Settlement Process for SPIKES™ Derivatives

This document outlines the procedure used for the final settlement calculation for SPIKES™ derivatives at expiration. The final settlement value is calculated from actual opening prices of SPY options on MIAX Options through the SPIKES™ Special Settlement Auction and makes use of a new Special Settlement Imbalance Process (SSIP).

MIAX's fully electronic and transparent Opening Process functionality, accessible to all Members of the Exchange for participation, results in a robust Opening Process that presents arbitrage opportunities across multiple exchange venues to drive prices into line and reach equilibrium.

Settlement Value Calculation for SPIKES™ Derivatives Overview

SPIKES™ options and futures are based on the SPIKES™ Volatility Index, a measure of 30-day expected volatility of the SPY ETF. The final settlement value for SPIKES™ options and futures is obtained via a SPIKES™ Special Settlement Auction using opening prices on MIAX Options of constituent SPY options that expire 30 days after the relevant SPIKES™ expiration date. These options are the Settlement Options. For instance, the final settlement value for SPIKES™ derivatives on November 21, 2018 will be derived using SPY options that expire 30 days later on December 21, 2018. If there is an Exchange holiday, the final settlement value shall be calculated on the preceding business day.

The opening prices for the SPY options used to calculate the SPIKES™ settlement value are determined through an automated auction mechanism on MIAX Options that matches locked or crossed buy and sell orders and quotes on the electronic order book at the opening of trading. This auction mechanism utilizes the SSIP, and the trade matching algorithm prioritizes price, then is pro-rata in the case of multiple participants' orders or quotes at the opening price.

Opening Mechanism for SPY Options

MIAX's existing Opening Process runs to completion and precedes the engagement of the new SSIP. The existing Opening Process starts when SPY opens, after 9:30am Eastern Time. The SSIP accounts for situations where there remains an order imbalance that must be filled at the opening price after the existing Opening Process. When there is an imbalance, the Exchange will broadcast a System Imbalance Message to subscribers of the Exchange's data feeds and initiate an imbalance timer. Two data feeds are relevant for SPIKES™ Settlement Auction traders:

1. MIAX Administrative Information Subscriber Feed (AIS) – Includes imbalance messages beginning at 9:15 am ET. It is available to all, and updates every 5 seconds until 9:30 am. Once SPY opens, the imbalance messages are updated in real time.

2. MIAX Order Feed (MOR) – Includes all orders on the book beginning at 7:30 am ET.

While the Exchange is conducting its Opening Process, all the other option exchanges will also be conducting their opening process for SPY options. As the Exchange works through its process to resolve imbalances under the existing Opening Process and the SSIP, other Exchanges will be open and will serve as real-time cross-reference prices for the relevant SPY options, enabling market participants to send orders to the Exchange if there are pricing anomalies for these SPY options across venues.

The longer it takes the Exchange to work through the imbalance, the greater the likelihood that other exchanges will have opened their SPY options market and the natural pressures of a competitive market will help to eliminate pricing anomalies and aid in satisfying the imbalance on the Exchange. Further, the Exchange's imbalance process is transparent, as every subscriber to the Exchange's data feeds receives the imbalance messages, and every Member of the Exchange can participate in the imbalance process.

Standard Opening Process

If there are quotes or orders that lock or cross each other, the MIAX Options System (System) will calculate an Expanded Quote Range (EQR, see Appendix), which represents the limits of the range in which transactions may occur during the Opening Process. The EQR is recalculated any time a route timer or Imbalance Timer expires. The System uses the EQR to determine the highest and lowest price of the opening price range.

To calculate the opening price, the System takes into consideration all valid Exchange quotes and orders, together with other exchanges' markets for the option, and identifies the price at which the maximum number of contracts can trade. If that price is at or within the EQR and leaves no imbalance, the Exchange will open at that price, executing marketable trading interest as long as the opening price includes only Exchange interest. If the calculated opening price included interest other than solely Exchange interest, the System will broadcast a system imbalance message and initiate a route timer for routable Customer orders. If, during the route timer, interest is received by the System which would allow all interest to trade on the System (i.e. there is no longer an imbalance) at the opening price without trading at a price inferior to other markets, the System will trade and the route timer will end.

