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Algorithmic Trading

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Praising Parameterization

The extent to which algorithmic trading has permeated the financial services industry depends on who you ask. Take, for example, a traditional, equities-only "pick-and-stick" asset manager, which typically employs lengthy investment horizons, and therefore, may only execute a small number of orders during the course of a normal month. Shredding large block trades into smaller child orders as a way of increasing the likelihood of obtaining a fill and reducing market impact and diversifying risk, is not something long-only shops are interested in. But scratch under the surface of a more "adventurous" buy-side entity—any firm that executes large numbers of trades during the course of a typical trading day—and you'll find a small army of home-grown, broker-provided, or third-party-developed algorithms hard at work, responsible for determining when to trade, where to trade, how to trade, and how often to trade. This might sound highly sophisticated, but in truth, the market's forerunners have been doing this sort of thing for at least the past decade.

What has changed in recent years, however, is the extent to which providers—both brokers and specialist third-party vendors—have "parameterized" their offerings, allowing users to tweak their parameters on-the-fly, effectively changing the algorithm's behavior without affecting its core logic. This means that in the event that traders believe market conditions have changed from what they were when the algorithm was initially deployed—which can undermine the algo's efficacy—they can modify any number of parameters, thereby maintaining its level of specificity and effectiveness. In the past, end-users were most often forced to rely on their algo developers to make the necessary tweaks, a process that was both long-winded and laborious. In the algorithmic trading roundtable on page 4, there is frequent reference by our four panelists to the importance of parameterization, and the extent to which it allows buy-side and sell-side practitioners to differentiate themselves in what has become a crowded and highly competitive space. ■

Victor Anderson
Editor-in-Chief

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Russia's BCS Taps QuantHouse to Target Quants, HFTs

Russian brokerage Broker Credit Service (BCS) Financial Group is rolling out low-latency data and trading infrastructure solutions from S&P Capital IQ's low-latency data subsidiary QuantHouse across its European trading operations in London and Cyprus, and its main base in Moscow, to support the trading activities of high-frequency and quantitative traders.

BCS signed the deal with QuantHouse at the end of last year, and over recent weeks has deployed the vendor's QuantFeed ultra-low latency consolidated datafeed, which captures raw data from exchanges and delivers a normalized feed through a single application programming interface (API), its QuantLink trading infrastructure—combining a fiber-optic network and proximity hosting at trading venues worldwide—and its QuantFactory framework for developing automated trading strategies.

Stephane Leroy, vice president and head of global real-time solutions at QuantHouse, says the suite will enable BCS to develop its customer base, especially among high-frequency traders and quantitative trading firms. "BCS is serving the quant trading community, which needs execution services from brokers, but also advanced trading technologies, which is why BCS has selected our entire portfolio for their usage and also the usage of their clients," Leroy says.

ConvergEx Unveils Premarket Trading Algo

ConvergEx Group has released a new algorithm that is designed to allow users to automate the largely manual process of premarket trading. According to ConvergEx, the algo allows users to capture liquidity in the morning before the markets open, when liquidity is sparse and pricing is more difficult. The process is challenging and largely manual for traders, which prompted ConvergEx to develop the algorithm, says Scott Daspin, managing director in ConvergEx's global electronic execution group.

"We noticed that clients were actually using hand-held calculators to figure out how much they should participate before the open when a manager wants to get involved after news or earnings," Daspin explains.

The algo will be targeted at momentum traders, Daspin says. It was developed in ConvergEx's automated testing facility over the course of about six weeks, and was back-tested multiple times over 20,000 different trading scenarios. A handful of clients are currently using the algo, according to Daspin.

"We had to back-test this over 10 years to figure out if it made sense to automate trading at a time of day when the volume isn't easy to find," he says. "And there's not a lot of non-displayed trading, or dark trading, before the market, if any at all. So to participate with volume, you need to know which exchange to post on, and it might not be the same exchange on any given day. We've done a lot of research with where we post and how long we post prior to taking liquidity in the displayed market, and our routing is very sophisticated with regard to average daily volume, spread, and dispersion."

ITG Releases Closing Auction Liquidity Algo

Agency broker ITG has announced the release of its Dynamic Close algorithm, which pursues market liquidity in NYSE and Nasdaq closing auctions. According to ITG, the algo provides traders with the ability to reduce price impacts from over-activity at the close, containing flow and rebalancing functionality, which prevents slippage and implementation shortfall.

