



Cost Survey Report on CAT Reporting of Options Quotes by Market Makers

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1 Executive Summary

The results of the cost estimate survey conducted by the industry associations show a large direct cost to be borne by the options market makers for Consolidated Audit Trail (CAT) reporting for quote reporting. Over a five year period, the eighteen survey participants would spend \$118.0M to meet the current Rule 613¹ requirement of market maker reporting options quotes to the CAT and it is estimated that between \$307.6M to \$382.0M is required for all options market makers to meet these obligations. Options market makers are already undergoing cost and consolidation pressures, especially among smaller options market makers.

The survey demonstrates that the costs disproportionately impact the smaller market maker – the costs required to support this regulation for the smaller market maker is 33% of the cost to the primary market maker, yet the average volume for the smaller market maker is 6% to 7% of the primary market maker. The disproportionate cost of complying with this regulation is likely to have a negative impact on competition and the ability of new and existing market makers to profitably participate in this segment of the industry. Indirect costs, such as impact on competition and opportunity costs, were not sized as part of this survey, but should be considered when evaluating the impact of this Rule 613 requirement on the options market maker.

Another cost not included in this direct cost estimate is the cost required to implement this functionality within the CAT processor. The CAT RFP estimated that market maker reporting of options quotes would represent 30% of the total volume of CAT reports to be captured by the CAT.² The infrastructure scaling required for this extra capacity across processors, storage, network bandwidth, systems performance, operations management in the production, disaster recovery, development and test CAT systems represents a significant delta cost to the CAT Processor that the industry would need to fund.

Options market maker reporting of options quotes would be duplicative of exchange reporting to the CAT for which the exchange's book is viewed by the market as the official source of options quotes. The only additional data that might be provided by the options market maker reporting options quotes to CAT is the market maker's original sent time of the quote message. The options market maker community does not understand the regulatory value of the sent time, and is concerned with the reconciliation challenges in matching market makers sent timestamp against exchange receipt timestamps.

However, rather than requiring options market makers to submit options quotes in order to obtain a single unique data element, an alternate solution was proposed. A cost estimate for this alternate proposal of adding the quote sent timestamp to the current quote message sent to the exchange was also requested as part of this survey. This alternate proposal, while less costly than market maker reporting of options quotes, represents additional cost to the options market maker community (\$8.5M

¹ (Securities and Exchange Commission 17 CFR Parts 242 (Release No. 34-67457; File No. S7-11-10) RIN 3235-AK51 Consolidated Audit Trail

² Sections 2.5.1 Data Types and Sources and 2.5.2 Capacity Performance Requirements, Consolidated Audit Trail, National Market System Plan, Request for Proposal, February 26, 2013, V 1.0

for the survey participants and estimated between \$36.9M to \$76.8M for all options market makers). Again, the burden to the smaller options market maker (mean = \$.8M) was significantly higher than the primary market maker (mean = \$.4M) for adding timestamps, disproportionately impacting the smaller market maker community. The cost of adding quote sent time across all survey participants was between 13% and 44% of submitting options market maker quotes.

Before requiring quote sent timestamp, the industry associations request that the regulatory bodies clearly articulate the value of including this data element for the purposes of market surveillance in light of the costs to the industry.

2 Objective

Rule 613 requires that both options market makers and exchanges report options quotes³ to the CAT. The Financial Information Forum (FIF)⁴, the Securities Industry and Financial Markets Association (“SIFMA”)⁵ and Security Traders Association (“STA”)⁶ (collectively, “the industry associations”) appreciate and support the provision of the rule⁷ to collect option quote information for purposes of market surveillance and reconstruction. However, the industry associations believe that the data requested is best provided exclusively by the exchanges and that requiring options market makers to also submit quotes would result in considerable implementation and ongoing costs to both options market makers and the CAT processor⁸ without corresponding benefits.

³ SEC Rule 613 (c)(5) - “[t]he national market system plan submitted pursuant to this section shall require each national securities exchange and its members to record and report to the central repository the information required by [Rule 613(c)(7)] for each NMS security registered or listed for trading on such exchange or admitted to unlisted trading privileges on such exchange...” .

⁴ FIF (www.fif.com) was formed in 1996 to provide a centralized source of information on the implementation issues that impact the securities industry across the order lifecycle. Our participants include trading and back office service bureaus, broker-dealers, market data vendors and exchanges. Through topic-oriented working groups, FIF participants focus on critical issues and productive solutions to technology developments, regulatory initiatives, and other industry changes.

⁵ SIFMA brings together the shared interests of hundreds of securities firms, banks and asset managers. SIFMA’s mission is to support a strong financial industry, investor opportunity, capital formation, job creation and economic growth, while building trust and confidence in the financial markets. SIFMA, with offices in New York and Washington, D.C., is the U.S. regional member of the Global Financial Markets Association. For more information, visit www.sifma.org.

⁶ STA is comprised of 24 local affiliates covering the entire US and Canada. The STA national board of governors is comprised of past presidents and industry specific leaders. Their membership represents over 4,000 individuals from varying business models – buy-side, sell-side, hedge funds, exchange traders and market makers- dealing in equity and derivative trading.

