

GAO

Report to the Chairman and Ranking
Minority Member, Committee on
Agriculture, Nutrition, and Forestry,
U.S. Senate

August 1990

FUTURES MARKETS

Use of Automation to Detect Trade Abuses



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**Information Management and
Technology Division**

B-234478

August 24, 1990

The Honorable Patrick J. Leahy, Chairman
The Honorable Richard G. Lugar, Ranking
Minority Member
Committee on Agriculture, Nutrition, and
Forestry
United States Senate

In our September 1989 reports, we noted that weaknesses in controls over futures trading¹ at exchanges provide dishonest trading floor participants with the opportunity to defraud customers by falsifying their trade records, which exchanges use to detect abuses.² While detecting every abuse may never be possible, we pointed out that abuses could be better detected with more accurate trade records. We concluded that to obtain such records the exchanges—not the trading floor participants—needed to independently and precisely record when (1) customer orders are received on the exchange floors, (2) orders are received by trading floor participants, (3) trades are executed, and (4) trades are reported off the exchange floors. We further pointed out that automation can be used to improve the accuracy of trade records needed to detect abuses, but that exchanges and the Commodity Futures Trading Commission needed to control the new risks associated with automation.

Your Commodity Futures Trading Commission reauthorization bill (S. 1729) would require the futures exchanges to maintain independent, precise, and complete trade records. In this connection, your office requested that we identify automation initiatives of the 14 U.S. futures exchanges that could record accurate trade times. Additionally, your office requested that we perform limited risk assessments of two automated trading systems that were being developed by the Chicago Board of Trade and the Chicago Mercantile Exchange, and identify steps taken by the Commodity Futures Trading Commission to assess automation initiatives. As agreed with your office, we limited the scope of this review to exchanges' automation initiatives and did not assess other means by which exchanges could maintain independent, precise, and

¹We are defining futures trading as the trading of futures contracts and options on futures contracts. A futures contract is an agreement to buy or sell a commodity for future delivery at a price determined at initiation of the contract. An option on a futures contract gives the buyer the right, but not the obligation, to perform on the terms of the contract within the life of the option.

²Futures Markets: Strengthening Trade Practice Oversight (GAO/GGD-89-120, Sept. 7, 1989); and Futures Markets: Automation Can Enhance Detection of Trade Abuses But Introduces New Risks (GAO/IMTEC-89-68, Sept. 7, 1989).

complete trade records. In conducting this work, we reviewed documentation and interviewed officials of the Commission and the 14 U.S. futures exchanges. Details of our objectives, scope, and methodology are included in appendix I.

Results in Brief

Five U.S. futures exchanges are designing, developing, or implementing 10 automated systems that could provide more accurate trade records to detect abuses. As currently planned, however, the use of some systems will be optional, and others may be limited to certain trading locations. Consequently, it is uncertain at this time whether and to what extent these systems will be implemented.

In addition, our limited risk assessments of the after-hours trading systems planned by the Chicago Board of Trade and the Chicago Mercantile Exchange identified internal control areas that the exchanges needed to strengthen before each system's implementation. The risks associated with these areas include those that could affect the security of the systems. The Commission and the exchanges agree with the need for strong internal controls of the systems. The exchanges have plans to incorporate needed improvements as part of their continuing system development efforts.

The Commodity Futures Trading Commission has taken steps to increase its oversight of automation initiatives, and to obtain the additional technical expertise needed to assess these initiatives. Because most of the Commission's efforts are in the formative stages, it is too early to assess their effectiveness.

Background

Currently, most futures contracts and options on futures contracts at U.S. exchanges are traded at centralized trading floor locations, called trading pits. Trading floor participants in the pits are called floor brokers and floor traders. Floor brokers trade for others and may also trade for themselves, while floor traders trade strictly for themselves.

Although variations exist among exchanges, a customer order, on the Chicago Board of Trade and the Chicago Mercantile Exchange, typically is transmitted to a booth on the trading floor through the telephone or

computer of a member firm. These firms are referred to as futures commission merchants.³ A member firm's clerk in the booth first prepares an order ticket and time-stamps it. The clerk then sends the customer's order to a floor broker who attempts to execute it by offering or bidding the order to other trading pit participants. This process is generally referred to as open-outcry trading. If accepted, the broker reports the trade results back to a member firm's employee at the booth, where the order ticket is time-stamped again, and the trade results are transmitted back to the futures commission merchant. Floor brokers and traders also record their executed trades on trading cards, and trade results are reported back to the exchanges.

