DataBase (CDB).

7.5.2. Non-execution of CBOE Marketable Order Within Time Window

CBOEdirect shall generate a TFL alert for a customer order that is marketable against the CBOE market and CBOE is not the NBBO at time of receipt, and is not executed within a configurable time window of n (30) seconds.

7.5.3. Access to TFL Alerts

A new role shall be defined for TFL users that will enable them to login and display TFL alerts. All TFL alerts shall be available for display by any TFL user. However, only one TFL user at a time can update the resolution status of a TFL alert.

7.5.4. TFL Alerts Display

The CBOEdirect administrative GUI shall be enhanced with new TFL Alert Displays. Two displays shall be available: an Alerts Summary Display and a single alert display.

Alerts Summary Display

The Summary Display lists the alerts for the day in chronological sequence. The TFL user shall be able to filter the alerts by date, session, time period (13:00-13:15), status (open or resolved or both), product class, product (series), and by a combination of these filters. Each line of the Summary Display shall present the following key data for the alert:

- Alert number
- Date (mm/dd/yy) and time (hh:mm:ss) the alert was generated
- Type of Alert: NBBO Tradethrough, CBOE Tradethrough, Non-execution of Marketable Order
- Alert resolution
- Product (series)
- Order ID
- Design of the Alert Summary will be modeled from what is currently provided to TFL by Regulatory Services for Open Outcry.
- The single alert display presents the details of the trade and the subject order that caused the generation of the alert. The user shall view this display by selecting one of the items in the Summary Alert Display.

Single Alert Display

The tradethrough alert display shall present the following data.

- Alert number
- Date and time the alert was generated
- Type of Alert: NBBO Tradethrough or CBOE Tradethrough
- Resolution (drop-down list of TFL reason codes; see below)
- Comments (for free text entry)
- Subject order details
  - Originating firm
  - Branch sequence number
  - Bought or sold
  - Product: Class, expiration year and month, strike price, call or put
  - Total trade quantity
  - Trade price
  - Order price
  - Time in force, e.g., Day or GTC
  - Open or close
  - Origin code, e.g., customer
- Trade details
  - Executing broker acronym (represented subject order)
  - Data about each contra party or order that traded with the above order
    - Quantity

    - Acronym
    - Firm
    - Time the contra order filled the above order, hh:mm:ss
- NBBO Quote (NBBO bid and ask prices, sizes, and exchange Ids, market indicators for NBBO exchange
    - At time of receipt of subject order and time of receipt
    - At time of execution of subject order and time of execution
- If order was marketable against CBOE quote at time of receipt, CBOE Quote (bid and ask prices and sizes):
    - At time of receipt of subject order and time of receipt
    - At time of execution of subject order and time of execution
- If order was sent to DPM for exception handling:
    - For a buy order:
        - Highest offer (price and size) for CBOE Quote within time window and, if CBOE Quote tradethrough, an asterisk to indicate trade through condition existed
            - Highest offer (price, size, exchange ID) for NBBO Quote within time window and, if NBBO Quote tradethrough, an asterisk to indicate so
    - For a sell order:
        - Lowest bid (price and size) for CBOE Quote within time window and, if CBOE Quote tradethrough, an asterisk to indicate trade through condition existed.
            - Lowest bid (price, size, exchange ID) for NBBO Quote within time window and, if NBBO Quote tradethrough, an asterisk to indicate so

Non-execution Alert Display

The Non-execution Alert Display shall present the subject order data below for an order that is marketable against the CBOE quote at time of receipt and not executed within the time window.