"Our research demonstrates that traders targeting the close should focus more of their open-market trading to the period prior to the imbalance announcement, not just prior to the close itself," says Jeff Bacidore, managing director and head of algorithmic trading at ITG. "The Dynamic Close algorithm provides a tool to tap the liquidity in and around the closing auctions, with different behavior depending on whether the trade is part of a portfolio rebalance or a flow trade."

National Bank Financial Activates Orc for Canadian Algo Trading

National Bank Financial (NBF), a wholly owned subsidiary of the National Bank of Canada, has extended its use of technology from Orc by offering clients algorithmic trading in Canadian markets. Clients will now have market access and the ability to use algorithmic execution tools in Canadian futures, options, and equities. NBF will also join the Orc ExNet financial extranet.

"Expanding the use of Orc technology enables NBF to offer direct market access to its suite of Canadian intelligent and dynamic algorithms, to global investors. Participants may leverage our direct membership to all sources of Canadian liquidity in a cost-effective and efficient manner to ensure best execution," says Michael Newallo, managing director for electronic trading at NBF.

Saxo Bank Re-Launches MT4 Platform

Online foreign exchange (FX) trading firm Saxo Bank has re-launched its MetaTrader 4 platform under the name SaxoMT4, with institutional business being handled through its French subsidiary, Saxo Banque.

Saxo Banque will provide a full service for hedge funds, as well as asset managers and introducing brokers. The retail segment of the release will gain access to mobile trading applications, the MetaTrader environment, and algorithmic execution. FX, commodities and trading stock indices through contracts-for-difference (CFDs) will be available.

"There is significant demand for the MetaTrader platform, primarily because of its algorithmic trading capabilities," says Lars Seier Christensen, co-founder and CEO of Saxo Bank. "With the SaxoMT4 platform, retail investors with a preference for MetaTrader will be able to benefit from the liquidity and execution previously reserved for SaxoTrader clients."

China Merchants Securities Rolls Out Algo

Shenzhen-based China Merchants Securities has announced that it will be offering algorithmic strategies to its retail investor clients, with plans to extend it to buy-side institutional clients later.

The firm will offer up to eight basic algorithmic strategies at first, such as volume-weighted average price (VWAP), along with bespoke offerings for equities and equity derivatives. The company is using Progress Apama's capital markets platform to facilitate the trading.

"Algorithmic trading in China has been growing but few brokerage firms can offer clients a customizable, scalable, and robust algorithmic trading platform with ultra-low latency," says GuangYan We, general manager of the individual investor department at China Merchant Securities. "To provide these value-added services to our customers and grow our retail business, we decided to build our algorithmic trading platform on top of the Progress Apama platform. Our first goal is to expand our presence in retail markets followed by our institutional buy-side clients."

Perseus Goes Public with Euro Microwave Network

New York-based Perseus Telecom launched a microwave service in Europe at the end of 2012.

"Perseus has seen a strong demand for high-speed microwave technology since our preliminary launch last year. In fact, that initial capacity quickly sold out," says CEO Jock Percy. "Since then, we have provisioned additional capacity to meet customer demand and remain the fastest available microwave service between London and Frankfurt. Perseus, along with partners who offer domain and technological expertise, designed a wireless route that is also backed up by the fastest fiber network route, promising high availability."

The market-to-market service offers connections between NYSE Euronext and Liffe in Basildon, and Deutsche Borse and Eurex in Frankfurt; Bats, Chi-X, Turquoise, Boat, and EBS in Slough, and Deutsche Bourse and Eurex in Frankfurt; London Stock Exchange (LSE), London Metal Exchange (LME) and Thomson Reuters in London, and Deutsche Borse and Eurex in Frankfurt. According to the vendor, the current Perseus connection between NYSE Basildon and Eurex/Deutsche Borse Frankfurt is less than 4.6 milliseconds round-trip delay (RTD).

Flex Appeal

Algorithmic trading strategies, responsible for executing a substantial portion of equities orders in the US and European financial markets, are not new by any means. But they are continually evolving, as are providers' services and end-users' requirements, chief among which is the ability customize algorithmic parameters on an intra-day basis.

Q How can firms build appropriate risk management processes and functions into their algorithmic trading infrastructure and strategies without impinging on their ability to execute large numbers of orders in very short time frames?