⁷ SEC Rule 613 (e)(7)-(e)(7.1)–“The national market system plan submitted pursuant to this section shall require the central repository to collect and retain on a current and continuing basis and in a format compatible with the information consolidated and stored pursuant to paragraph (c)(7) of this section: (i) Information, including the size and quote condition, on the national best bid and national best offer for each NMS security”.

⁸ Jan. 18 FIF document, March SIFMA White Paper, FIF meeting in April 18 with SEC, SIFMA meeting in June 27 with SEC

In discussions with the CAT Development Advisory Group (DAG) on this concern in May 2013, the SROs encouraged the industry associations to determine the cost to the industry in support of an exemptive relief request. As a result, the industry associations jointly sponsored a cost survey of the options market maker community with the purpose of understanding the cost of meeting the options market maker quote reporting requirement.

In evaluating the costs of this requirement, the industry associations also explored the cost of adding a quote sent timestamp to exchange protocols to allow for exchange reporting of this attribute that is not currently available to exchanges. It is important to recognize that the options market relies only on the information present on the books of the exchanges so this attribute may not be relevant for market reconstruction purposes. Additionally, clock synch issues may result in situations where the exchange receipt time will be before the market maker sent timestamp. Even with lower costs, the benefits of this approach must also be evaluated before moving forward with this proposal.

Given the significant concerns identified with both approaches, this report seeks to put costs in context by also discussing the benefits of the Rule 613 requirement and proposed alternative.

3 Review of Costs Associated with Options Market Maker Reporting

This survey was designed to capture the direct costs of options market makers to fulfill the CAT reporting requirements for options quotes. These direct cost estimates are concrete evidence of the impact to the options market maker to support these reporting requirements. However, there are other costs not captured in this survey that should be considered when evaluating the cost/benefit analysis of this function and the overall burden to the industry. These indirect costs are discussed in Section 3.3.

3.1 Direct Costs

The direct costs captured in this survey include the hardware, software and maintenance costs associated with implementing and maintaining the CAT reporting functionality. The specific categories of cost as itemized in the survey are shown in Appendices 1 and 3. Note that firms could specify other costs in addition to the ones listed in the survey.

3.2 Variation in Direct Costs

The survey results represented a wide variance of costs in all categories. The variations are especially seen in reviewing the elements of cost in Sections 6.2 and 7.2. Follow-up interviews were conducted with 33% of the participants to better understand the estimates. The insight learned from these interviews is included in this report to further explain the cost estimates. The variations seen in the cost estimates are due to a number of factors cited by survey respondents:

- The designs envisioned to implement CAT reporting mostly reflects the design approaches in place today within the options market maker community. **This varies considerably by cost and performance efficiency, robustness, compliance focus.** However, all agreed that adding regulatory reporting requirements to their infrastructure meant added investments to improve their systems' robustness.

- The lack of specifications for the broker-dealer interface to the CAT Processor, and specifically the interface and requirements for implementing CAT reporting of options quotes by market makers made it difficult to determine the level of effort required.
- Because the CAT reporting infrastructure and interfaces are not known at this time, only very general assumptions could be provided for the cost estimate. This resulted in variations in survey results, depending on interpretation of assumptions and level of risk imbedded in the estimate (conservative to aggressive).
- The maturity of the cost estimation process in place across the industry and the various methodologies used in cost estimating ranging from scaling based on OATS to scaling based on project complexity.

3.3 Indirect Costs

The focus of the cost estimate survey was to project the direct costs that would be borne by the options market makers in implementing and maintaining the required CAT reporting of options quotes. Other costs not included in the survey are discussed here. These costs either could not be quantified (e.g., the costs to the CAT Processor to support options quote reporting) or would be more subjective in deriving (e.g., opportunity costs). Only direct costs received from the options market maker firms were used in this survey report. This provides the most conservative view of the industry cost to support the Rule 613 requirement for CAT reporting of options quotes.

The following additional costs are not included in the survey or survey results but should be considered in assessing the complete financial burden that this regulatory requirement will impose on industry participants.

3.3.1 CAT Processor

Market maker options quotes are the data type with the single largest projected volume of all data types for which CAT reporting is required. Capacity planning for CAT reporting is shown in the table below, with an expected 25% annual growth.⁹ It is important to recognize that the CAT processor will need to take into account peak volumes in assessing its storage costs.

Data Type	Data Source	Product	Description	Approximate Average Daily Record Count	Approximate Peak Daily Record Count
Market Maker Quotes	BDs	Options	Market maker quotes submitted to exchanges	18,000,000,000	44,000,000,000
Market Maker Quotes	SROs	Options	Market maker quote sides received and/or generated by an exchange	9,000,000,000	22,000,000,000

Based on the RFP for the CAT processor, Market Maker reporting of options quotes represents more than 30% of the overall reporting capacity to be handled by the CAT Processor. Accommodating options

⁹ Sections 2.5.1 Data Types and Sources and 2.5.2 Capacity Performance Requirements, Consolidated Audit Trail, National Market System Plan, Request for Proposal, February 26, 2013, V 1.0

market maker quote messages will require servers, storage capacity, network bandwidth, systems software for configuring/managing these systems, as well as maintenance staff. These system costs must be replicated, in varying degrees, in all related CAT systems – development, test, staging, production and DR systems. The incremental cost associated with handling options quotes from market makers represents a significant cost for the CAT Processor.