If all marketable interest cannot be completely executed at or within the EQR without trading at a price inferior to the ABBO, or cannot trade at or within the quality opening market range in the absence of a valid width NBBO, the System will automatically institute an imbalance process. The System will broadcast a system imbalance message and begin an Imbalance Timer. Market Makers may enter Opening Only (OPG) eQuotes, Auction or Cancel (AOC) eQuotes, Standard quotes, Opening Orders (OPG Orders), AOC Orders and limit orders during the Imbalance Timer. Other Exchange Members may enter OPG Orders, AOC Orders and other order types. At the conclusion of the timer, a route timer may be initiated if required. The imbalance process may be repeated up to three times. Eligible liquidity that would not fully trade that is priced more aggressively than the Opening price is considered to be "must fill" liquidity. If at any time during the imbalance process if all must fill liquidity can trade, open. After the third imbalance process in the standard opening process, open and cancel all other interest except for that in the Settlement Options. This interest is subject to the SSIP, as discussed on the following page.

The Special Settlement Imbalance Process (SSIP)

On SPIKES™ expiration, a revised process is used. In the SPIKES™ Special Settlement Auction, in addition to any order types that may be regularly accepted by the Exchange, the Exchange will also accept Settlement Auction Only orders (SAO Orders) and Settlement Auction Only eQuotes ('SAO eQuotes').

Strategy Orders

All orders for participation in the SPIKES™ Special Settlement Auction that are related to positions in, or a trading strategy involving SPIKES™ Index options ('SPIKES™ strategy orders'):

• are only on SPIKES™ settlement days and only in the SPY expiration used for SPIKES™ settlement.

• must be received prior to the applicable SPIKES™ strategy order cut-off time (9:20 a.m. Eastern) for the constituent option series, as determined by the Exchange; and

• may not be cancelled or modified after the applicable SPIKES™ strategy order cut-off time, unless the SPIKES™ strategy order is not executed in the SPIKES™ Special Settlement Auction and is automatically cancelled.

The SPIKES™ strategy order cut-off time exists because trades to liquidate hedges can contribute to an order imbalance during the SPIKES™ Special Settlement Auction in SPY option series on expiration dates. As a result of having a SPIKES™ strategy order cut-off time in place, the Exchange has created a defined window to encourage participation in the SPIKES™ Special Settlement Auction among market participants who may wish to place off-setting orders against imbalances to which SPIKES™ strategy orders may have contributed. Additionally, by precluding the modification or cancellation of SPIKES™ strategy orders from occurring after the cut-off time, the Exchange is ensuring that the order book reflects bona-fide interest for execution. This is a feature designed to prevent manipulation of the final settlement price.

If, after the standard opening process and the three iterations of its imbalance process have been run, a must fill imbalance still exists, the SSIP is initiated. The SSIP is an iterative process that is designed to determine a price at which all must fill imbalance interest can be satisfied.

To begin the SSIP, the System will broadcast a system imbalance message to all subscribers of the Exchange's AIS data feed and begin an SSIP Imbalance Timer, the duration of which is to be determined by the Exchange, not to exceed ten seconds, and communicated via Regulatory Circular. During the SSIP Imbalance Timer, the System accepts all quote and order types supported during the standard Opening Process.

Next, the System will evaluate the must fill imbalance and adjust the EQR by a defined amount (as previously determined by the Exchange and communicated via Regulatory Circular). At each iteration of the SSIP, the allowable EQR will be increased 0.5 times the EQR value. The SSIP will be repeated until a price is reached at which there is no remaining must fill imbalance.

Once there is no remaining must fill imbalance, open. Unfilled SAOs, AOC Orders, AOC eQuotes, OPG Orders, and OPG eQuotes submitted into the SPIKES™ Special Settlement Auction are cancelled. Any unfilled day limit orders and GTC orders that are priced at or inferior to the Opening Price are placed on the Book and managed by the System.

An example of a SPIKES™ Special Settlement Auction (which utilizes the Exchange's standard, existing Opening Process, as modified by the SSIP), for a constituent option is provided to illustrate the process.