Andrew Banhidi, managing director and CTO of electronic trading, equities, sales, research, and client-facing technology, Bank of America Merrill Lynch: We need to be clear on the differences between high-frequency strategies that require low latency from long-horizon strategies like volume-weighted average price (VWAP), time-weighted average price (TWAP), implementation shortfall, and so on. The latter will not unduly suffer from an additional one millisecond of necessary risk checks, while the former usually involve the implementation of special risk checks in the same process as the strategy execution, and use specialized technology like field-programmable gate arrays (FPGAs) and remote direct memory access (RDMA)—or both—to achieve latency targets.

Scott Sellers, president, CEO and co-founder, Azul Systems: A good risk management system for an algorithmic trading system does two things: first, it compartmentalizes risk, and second, it creates multiple levels of risk controls. The first is very important because different types of algorithms can have dramatically different risk profiles—it might be standard behavior for a market-making algorithm to send hundreds or more orders per second, while a passive execution algorithm may send substantially fewer. Understanding the correct behavior of an algorithm allows traders, developers, and risk managers to better understand how an algorithm can stray. From there, the next step is evaluating the "side effects" of a malfunctioning system, and determining how to limit these. Sound engineering practices, like well-defined message parsing, separate risk controls, and good componentization of a system, can limit side effects.

Once the compartmentalization is achieved, the next step is setting up proper risk monitoring and controls in relatively separate

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layers. The layered approach attempts to catch problems at the lowest possible level, where they tend to have the least impact. At the most basic level, a trading algo or model should attempt to detect a "bad state"—exceptions, bad data, and so on—as it runs, and take appropriate action by shutting itself down. A level up from that is a monitoring algo or system that looks at the group of algos that operate together and watches for errant behavior among the group. Even higher is a system-level threshold that will trigger if certain conditions are met, such as too many orders or trades in a given time frame or bad prices. Finally, many firms employ a "kill switch" that can be manually triggered if the exchange reports problems.

Audris Siow, director, electronic trading sales and consulting, ITG: From the decision to execute the order through to settlement, ITG helps clients understand market trends, improve performance, mitigate risk, and navigate increasingly complex markets. As such, ITG's algorithmic execution profile is largely comprised of large institutional orders across multiple clients.

We set appropriate risk management processes, and controls are set at both the market and end-client level. ITG has a variety of tools to support the controls and rules set in place to minimize the risk of accidental or erroneous execution. Such monitoring systems are able to provide triggers intra-day to our electronic trading desk or the end-client/trader if certain limits have been breached or are nearing their limits. While the firm may have overall aggregate limits as part of the risk and credit management responsibilities under the European Securities and Markets Authority (ESMA) guidelines, the adoption of client-specific limits based on their typical trading profiles is essential to facilitate smooth execution with minimal interruptions across large volumes or large numbers of orders, while mitigating the above-mentioned risks.

Value limits, restrictions on order values, limit-price validation, and blocking unpriced orders are just some examples of controls that have been incorporated. ITG algorithms have additional protections, which help prevent algorithmic orders with inappropriate parameters creating significant market impact. There are automatic warning functions which prompts traders to be aware of the trading parameters placed or accepted. Certain automatic rejection rules are also in place to protect fat-finger trading or rogue trading, such as an order exceeding a high percentage of average daily volume (ADV).

Louis Lovas, director of solutions, OneMarketData: The "Knight-mare" on Wall Street has exposed a latent fear of failure. Their code bug has reignited warnings of market mayhem and the portents of another Flash Crash causing many firms to review their risk profile. Pre-trade risk is a toll that some firms chose to pay by their own volition and by regulatory mandate—i.e., the 15c3-5 Market Access Rule. This independent function of a trading infrastructure is designed to monitor order flow and act as a gatekeeper. Firms desire a confidence that their algos will turn a profit, and likewise are fearful that what is deployed could become headline news as the latest rogue algo to wreak havoc.

> "It's not the execution algorithms themselves that improve the quality of execution, but rather the way the market has evolved over the last decade. Things have gotten to a point where it's essentially an arms race between the market-making algorithms run by the liquidity providers, and the liquidity-removal algorithms run by the customers. Without an algorithmic execution system, customers would have an extremely hard time effectively executing a large block of shares on an electronic market, because they would quickly signal their intentions to the rest of the market."
> **Scott Sellers, Azul Systems**

Pre-trade risk is a run-time tax firms must pay for this goal, and is fast becoming the next low-latency battleground. To achieve the needed parallelism and microsecond latency there is renewed emphasis on multi-core CPUs and hardware acceleration through FPGAs.