The CAT Processor would also need to design, implement, test and maintain the software necessary to comply with the Consolidated Audit Trail quote reporting requirements. Additional cost would be incurred for the development of a separate protocol suitable for reporting options quotes and the systems to implement this protocol. It is important to recognize that exchange options quoting protocols are dramatically different from order routing protocols.¹⁰ In addition, reconciliation tools for matching the Market Maker and exchange CAT reporting of the Market Maker options quotes would need to have subtle and complex algorithms. Some of the challenges are time-skews and clock drifts that occur between two systems, in-flight race conditions between new quotes and withdrawal requests, data transmission delays, interruptions in data transmissions due to transmission or system errors, lost messages, unexpected congestion in data traffic, and constrained bandwidth in communication channels.

These costs for the CAT Processor – scaling of its capacity by 30% and unique development to accommodate options quote reporting requirements - would need to be borne by the options market makers and exchanges, or apportioned across all CAT Reporters. In either case, it represents a significant additional cost to the industry with little corresponding benefit.

3.3.2 Opportunity Costs

The opportunity costs forgone by each firm due to the necessary investments to implement CAT reporting of option quotes are not included in these survey results. However, firms participating in the study did raise concerns that meeting CAT requirements would interfere with their ability to expend resources on innovation and customer experience improvements.

3.3.3 Impact on Competition

In reviewing the survey results, the industry associations are concerned with the impact of the options market maker quote requirement on new market entrants who may be discouraged from entering the options market making space. This proves to be especially true with options quote reporting because (as described in Section 4.2) there is a high fixed cost to implementing CAT reporting of options quote, whether the firm has an average daily quote volume of 10,000 or 1 billion quotes. In addition, there is an annual cost of maintaining and supporting the CAT reporting of options quotes. These costs increase the barriers to entry, and make it more difficult to gain a foothold in this very competitive marketplace. Even the second cost estimate of adding the sent timestamp to the quote message resulted in higher per firm costs for the smaller option market maker.

¹⁰ Quoting protocols are streaming and stateless. A single message may contain multiple instruments and multiple types of requests. Withdrawals are not explicitly linked to a specific quote message. In contrast, Order Routing protocols are transaction-based and stateful. A message contains a single instrument and single request. Cancels are explicitly linked to an order message.

4 Survey Methodology

As stated earlier, this survey was developed upon request of the SROs in the CAT Development Advisory Group to provide conclusive data regarding the options market maker costs associated with implementing market maker CAT reporting of options quotes. In addition, the SROs requested that the survey also solicit cost information on an alternate proposal, in place of market maker CAT reporting of options quote, which would require the options market maker to add the sent timestamp to the quote message transmitted to the exchanges.

The survey questions (see Appendix 1) and survey assumptions (Appendices 2 and 3) were developed in partnership with the industry associations and their members as well as reviewed by the SROs. Due to the lack of CAT interface specifications and for consistency across the cost estimates, it was important to provide assumptions and guidelines to the firms for use in this cost estimation process. The cost estimate survey was publicized and distributed through the industry associations, and posted on-line for access by any industry firm. Additional outreach was attempted to specific known market makers to request their participation in the survey. The surveys were submitted with attribution, to ensure uniqueness and for follow-up questions, but all results have been summarized to ensure anonymity.

Because of the varied results received through the survey, follow-up interviews were held with a third of the participants to better understand the rationale behind their cost estimates.

According to the OCC (Options Clearing Corporation), there are 238 entities identified as options market makers, some of which may fall under the same parent firm. For purposes of this cost study, it was conservatively assumed that the total number of options market maker companies was 100. It was also assumed that there are 20 primary options market makers, representing 20% of the total number of options market maker firms.

Eighteen firms participated in the survey, representing 18% of the options market maker community. Fourteen of the eighteen firms participating in the survey were identified as primary market makers, which represents 70% of the total number of primary market makers. The actual cost estimate totals are one dimension of the cost picture. These numbers are shared in Sections 4 and 6, as “Actual Firm Cost Estimates” and represent the “minimum” costs to the industry, because they represent the actual (estimated) costs for the 18 firms included in the survey.

To project industry direct costs, the survey results were divided into two categories: Primary Market Makers and “Other” Market Makers. The rationale for this division was three-fold:

1. The representation of primary market makers was exceptionally high, giving a high degree in confidence in using these survey results to predict the costs for the primary market maker community.
2. Generally, the primary market makers represented firms with a large presence in the options market making community and their infrastructure and cost structures may not be representative of the whole community.

3. Scaling within these two groups of market makers used the conservative assumption that the characteristics of each group, and associated cost structures, were different so the averages of costs should only be applied within each group.

This division allowed scaling of two categories based on the estimated industry population of these groups - twenty primary market makers; eighty non-primary (or “Other”) market makers. Although this may understate the total number of options market makers, a conservative approach was used throughout the survey process. These second set of survey results, shown as “Projected Industry Cost Estimates” are also provided in Sections 4 and 6.