Example

SPY Mar 280 Call – constituent option

The Exchange interest for the constituent option is as follows:

MIAX Participant	Bid Size	Bid Price	Ask Price	Ask Size
PLMM	100	1.01	1.10	100
MM1	50	1.02	1.10	50

The Exchange receives an SAO Order to purchase 500 SPY March 280 contracts at the market price. Accordingly, there are 150 contracts offered at $1.10 and a market order to buy 500 contracts. This results in the following:

Imbalance Quantity	350
Must Fill Imbalance Quantity	350
Matched Quantity	150
Expected Opening Price	1.10

The Exchange's standard Opening Process is used, and because an imbalance exists, the Exchange's Standard Opening Imbalance Process commences. The EQR is expanded by the EQR value of $0.10, becoming $0.92 x $1.20.

After three iterations of the Exchange's Standard Opening Imbalance Process, if the must-fill imbalance quantity has not been satisfied, the new SSIP will be employed. (For purposes of this example, assume that all such three iterations have completed and the must fill imbalance quantity still has not been satisfied.)

The SSIP will begin by using an EQR expanded by 1.0 times the EQR value ($0.10). Therefore, the EQR for the first iteration of SSIP is $0.92 x $1.20. Since no responses have yet been received, a system imbalance message is broadcast to all subscribers of the Exchange's data feeds and the SSIP auction period is started: The following responses are received:

• @ 20 milliseconds BD1 response, AOC Order to sell 200 @ $1.20 arrives

At the end of the SSIP auction period, the System evaluates the orders and responses to determine if the must-fill imbalance quantity can be satisfied at or within the EQR. The Exchange market for the constituent option is as follows:

MIAX Participant	Bid Size	Bid Price	Ask Price	Ask Size
PLMM	100	1.01	1.10	100
MM1	50	1.02	1.10	50
BD1			1.20	200
SAO Order	500	Market		

The offer of 150 contracts at $1.10 remains and there are now an additional 200 contracts offered at $1.20. This results in the following:

Imbalance Quantity	150
Must Fill Imbalance Quantity	150
Matched Quantity	350
Expected Opening Price	1.20

A must fill imbalance quantity of 150 contracts priced through the EQR remains, as there are a total of 350 contracts offered and a buy order for 500 at the market. Because an imbalance still exists, a second iteration of the SSIP will begin by expanding both sides of the EQR opposite the must fill imbalance quantity quote range, from the original EQR value to the quote range plus 1.5 times the original EQR value ($0.10), becoming $1.25 ($1.10 + $0.15).

A new system imbalance message is broadcast to all subscribers of the Exchange's data feeds and a second SSIP auction period is started. The following responses are received:

• @ 500 milliseconds MM2 response, AOC eQuote to sell 1000 @ $1.23 arrives

• @ 700 milliseconds MM3 response, AOC eQuote to sell 500 @ $1.23 arrives

 At the end of the SSIP auction period, the System evaluates the orders and responses to see if the must-fill imbalance quantity can be satisfied at or within the EQR. The Exchange market for the constituent option is as follows:

MIAX Participant	Bid Size	Bid Price	Ask Price	Ask Size
PLMM	100	1.01	1.10	100
MM1	50	1.02	1.10	50
BD1			1.20	200
MM2			1.23	1000
SAO	500	Market		
MM3			1.23	500

The offer of 150 contracts at $1.10 remains, as well as the 200 contracts offered at $1.20. In addition, there are now offers to sell 1,500 contracts at $1.23. In this case, the entire must fill imbalance quantity can be satisfied at $1.23. Open at $1.23. The SAO Order to purchase 500 contracts at the market price is filled in the following fashion:

• The SAO Order buys 100 from the PLMM @ $1.23 (must fill)

• The SAO Order buys 50 from MM1 @ $1.23 (must fill)

• The SAO Order buys 200 from BD1 @ $1.23 (must fill)

• The SAO Order buys 100 from MM2 @ $1.23 (pro rata)

• The SAO Order buys 50 from MM3 @ $1.23 (pro rata)

Settlement Calculation for SPIKES™ Derivatives at Expiration

At the conclusion of the SPIKES™ Special Settlement Auction, including the existing Opening Process and the SSIP, MIAX Options arrives at a single-price open, called the Settlement Reference Price (SRP), for each constituent SPY series at the price that allows the most contracts for that series to match within certain price boundaries, and leaving no "must fill" imbalance.