Yet pre-trade risk is just one of two important measures to guarding the keys to the kingdom. The other is the need for robust back-testing prior to a production rollout. Robustness is a measure of the stability of an algorithm. And testing minimizes the risk of algo failure and also tunes for profitability. It is determined by replaying historical data through algorithms. History can represent normal market activity, highly volatile conditions, bubbles, and even crash periods. The vital measure of an algorithm's profitability and stability are hidden in the "what-if" conditions of market history.

Regulation and fear of algo-failure has triggered a laser-focused emphasis on pre-trade risk. While thorough testing can validate new algorithms, it is pre-trade risk that is the sentinel safeguarding the castle and ultimately the entire kingdom.

Audris Siow
ITG

Q What new asset classes are firms looking to trade algorithmically? What lessons can be learned from equities and applied to these asset classes?

Siow: We are seeing interest in areas of equity-linked futures algos and possibly in the foreign exchange (FX) space, particularly for currency-linked pairs. The microstructure of the fixed-income market creates an environment that is less conducive for algorithmic trading. This is possibly due to the specificity of the securities' attributes, which make the contracts/instruments less standardized and therefore harder to structure for algorithmic trading.

Errors, when compared to equity trading mistakes, are likely to produce larger significant notional value due to the nature of the derivative instruments. As a consequence, there will be a greater ripple effect on the underlying asset (equity) market due to the linkage between the derivative and its underlying equity, should trading errors or system shocks such as the Flash Crash occur when trading such asset classes. Pre-trade risk checks should be given even more scrutiny over such asset classes where systematic trading is introduced. Market venue/exchange circuit-breaker rules and tolerance levels should also be reviewed to incorporate cross-exchange linkages particularly in "fast" market conditions to prevent contagion spilling over to the derivative market, or vice versa.

> "The breadth of algorithmic offerings across firms in the industry today is common, but what differentiates one from another is the performance or execution quality of individual strategies. The driving force behind such 'tailoring' of algo strategies is the ability to customize and match the execution profile of the algorithm to the alpha of the fund manager." **Audris Siow, ITG**

Sellers: With some of the potential regulations coming from Dodd–Frank and the review of the Markets in Financial Instruments Directive (Mifid II), firms are preparing for more over-the-counter (OTC) trades to get pushed to central clearing and exchanges. The hope is that this will open the door to new areas of revenue in swaps, fixed income, and certain commodities markets that have traditionally existed largely through broker markets. One difficulty with these types of trades is that OTC trades are often big blocks done between large entities, such as insurance companies or oil producers that need to hedge large chunks of risk at once. Equities markets tend to be more retail-focused, so equities algorithms and trading firms are often focused on distributing risk, whereas large over-the-counter (OTC) players tend to be more focused on warehousing it, because there are a more limited number of parties willing to take pieces.

That said, it is possible that pushing some of this to the exchanges will integrate them more into the retail investment landscape and allow smaller players to get involved in small-sized pieces. If this occurs, a lot of the same mechanisms that drive the equities markets—exchange-traded funds, inexpensive retail platforms, execution algorithms, and so on—could generate a new set of tools and buyers for these traditionally institutional instruments.

Lovas: With lower equity volumes, algorithms become more critical as tools for trading in illiquid conditions. It has forced everyone to get a better understanding of illiquidity and has accelerated algo-trading expansion into other asset classes such as foreign exchange (FX).

The FX market is the world's largest and most liquid. FX by its very nature is a fragmented marketplace. ECNs and single-bank providers offer up a plethora of liquidity, but price discovery can be a challenge. That fragmentation is the opposite of price transparency. FX data providers have expanded cross rates, synthetic rates, open-high-low-close (OHLC) prices, and price ladders for both real-time and historical content with standardized delivery via the FIX protocol. Multi-connectivity provides a means to build consolidated best bids and offers (BBOs), complex spreads, and arbitrage analytical models. Equity smart-routing technologies and mathematical models designed for the fragmented equity markets can operate in a similar manner in the search for liquidity and alpha in the near-round-the-clock currency market.

Banhidi: Foreign exchange (FX) is the most common mentioned and in fact has been implemented in many places. Equity technology is being used to execute spot and forward orders, when traded in an order-driven fashion as in some FX ECNs. There are also a number of firms looking to implement, or are in early stages of implementing, true multi-asset algo capability.