Significant variances were seen in the industry results (See Section 4.0 for discussion). To account for these variances in providing an industry cost estimate, a mean and median for each industry cost is shown. All costs were aggregated to show a five year cost due to the large on-going costs that were estimated by many firms. This further leveled the different methodologies used by firms in their cost estimating procedures in how they divided costs between one-time and on-going costs. In addition, some firms included the first year operating costs in the one-time costs, meaning that the annual costs would be applied for four years to achieve a five year cost estimate. Other firms provided only one-time costs and their annual cost estimates needed to be applied against a five year horizon. This variation was included in the calculations. Presenting a multi-year view normalizes these different methodologies.

For cost estimate #1, some firms chose to only provide summary cost estimates for each major element of costs (e.g., one estimate for all hardware elements) and provided no detail on how those cost estimates were spread across the various sub-elements. Therefore, only summary numbers of the hardware, software and maintenance cost elements are shown in this report. However, information gleaned from firms which did provide this detail, along with rationale provided in interviews, are included in these survey results.

For cost estimate #2, some firms (3) chose to only provide one summary number with no details at all on how the costs were distributed across the major cost elements (hardware, software, maintenance, other). In order to provide detailed break-downs on costs for cost estimate #2, the three firms’ summary numbers were distributed across the major cost elements in the same percentages as calculated from the remaining firms’ cost estimates.

5 Survey Participation

Eighteen firms participated in Cost Estimate #1 (Market maker CAT reporting of options quotes) of the survey. This represents 18% of all (estimated) options market makers. Of the eighteen firms which participated in cost estimate #1, fourteen were primary market makers, representing 70% of the (estimated) primary market makers. The four “other” firms which participated in the survey were some of the smaller options market makers. Although there was outreach to the smaller options market maker community to attempt expansion of survey respondents, the participation represents 5% of this community. Some explanations of the level of interest in the survey from the smaller firms include:

- Their focus is more on short-term projects that affect them (over the next year or two). CAT implementation is not required from the smaller firms for another four to five years.
- These firms are tightly staffed, with little spare resource available to contribute to cost estimate surveys.
- The importance of the Consolidated Audit Trail and specifically, the impact of the CAT on their processing might not have effectively reached this audience yet.

To provide insight into the participating firms’ size in the options market making business, the following statistics were gathered in the survey:

	<i>Primary Market Makers</i>	<i>“Other” Market Makers</i>
Average No. of Issues¹¹	8,164	489
Average quotes/day	519.8M	38.6M

Sixteen market maker firms participated in Cost Estimate #2 (adding timestamp to exchange quote message) - two primary market maker firms provided cost estimates only for Cost Estimate #1. Thus, the total number of participants in this second survey was twelve primary market makers and four “other” market makers. Also, three firms only provided a total estimate of their costs for adding timestamp, with no details of how those costs were divided among the major cost element groups. However, these actual summary totals are still shown in this report, because it provides insight into the expenditures required for this functionality. CAT Reporting of Options Quotes by Market Makers
This section provides a summary of the data captured in the survey, scaling of the participant’s cost estimates to provide a projected industry perspective of cost, and details on the distribution of costs across the major cost elements – hardware, software, and maintenance. Explanations and rationale for the data is also offered in this section.

5.1 Survey Results for CAT Reporting of Options Quotes by Market Makers

Following is a summary of the actual cost estimates provided by all eighteen firms participating in the options market maker survey.

Total 5 yr. Cost for MM Quote Reporting of 18 firms participating in Options MM Cost Estimate Survey	
Primary Market Makers (14 firms)	\$106,398,615
“Other” Market Makers (4 firms)	\$ 11,502,000
Total Costs for all reporting firms	\$117,900,615
Actual Total Cost for 18 participating firms - \$118.0M	

A conservative total projected cost to the industry over a five year period to implement and maintain CAT reporting of options quotes by market makers is within a range of \$307.6M to \$382.0M. Details behind this range are shown below.

¹¹ Defined as total number of issues over all exchanges for which the firm is a market maker. E.g., if the firm is a market maker for 12 issues on BATS and 10 issues on CBOE, the total number of issues would be 22.

	Primary Market Makers	“Other” Market Makers
Survey Mean	\$7,599,673	\$2,875,500
Survey Median	\$5,069,658	\$2,579,500
Projected Cost Range	\$101.4M - \$152.0M	\$206.4M – \$230.0M
Industry Estimate for MM CAT Reporting of Options Quote	\$307.6M to \$382.0M	

5.2 Cost Elements

Hardware represents the largest driver of cost, both as a one-time cost, and with annual expenditures over the five year period. As can be seen in the following tables, while the ratio of costs differ between primary and other market makers, hardware remains the largest expenditure for market maker CAT reporting of options quotes. The one-time costs of software and maintenance differ significantly, with software requiring significantly larger investments initially than maintenance. However, when viewed over a five year period, the costs are more equalized over these two cost elements, due to the increased annual maintenance expenditures for this function. Although the percentages differ between primary and other market makers, there is a similar pattern relationship for software and maintenance expenses across these two groups.

Using the survey information, the cost elements were scaled to provide an industry view of the range across these three categories of costs.