For each constituent SPY series the SRP is determined as follows:

(a) If MIAX Options opens with a trade, the SRP is the trade price

(b) If MIAX Options opens without a trade (no locking or crossing interest):

  (i) Use all liquidity (all valid quotes and orders, including OPG, AOC and SAO orders and eQuotes) in determining the initial Settlement Opening bid and ask

  (ii) Each relevant SPY option with a Settlement Opening bid ask spread equal to or less than the Settlement Reference Price Opening Width (SRPOW, see Appendix II), use the exact midpoint (i.e. no rounding) as the SRP

  (iii) If a SPY option's Settlement Opening bid ask spread is greater than the SRPOW, open the series with the wide market and start a Settlement Reference Price Timer (SRPT):

   1) The timer ends and the SRP is set accordingly, if there is a trade on MIAX Options or the option's bid ask spread on MIAX Options narrows to the SRPOW

   2) If the SRPT expires without establishing an SRP, compare the MIAX bid and ask to the Cash Reference Price (CRP) used for the SPIKES™ cash index calculation (which uses data from ALL exchanges that trade SPY options) and determine the SRP accordingly:

    a) If the CRP is inside the MIAX bid ask, use it as the SRP

    b) If the CRP is higher than the MIAX ask, use MIAX ask as the SRP

    c) If the CRP is lower than the MIAX bid, use MIAX bid as the SRP

    d) If the CRP is zero, and all adjacent options have a non-zero SRP, exclude the option from the calculation

    e) If the CRP is zero, and any adjacent options have a SRP of zero:

     i) Use the midpoint of the NBBO if the NBBO spread width is at or within 2 times the SRPOW

     ii) If at any point during the process:

      a) There is a trade on MIAX, use the trade price

      b) The MIAX bid ask spread narrows to be at or within the SRPOW, use the midpoint

      c) The NBBO bid ask spread narrows to be at or within 2 times the SRPOW, use the midpoint

      d) A CRP is established, use the CRP

(c) If the SPY goes into a trading halt during the SPIKES™ settlement process:

  (i) Keep the SRP for all SPY options which have already opened and have an SRP assigned

  (ii) For those that have not yet opened or established a SRP, use the SRP at the opening process described above once the series re-opens on MIAX

(d) Use each SPY option's SRP for the SPIKES™ settlement value calculation via the SPIKES™ index formula.

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[1] Deep in-the-money (ITM) Calls and Puts are not subject to the SRPOW parameters.

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SPIKES™ Cash Index Dissemination on All Days Including Expiration

Symbol: SPIKE

Every trading day for SPIKES™ derivatives, MIAX Options will start disseminating the SPIKES™ spot value as normal, as price data from ALL exchanges trading SPY options come in through OPRA.

SPIKES™ Settlement Value Dissemination

Symbol: SPKCS

On expiration days for SPIKES™ derivatives, MIAX Options will disseminate the SPIKES™ settlement value once all Settlement Options are open and have an SRP.

APPENDIX I. Expanded Quote Range (EQR) Table[*]

Bid Price	EQR
$0.00 - $1.00	$0.05
$1.01 - $3.00	$0.10
$3.01 - $5.00	$0.20
$5.01 - $10.00	$0.30
$10.01 - $20.00	$0.50
$20.01 - $40.00	$0.70
$40.01 or greater	$0.90

APPENDIX II. Settlement Reference Price Opening Width (SRPOW) Table[*]

Bid Price	Maximum Spread: Near ITM, ATM and OTM Options[**]
Less than $0.25	$0.06
$0.25 to less than $0.50	$0.10
$0.50 to less than $1.00	$0.15
$1.00 to less than $2.00	$0.20
$2.00 to less than $4.00	$0.25
$4.00 to less than $10.00	$0.40
$10.00 or greater	$0.50

[*] These tables show current values as at Oct 2018 and are subject to change.
[**] At-the-Money (ATM), In-the-Money (ITM), Out-of-the-Money (OTM).

Disclaimer

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