- Alert number
- Date and time the alert was generated
- Type of Alert: Non-execution
- Resolution (drop-down list of reasons; to be determined)
- Comments (for free text entry)
- Subject order details
    - Originating firm
    - Branch sequence number
    - Bought or sold
    - Product: Class, expiration year and month, strike price, call or put
    - Total trade quantity
    - Trade price
    - Order price
    - Time in force, e.g., Day or GTC
    - Open or close
    - Origin code, e.g., customer
- NBBO Quote (NBBO bid and ask prices, sizes, and exchange Ids, market indicator)

  - At time of receipt of subject order and time of receipt
- CBOE Quote (bid and ask prices and sizes) at time of receipt of subject order and time of receipt
- If order was sent to DPM for exception handling:
  - For a buy order:
    - Highest offer (price and size) for CBOE Quote within time window
    - Highest offer (price, size, exchange ID) for NBBO Quote within time window
  - For a sell order:
    - Lowest bid (price and size) for CBOE Quote within time window
    - Lowest bid (price, size, exchange ID) for NBBO Quote within time window

TFL Reason Codes for Tradethrough Adjustments

The reason codes below are used in the trading floor. Not all of them pertain to SBT. The pertinent codes shall be presented in a drop-down list from which the user selects the reason code for the adjustment of the particular tradethrough alert.

AP - Partial price adjustment
AQ - Partial quantity adjusted
UA - No adjustment made
CU - Contra party unavailable to seek adjustment
FD - Firm Floor Broker executed order
FI - Executed under Firm instructions
FQ - Flash quoting
IN - Away market unavailable to trade
NF - NBBO fade, sent order
NU - Away market refuses to trade or fade
FM - Fast market away
ER - Erroneous report
E - Shut off error
TB - Trade busted
SP - CBOE system problems
LB - NBBO locked with a CBOE customer limit book order
O - Other
PQ - Post trade quote
SL - Single listed security

7.5.5. TFL Alerts Data Print

During the trading session, the TFL user needs the capability to print a particular TFL alert in a screen image print or in a formatted report.

7.5.6. Passing of Alerts Data for Offline Processing

Offline regulatory processing for BestEx and COATS (Consolidated Options Audit Trail System) requires that the data provided to the single alert display be provided to the CDB. See the alert display section for details. These data includes the following.

- Subject order data

- Trade data (for tradethroughs)
- For all customer orders the NBBO Quote data (including market indicators) is required to be recorded at two points in time:
  1. At the time of receipt of the order
  2. At the time of execution of the order
- In addition, for customer orders that are marketable against the CBOE Quote at point of entry the CBOE Quote data is required to be recorded at two points in time:
  1. At the time of receipt of the order
  2. At the time of execution of the order
- In addition, for customer orders that go through exception handling the following data is required also.

1. For a buy order the Highest Offer for both the CBOE Quote and the NBBO Quote within the time window.
2. For a sell order the Lowest Bid for both the CBOE Quote and the NBBO Quote within the time window.

8. Interfaces to Other Systems

8.1. Data Warehouse

CBOEdirect will replicate the data on tradethroughs and non-execution, including the order data, trade data, NBBO quote, and CBOE quote information for acquisition by the Consolidated DataBase and storage in the Data Warehouse.

9. Performance Requirements

System Performance will be monitored throughout the life cycle of this project to ensure acceptable throughput.

10. Operational Setup and Control

No special procedures are required.

11. Backup and Recovery Requirements

Current CBOEdirect backup and recovery procedures will be followed.

12. Fallback Requirements

None

13. Appendix

13.1. Possible Outcomes for An NBBO Agent Order

The response from the NBBO market may be a ‘cancel’, or an execution, complete or partial, at the NBBO price, or no response.

- If the NBBO market responds with a ‘cancel’, e.g., the away market is no longer NBBO, the NBBO Agent accesses the held order in CBOEdirect and fills it at an appropriate price.

- If the NBBO market fills his order for a certain size, the Agent fills the original customer order at the NBBO price and for the same size.

- The NBBO market may not respond at all --- it does not cancel the order, nor fill the order fully, nor adjust its quote to a price inferior to the reference price. If an away market quote is at the CBOE BBO, the Agent then fills the order at the CBOE BBO. If an away market quote is not at the CBOE BBO, the Agent re-sends the original customer order through the routing edit logic without NBBO checks. The customer would then be filled at the CBOE BBO.