Primary Market Makers Cost Elements						
	Hardware		Software		Maintenance	
	Median	Mean	Median	Mean	Median	Mean
Survey one-time costs	\$308,000	\$706,543	\$195,000	\$651,829	\$ 1,500	\$163,071
Survey on-going costs	\$312,000	\$629,350	\$190,100	\$300,636	\$211,000	\$358,514
Industry Range one-time costs	\$6.2M - \$14.1M		\$3.9M - \$13.0M		\$.03M - \$3.3M	
Industry Range on-going costs	\$6.2M - \$12.6M		\$3.8M - \$6.0M		\$4.2M - \$7.2M	
Industry range total 5 yr. cost	\$38.3M - \$73.1M		\$28.3M - \$42.0M		\$21.4M - \$37.0M	
Cost Element % of Total Cost	48%		28%		24%	

“Other” Market Makers Cost Elements						
	Hardware		Software		Maintenance	
	Median	Mean	Median	Mean	Median	Mean
Survey one-time costs	\$582,500	\$561,500	\$ 95,000	\$186,250	\$ 44,400	\$ 53,450
Survey on-going costs	\$300,700	\$312,350	\$ 27,700	\$ 76,350	\$ 86,000	\$115,625
Industry Range one-time costs	\$44.9M - \$46.6M		\$7.6M - \$14.9M		\$3.6M - \$4.3M	
Industry Range on-going costs	\$24.1M - \$25.0M		\$2.2M - \$6.1M		\$6.9M - \$9.3M	
Industry range total 5 yr. cost	\$146.1M - \$147.3M		\$17.2M - \$40.1M		\$35.9M - \$42.7M	
Cost Element % of Total Cost	64%		17%		19%	

The following table shows the distribution of costs from the 18 participating firms across the three main cost elements – hardware, software and maintenance.

Total Cost of Major Elements for MM Quote Reporting of 18 firms participating in Options MM Cost Estimate Survey		
Cost Element	One-Time Costs	Annual On-going Costs
Hardware	\$12,137,600	\$10,060,303
Software	\$ 9,870,600	\$ 4,514,300
Maintenance	\$ 2,496,800	\$ 5,481,700
Total	\$24,505,000	\$20,056,303

5.2.1 Hardware and Software Cost Elements

Hardware being the largest single determinant of cost should be expected, given current options quote volume and the 25% growth assumption. Hardware was the largest single determinant of cost. The hardware expenses include: archiving/warehousing of the CAT reports (storage costs); processing costs to handle reporting to CAT (processors); co-location expenses because all firms surveyed had quote servers co-located at exchanges and infrastructure staff costs to manage this extra growth account for the bulk of the hardware costs.

Each firm’s infrastructure which handles options quote reporting to exchanges **varied**. Firms considered their **current infrastructure as the basis** for their design to implement the two solutions (MM CAT reporting of options quotes and adding timestamps to current quote messages sent to exchanges).

Following are two examples of the varied infrastructures described during the survey interviews:

- Low cost - one firm has an infrastructure today that archives all quote data and stores for multiple years, plus has current staff that can contain additional storage requirements for five year archiving of CAT reporting, with no additional processing capacity.
- High cost – no current archiving of quotes requiring a large investment of storage and infrastructure for managing the archive including staging of archive from on-line to offline storage and additional processing capacity needed for reporting.

Many firms generate and send quotes to the exchanges from their co-located servers, but then send the quote information to centralized servers for warehousing, auditing, etc. The **level of warehousing varies** greatly across the industry from none, to storage for a few days to a few years, and in some cases, including duplicative warehousing across multiple levels of storage devices.

The systems which generate quotes are often in co-location centers with exchanges. These market maker quoting systems are separate from firms’ main processing centers. Meeting the **fine grained clock synchronization** requirements associated with CAT reporting, requires the installation or upgrade of more robust clock management hardware and software including GPS devices, antennas, etc.

All firms interviewed cited the need to **add robustness** to their infrastructures to ensure guaranteed handling of CAT reporting of options quotes. Additional investment would be needed to achieve the level of high reliability for which firms believe is needed for regulatory reporting by their quote reporting systems.

Additionally, it is worth noting that firms used the 25% quote growth assumption even when they indicated that they believed the growth of their business might exceed that number.

5.2.2 Maintenance Cost Elements

Maintenance as the second largest driver of on-going costs is due to the expected operations and compliance staff required to monitor, maintain, and repair the CAT reports based on discrepancies reporting between options market makers and exchanges.

The understanding of the **responsibilities of regulatory reporting also varies** greatly within the options market maker community, depending on the firm's current reporting obligations to OATS. Generally, if a firm currently is required to perform OATS reporting today, they had a higher cost associated with the ongoing operations and compliance associated with CAT reporting.

Some firms articulated (and included) **more complete costs of infrastructure, IT and compliance staff**. This could be due to more formalized methodology for cost estimation, more mature business processes implemented within the firms, or more agile business processes resulting in less overhead costs.

6 Alternate Proposal – Adding Timestamp to Exchange Quote Message

As stated earlier, the SROs in the DAG requested that cost information also be captured in this survey on the alternate proposal of adding sent timestamp to the exchange quote message. If Market Maker's *timestamp of quote send time* was viewed as a critical data element needed to achieve regulatory goals, this data element could be added directly to the real-time quoting protocols. If every exchange quoting protocol were augmented with this data element, the regulatory goals might be achieved at a much lower, but still significant, cost to the industry.