Q Given that algorithms only have a 10-day to two-week lifespan, how do providers go about providing algorithms that can be modified on-the-fly by end-users so that their specificity can be maintained?

Siow: We believe the lifespan of an algorithm is related to the execution of the algo order rather than the construct of the algo design. Furthermore, several specific algos—market-making ones, for example—do not have a particular lifespan for the exact purpose of trading repeatedly and continuously over an indefinite period.

Flexibility and adaptability are key factors in driving the effectiveness of algorithms. ITG's algos are designed to be self-adjusting—the analytical input for the algo decision engine

is based off rolling benchmarks that are updated daily with real-time tick data and market data analytics.

Further flexibility to enable "on-the-fly" changes can be supported by keeping configuration and development layers as separate points of change control. This allows small tweaks to configuration, parameterization and algo behavior to be deployed to individual end-clients to maintain the level of specificity.

Lovas: In that short time span, market conditions can change and stress algorithm profitability. Consequently, the quest to revise and tune models is never-ending. One side effect of this is increasing demands for deep historical data over longer time periods across a firm's tradable markets. Firms demand configurable trading algorithms, both execution and systematic alpha-seeking, to support a range of trading styles. Customization through visual modeling of the semantic logic and run-time parameterization is vital for rapid redeployment, as is the deep history for back-testing to model a firm's risk tolerance. Making the run-time status of algorithms visible at all times through real-time dashboards, including quantity traded, quantity still to trade, profit and loss (P&L), and risk exposure, ensures the feedback loop between machine and human.

Banhidi: Providers mostly "parameterize" a lot of the behavior in their algos so that clients can change behavior pretty much on-the-fly. Another technique is to allow modification of the urgency of executing algos so that they will adapt to become more or less aggressive based on urgency factors.

> "The vital measure of an algorithm's profitability and stability are hidden in the 'what-if' conditions of market history. Regulation and fear of algo-failure has triggered a laser-focused emphasis on pre-trade risk. While thorough testing can validate new algorithms, it is pre-trade risk that is the sentinel safeguarding the castle and ultimately the entire kingdom." **Louis Lovas, OneMarketData**

Sellers: It is important to make the distinction between the algorithm and the parameters that go into it. An algorithm can be fairly simple, but the parameters that it uses can be updated daily after hours of computation to reflect new market conditions. Providers are aware of this, and strive to provide a robust set of tools that allows many different configurations within the same set of core logic. Traders can then modify dozens or more parameters to customize the algo to the exact conditions. Tuning the trading system in this way is how traders add value.

Q How has the rise in intelligent algorithms—liquidity-seeking algorithms and news-reading algorithms, for example—allowed buy-side and sell-side firms to improve the quality of their executions?

Lovas: The in-depth understanding of market structure and order book dynamics is necessary for optimal price transparency. This is the goal of liquidity-seeking smart order-routing platforms and vital for buy-side best execution. Data takes center stage with a focus on connectivity, consolidation and conflation across a multiplicity of markets—listed exchanges and dark pools. For firms to prevail over a market structure characterized by fragmentation, they need to get a better handle on managing data and ensuring its quality. News sentiment has been around for a number of years. Its value as an influencer of trade decisions has been rather dubious, however. The biggest challenge is filtering out the noise and consequently the uptake has been slow.

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Sellers: In many respects, it's not the execution algorithms themselves that improve the quality of execution, but rather the way the market has evolved over the last decade. Things have gotten to a point where it's essentially an arms race between the market-making algorithms run by the liquidity providers, and the liquidity-removal algorithms run by the customers. Without an algorithmic execution system, customers would have an extremely hard time effectively executing a large block of shares on an electronic market, because they would quickly signal their intentions to the rest of the market. While this is not new—since the beginning of stock trading, people have tried to hide their orders—computers make both the hiding and the seeking easier. Hence, the arms race.

The media has maligned the "bots" situation extensively, but, in reality, the existence of algorithmic liquidity providers has dramatically reduced the costs of the financial markets to the ultimate end-users. George Sauter, chief investment officer of the Vanguard Group, estimates that the existence of algorithmic trading and liquidity provision reduces trading costs by 10 percent per decade to end-users. To realize this 10 percent saving, investors need to change their trading behavior slightly, but that's just the new rules of the game. So, overall, it's probably a bit too narrow-focused to look at liquidity-seeking algorithms as a driver of reduced costs. A better way to frame the situation is that the entire way the market now operates has reduced costs, and intelligent customer algorithms play a part in the overall environment.