All quotes generated by Market Makers are sent to an exchange for publication/dissemination. There is no intermediate system or processing between a Market Maker sending a quote and the receipt of the quote by the exchange, except for the necessary message transmission. The time difference between Market Maker quote sending time and exchange receiving time of quote is minimal, often accounting for only two to three milliseconds. Given expected clock drift across servers and firms, concerns have been raised that matching CAT report timestamps between sending market makers and receiving exchanges of option quote reports will be difficult. This concern may be one cause for the maintenance costs projected by the participating firms in the survey.

The cost estimate results are shown below.

6.1 Survey Results of Sent Timestamp added to Exchange Quote Message

The survey results for Cost Estimate #2 – sent timestamp added to exchange quote message – is provided in this section and Section 7.2. Following is a summary of the actual cost estimates provided by all sixteen firms participating in this cost estimate. The survey results were quite varied in all categories.

Total 5 yr. Cost for adding sent timestamp to exchange message of 16 firms participating in Options MM Cost Estimate Survey	
Primary Market Makers (12 firms)	\$5,133,000
“Other” Market Makers (4 firms)	\$3,413,600
Total Costs for all reporting firms	\$8,546,600
Actual Total Cost for 16 participating firms - \$8.5M	

A conservative total projected cost to the industry over a five year period to implement and maintain adding a sent timestamp by the options market makers to the existing exchange quote message is within the range of \$36.9M to 68.2M.

	Primary Market Makers	“Other” Market Makers
Survey Mean	\$427,750	\$853,000
Survey Median	\$65,500	\$444,800
Projected 5 yr. Cost Range	\$1.3M - \$8.6M	\$35.6 – 68.2M
Industry Estimate for adding timestamp to exchange quote message	\$36.9M to \$76.8M	

The mean and median of both categories of respondents (primary market makers and “other” market makers) for the timestamp cost estimate are shown above. The results produced surprising results. The overall costs, for both primary and other market makers for adding sent timestamp to the exchange quote message was, on average, higher than expected. The projected costs for options market makers are higher, per firm, for the smaller firms. Also, the costs are distributed differently for the primary market makers and other market makers. Some of the rationale for this outcome is:

- Due to the introduction of regulatory reporting, significant additional investment would be required to be added to infrastructures for robustness (recovery, guaranteed delivery, etc.)
- Additional logic and complexity were added to the solutions to ensure that current quote performance (e.g., latency) was not impacted.
- Capturing of timestamps at the required granularity and managing clock offsets to within CAT specified ranges. Quote servers are housed in co-location centers which add to the costs required to secure atomic clock synchronizations. This also includes on-going maintenance costs for this specialized hardware/software.
- Compliance monitoring, error correction and responding to regulatory inquiries were new staffing requirements for these firms.

Some of these factors are also present with the primary market maker estimates but were offset by low cost estimates by some firms within this group.

6.2 Cost Elements

The timestamp cost estimates captured the details on distribution of costs across the major cost elements – hardware, software, maintenance, and other (clock management hardware, software and maintenance). Note that 3 primary market maker firms only provided one total number, with no details of distribution of cost across the major cost elements, so that detailed data was supplied by 13 firms (9 primary market makers and 4 “other” market makers).

Primary Market Makers Cost Elements								
	Hardware		Software		Maintenance		Other	
	Median	Mean	Median	Mean	Median	Mean	Median	Mean
Survey one-time costs	0	\$17,889	\$10,000	\$30,778	0	\$67,667	0	0
Survey on-going costs	0	13,889	\$5,000	\$15,778	0	\$68,778	0	0
Industry Range one-time costs	\$0M - \$.3M		\$.2M - \$.6M		\$0M - \$1.4M		0	
Industry Range on-going costs	\$0M - \$.4M		\$.1M - \$.3M		\$0M - \$1.4M		0	
Industry range total 5 yr. cost	\$0M - \$1.3M		\$.8M - \$1.6M		\$.6M - \$5.7M		0	
% of Total Cost	15%		19%		66%		0%	

“Other” Market Makers Cost Elements								
	Hardware		Software		Maintenance		Other	
	Median	Mean	Median	Mean	Median	Mean	Median	Mean
Survey one-time costs	\$26,000	\$83,000	\$27,000	\$142,250	\$5,000	\$27,500	0	\$5,000
Survey on-going costs	\$18,950	\$29,475	\$10,200	\$67,600	\$22,500	\$30,000	0	\$21,438
Industry Range one-time costs	\$2.1M - \$6.6M		\$2.2M - \$11.4M		\$.4M - \$2.2M		\$0M - \$.4M	
Industry Range on-going costs	\$1.5M - \$2.4M		\$.8M - \$5.4M		\$1.8M - \$2.4M		\$0M - \$1.7M	
Industry range total 5 yr. cost	\$8.1M - \$16.1M		\$5.3M - \$33.1M		\$7.6M - \$11.8M		\$0M - \$7.3M	
Cost Element % of Total Cost	24%		49%		17%		10%	

The following table depicts the actual estimates provided by the participating firms for the major cost elements.

Total Cost of Major Elements for adding sent timestamp to exchange message of 13 firms supplying cost breakdowns in second cost estimate		
Cost Element	One-Time Costs	Annual On-going Costs
Hardware	\$ 493,000	\$ 242,900
Software	\$ 846,000	\$ 412,400
Maintenance	\$ 719,000	\$ 739,000
Other	\$ 20,000	\$ 85,750
Total	\$2,518,000	\$1,394,300

Some explanations for the wide variances in cost estimates are repeated from the Section 3.2 because the firms applied their logic to both cost estimates:

- Varying investments required for adding robustness to their infrastructures due to regulatory reporting requirements.
- Current infrastructure and system designs vary considerably over the survey respondents resulting in different development/maintenance costs required to add timestamp to an existing quote message.
- Different interpretation on the compliance staff required for regulatory reporting and compliance.
- Additional investment needed for clock management hardware and software to comply with CAT reporting timestamp requirements (reflected in all four cost categories, including “Other”).

7 Conclusion

The industry associations support the objective of reporting of options market maker quotes for the purposes of market surveillance and reconstruction. However, all essential information needed for these purposes is available by the **exchange** reporting of market maker quotes to the CAT processor.

To provide industry costs for implementing the current Rule 613 requirement of **market maker** reporting of options quotes to the CAT, a cost estimate survey was performed by the industry associations. This cost estimate survey provides evidence that the cost of market maker reporting of options quotes to the CAT over a five year period is \$118.0M for the survey participants alone and estimated to cost between \$307.6 to \$382.0M for the entire options market maker community. Indirect costs, such as opportunity costs impact on competition, were not sized in this survey but should be considered in evaluating the impact of CAT reporting to the options market makers. In addition, the CAT Processor cost to implement the duplicative reporting by the options market makers, estimated to be 30% of the overall CAT reporting volume, is likely to be significant. The additional processing, storage

and infrastructure costs would need to be apportioned to either the options market makers, or the whole industry.

An alternative proposal of providing sent timestamp on exchange quotes was also included in the cost estimate survey. This proposal, adding sent timestamp to the existing quote message sent by the market makers to the exchange, will cost the survey participants \$8.5M over a five year period and estimated to cost between \$36.9 to 76.8M for all options market makers. While less costly than market maker reporting of options quotes to CAT, it still represents a considerable cost to this community. Before requiring quote sent timestamp, the industry associations request that the regulatory bodies clearly articulate the value of including this data element for the purposes of market surveillance in light of the costs to the industry.

8 Appendix 1. Cost Estimate Survey Questions

Following are the questions included in the cost estimate survey:

Characterize your firm's options business:

- Specify the number of options exchanges on which your firm makes markets.
- Specify the number of issues for which your firm is an options market maker.
- Specify the total number of issues over all exchanges for which your firm is a market maker.
- Average daily quote volume.

Cost Estimate #1 – CAT Reporting of Options MM Quotes

- **Hardware** - Provide one-time and on-going costs (\$/year) for each of the following:
 - Processor
 - Storage Devices
 - Telecom
 - Co-location services
 - Infrastructure Staff
 - Other
- **Software** – Provide one-time and on-going costs for each of the following:
 - Systems/Application Software
 - Development Staff
 - Other
- **Maintenance** – Provide one-time and on-going costs for each of the following:
 - Operations Staff
 - Compliance Staff
 - Other

Cost Estimate #2 – Add Timestamp to Option MM Quote Message Sent to Exchanges

- Provide the one-time and on-going costs for each of the following:
 - Hardware
 - Software
 - Maintenance Staff
 - Other

9 Appendix 2. Assumptions used for Cost Estimate #1 – CAT Reporting of MM Options Quote

Hardware (Equipment) Cost Considerations:

Consider the new CAT reporting will be subject to compliance and enforcement regulations. CAT reporting of all quote messages sent to exchanges **will be required by 8AM of the following business day** of quote issuance. Elements to consider are new or upgraded equipment needed for any additional processing, storage and telecommunications costs associated with reporting all options market maker quotes (in block format) to the CAT. Costs should cover equipment needed for **primary, backup, disaster**

recovery, development, test, QA and on-going maintenance charges. Estimates should **assume a 25% annual growth** rate of the options quote volumes. For purposes of this cost estimate, an **average CAT report message size of 50 bytes** (based on current message size) should be assumed. Consider **your firm's average and peak quote message volume** when considering storage costs. **Personnel costs for planning and installation** should be considered. If estimating in people-days, assume \$1200/day for personnel costs.

- 1. Processors** - Estimate of additional processing capacity required in systems listed above to absorb the message processing for reporting, reconciliations, reference data management, monitoring, alerting, error correction, archiving. Rule 613 requires time stamps at least to the millisecond level.
- 2. Storage Devices** – Rule 613 imposes a 5 year retention requirement on the CAT Processor for the CAT reporting data. Currently FINRA Rule 7440 requires that OATS records be preserved at least 3 years, the first two years in an accessible place. For purposes of this cost estimate, **assume that firms match the 5 year record retention policy in order to** address market surveillance or reconstruction issues/questions that may be raised by the SEC/SROs. Message compression for storage purposes can be assumed. Cos
- 3. Telecommunications** - Reports of options MM quotes are due to CAT by **8AM of following business day** of quote issuance. Estimate the communications costs required to link and send to CAT the reporting of options quotes, **including lines, switches and other equipment.** Include costs for **primary, backup and disaster recovery links.**
- 4. Co-location Services** – Consider any costs related to new hardware (identified above) requiring co-location.
- 5. Infrastructure Staff** - Consider the costs for infrastructure support to plan, purchase, install, configure and test any additional equipment required by your firm for handling CAT reporting of options MM quotes.
- 6. Other** – Identify any other hardware cost elements required for your firm to implement CAT reporting of options MM quotes.