Andrew Banhidi
Bank of America Merrill Lynch

Banhidi: Liquidity-seeking algos allow efficient price discovery without necessarily revealing intent. News is typically used as a refinement for trading signals that are generated by a variety of factors, and, by itself, doesn't necessary increase execution quality.

Siow: Such algorithms have enabled traders to be more informed when making trading decisions, and utilize tools that can provide sentiment-led, market-adjusted signals to improve the quality of execution during trading. Liquidity-seeking algorithms have enabled traders to execute their orders with less trading impact and cost, particularly if access to multiple liquidity sources, both on- and off-exchange, can be managed effectively within such strategies.

Q To what extent are algo providers tailoring their algorithms to individual user-firms? What part does technology play in allowing providers to tailor their services to individual firms?

Siow: The breadth of algorithmic offerings across firms in the industry today is common, but what differentiates one from another is the performance or execution quality of individual strategies. The driving force behind such "tailoring" of algo strategies is the ability to customize and match the execution profile of the algorithm to the alpha of the fund manager. Specificity, with regard to how and when the algorithm goes about interacting, managing, and targeting relevant liquidity specific to the trading instruction or the client profile, can vary widely, even though the algorithm design or underlying trading objective itself stays constant.

Subsequently, technology plays a crucial role in terms of enabling algo service providers to support and maintain varying degrees of configuration preferences across multiple end-clients in a scalable and efficient manner. Tools for real-time monitoring of executions and taking control over (in special circumstances) clients' orders are also crucial to provide transparency to the trading process.

Banhidi: Individual firms' tailoring needs are usually addressed by parameterization as discussed above. A combination of technology and quants usually determine the extent to which an algo's behavior can be parameterized, and the technology to implement it.

> "Providers mostly 'parameterize' a lot of the behavior in their algos so that clients can change behavior pretty much on-the-fly. Another technique is to allow modification of the urgency of executing algos so that they will adapt to become more or less aggressive based on urgency factors."
> **Andrew Banhidi, Bank of America Merrill Lynch**

Sellers: This is a difficult question—a big reason firms gain edge in a market is because they have discovered a new idea or strategy that others have not yet discovered. This is fairly at odds with the vendor model of selling a similar product to many entities at a cost below what it would cost those entities to build the product themselves. Therefore, for a typical vendor, there is little incentive to develop highly customized algorithms for individual firms. If the firm knows enough to fully dictate how the algorithm works, and that algorithm is a profitable one, they would likely just build it themselves. The same applies to the vendors—if they could reliably devise profitable algorithms, they would simply open a trading arm.

The area where vendor solutions and trading firms overlap is algorithms that require extensive customization to function. If an algo or system takes 50 inputs that all change how it operates over different market conditions, it's not unreasonable to think that a vendor might work with a firm to add new inputs that they think might let them better control the system. In this area, vendors can provide a lot of value by building out flexible and reusable systems that each firm may run differently depending on their own inputs.

Aside from that, there are also consultants who run businesses converting trading ideas into algorithmic software. I consider this a form of "in-house" development, since the algos and systems are ultimately owned by the firms themselves, not the consultant.

Technology's role is to ensure that new inputs to existing algorithms—and entirely new trading strategies—can be developed, tested, and implemented quickly in conditions as close to "real-world" as possible.

Finally, I would like to acknowledge the assistance and expertise of Andrew Lisy and Hazem Dawani from our partner, OptionsCity. Their Freeway algorithmic trading platform is a low-latency, server-based algorithmic trading solution designed for deploying user-built multi-asset strategies.

Lovas: The trading industry demands algo-building technology to enable rapid design and customization. The demand is to model trading styles as firms diversify and adapt to uncertain market mechanics—low volume, erratic volatility and unsettled regulatory policy—the narrative of the new normal in today's financial markets. Visual design empowers creativity by providing a means to assemble an algorithm's semantic logic. The algorithms can be built using components such as real-time analytics, statistical arbitrage modules, execution-strategy modules, and order management modules. Once assembled, the algorithms can be back-tested using a range of historical data and simulation capabilities to ensure robustness and profitability. ■

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Financial Information Summit 2013
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Toronto
Trading Architecture Summit 2013

October

Buy-Side Technology | North American Summit 2013

Frankfurt
Financial Information Summit 2013
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November

Asia Pacific
Financial Information Summit 2013
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