Software Cost Considerations:

Elements to consider are systems and applications installation **costs to configure any new processors** added to handle the increased capacity needed for CAT Reporting (see Question #1). Also to be considered are the costs incurred for **vendor enhancements or development/test of in-house software for CAT reporting of options MM quotes.**

Technical Assumptions are outlined below. Software applications that should be considered include the market maker quotes data collection process and the market maker reporting process. Costs should include **business analysis, development of changes, validation (test, QA) of the changes.** System/vendor/application **maintenance charges** should be considered.

- 1. Systems/Application Software** – Estimate the costs to configure any new processors identified in your estimate, including operating systems, systems and application software.

2. **Development Staff** – Changes are required to **application software to capture the MM options quotes and report to CAT**. If estimating in developer days, assume \$1200/day for personnel costs.

Technical assumptions to implement CAT reporting are:

- **Mapping the exchange quote message to the CAT report message format** (format not defined at this time, but assume different from exchange message format), sending the report to CAT, and archiving the CAT Reports (in compressed format) for 5 years
 - CAT reports are required for all events sent by B/D to exchange (e.g., original block quote, withdrawal of quote).
 - **Each CAT report would include:** the quote data included in the block quote, the CAT Reporter ID, date of quote submission and timestamp of quote submission.
 - CAT reporting life cycle linkages between orders, SIP/OPRA quotes and trades will not be required. For purposes of this cost estimate, **linkages between the original quote CAT report and subsequent CAT reports of quote withdrawals are considered out of scope.**
 - For purposes of this cost estimate, assume the current options symbology protocol used by B/D in communicating with each exchange is to be used also for CAT reporting.
 - Timestamp recording is assumed to be milliseconds (or lower if current application has more granular support).
 - Compression of options MM quote sent to the CAT (either via message protocol or batch file transmission) is **NOT** assumed for this cost estimate (CAT protocols not known at this time).
 - The CAT report should be sent to the CAT Processor by 8AM of the following business day of quote issuance.
3. **Other** - Identify any other software related cost elements required for your firm to implement CAT reporting of options MM quotes.

Maintenance Cost Considerations:

Elements to consider are the **additional staffing costs that may be required to manage the CAT reporting of options MM quotes**. This includes training, daily operations monitoring of message/communication traffic, daily compliance monitoring and error correction of CAT reports. Costs should also include **reconciliations** – to both verify correct CAT reporting, investigate issues raised by CAT on reporting, and normal correction of identified reporting errors to CAT). The timeframe for identification, communication and correction of errors from the time an event is received by the CAT processor is as follows (as defined in the CAT RFP):

1. 12:00 P.M. Eastern Time T+1 (transaction date + one day) – Initial data validation, lifecycle linkages and communication of errors to CAT Reporters
 2. 8:00 A.M. Eastern Time T+3 (transaction date + three days) – Resubmission of corrected data
 3. 8:00 A.M. Eastern Time T+5 (transaction date + five days) – Corrected data available to SRO regulatory staff and the SEC
1. **Operations Staff** - Identify the costs associated with any increased operations staffing requirements (e.g., managing reconciliation processes) needed to manage the CAT reporting of options MM quotes. If estimating in personnel days, assume \$1200/day for personnel costs.

2. **Compliance Staff** – Identify the costs associated with any increased compliance staffing requirements (e.g., responding to inquiries) needed to manage the CAT reporting of options MM quotes. If estimating in personnel days, assume \$1200/day for personnel costs.
3. **Other** - Identify any other staffing related cost elements required for your firm to implement CAT reporting of Options MM Quotes.

10 Appendix 3. Assumptions used for Cost Estimate #2 - Adding Timestamp to Exchange Message

1. **Software** – Consider the costs for vendor and/or in-house software that would need to be modified to for adding timestamp to block quote messages. Software applications that should be considered are the market maker quotes data collection process and the market maker reporting process. The message format should match current exchange message format, with the addition of a timestamp reflecting time that the message was sent to exchange. The timestamp should be in milliseconds (or lower granularity if current application captures more granular time units). The costs should include **business analysis, development of changes and validation (test, QA)** of the changes. Also consider any maintenance costs on the software changes for handling on-going improvements or regulatory changes.
2. **Hardware** – Consider if any additional hardware (equipment) is needed due to the addition of timestamp to the current options block quote message sent to the exchanges today. Is additional storage needed for archiving of a now larger message? Your firm’s current archive practice for quote messages does not need to change. Is additional processing capacity needed for timestamp capture and clock synchronization? Is any increased telecommunications capacity needed due to a larger message size (adding timestamp)?
3. **Maintenance Staff** – Consider the on-going monitoring and error correction to support quote sending time, if required. For the purposes of this cost estimate, assume that if CAT identifies timestamp discrepancies (e.g., broker-dealer sent time is equal or later than exchange receipt time), it will **not** represent a CAT reporting error.
4. **Other** - Identify any other related cost elements required for your firm to add timestamp to existing options quote message sent to an exchange.