To deter trade practice abuses, the Commodity Futures Trading Commission requires that futures exchanges maintain surveillance and other programs to detect trading violations. As part of their surveillance, the exchanges and the Commission generally use trade records submitted by trading floor participants. However, the accuracy of the trade timing data that are handwritten or manually stamped on order tickets or trading cards is questionable because floor participants can intentionally or accidentally provide erroneous information. Additionally, dishonest floor participants could manipulate reported trade times and prices because trade records are not always turned in immediately following each trade. For example, the Chicago Board of Trade and the Chicago Mercantile Exchange allow trading cards to be maintained by trading floor participants for up to 45 minutes. Because a trading participant can execute a number of trades at different prices in a minute, information that is only seconds old can be used to alter trading records and potentially cheat a customer without detection.

Automation Holds Potential to Precisely Record the Timing of Trades

The Chicago Board of Trade, the Chicago Mercantile Exchange, and the Commodity Exchange, Incorporated, are pursuing six automation initiatives for their open-outcry trading processes that could provide improved trade records. The two Chicago exchanges have individually developed exchange-managed, order-routing systems that are designed to electronically transmit customer orders from futures commission merchants to exchange floors. In addition, the Chicago exchanges are separately developing workstations to provide floor brokers and their assistants with an automated means to receive and manage customer

³The futures commission merchants are individuals, corporations, associations, partnerships, and trusts that solicit or accept orders to buy or sell futures contracts, and accept payment from or extend credit to those whose orders are accepted.

orders, and record executed trades near the trading pits. The two exchanges are also cooperating in a fifth initiative to develop hand-held trading terminals. The terminals are intended to electronically receive orders in the trading pits and enable floor brokers and traders to record all transactions that the system will automatically time-stamp. Initially, the exchanges plan to issue terminals to floor traders. Chicago Board of Trade officials said that they were actively pursuing efforts to have hand-held terminals for floor brokers within the next 2 years. Chicago Mercantile Exchange officials did not envision such terminals within this time frame.

The Commodity Exchange, Incorporated, is also developing hand-held trading terminals. Unlike the Chicago exchanges' initiative, the Commodity Exchange is initially developing hand-held terminals that will not directly communicate with a supporting computer. Users will preset the terminal's starting time at the beginning of the trading day, and the terminal will then be used throughout the day to record trades, which will be automatically time-stamped and stored on an internal-memory device for later loading into a supporting computer. Phase two of the initiative includes the development of hand-held terminals that will communicate directly with a supporting computer, which will maintain accurate times for the purpose of time-stamping trades.

None of the six initiatives individually will provide accurate trade records to document when (1) orders are received on exchange trading floors, (2) orders are received by trading floor participants, (3) trades are executed, and (4) trade results are reported off the exchange floors. However, if the Chicago exchanges' initiatives are successfully implemented, the resulting systems could collectively provide accurate records in three of the four areas and potentially for the fourth as well. The precise time of trade execution may not be captured because the broker workstations and hand-held terminals are intended to record the time when trades are recorded, not when they are executed. However, if hand-held terminals are used by all floor brokers and traders in the trading pits, the times recorded should closely approximate the execution times. Table 1 provides system descriptions, the development status of the initiatives, and plans for each system to automatically provide accurately timed trade records.

Table 1: Six Planned Automation Initiatives That Could Provide Accurately Timed Records for Open-outcry Trading

Exchange name(s) and system name (if any)	System description	Status of development	Accurate trade times for when:			
			customer orders are received on exchange floors	orders are received by floor brokers or their assistants	executed orders are recorded by trading floor participants	executed orders are reported off exchange floors
Chicago Board of Trade EOS	An order-routing system is being developed to transmit orders from futures commission merchants to and from the trading floor and the planned after-hours trading system.	Currently testing system functions. Implementation planned to start within 18 months.	X			X
Chicago Board of Trade	Broker workstations are being developed to extend automated order-routing to and from the floor brokers or their assistants at the edge of the trading pits. Orders can be accepted and maintained until execution, and trade results can be recorded.	In an early development stage. Implementation planned to start within 2 years.		X		X
Chicago Board of Trade and Chicago Mercantile Exchange Automated Data Input Terminal (AUDIT)	The two exchanges are developing hand-held trading terminals to electronically record trade results in the trading pits.	Software testing expected in late 1990. Implementation planned to start within 18 months.		X		X
Chicago Mercantile Exchange Trade Order Processing System (TOPS)	An order-routing system is being developed to transmit orders from futures commission merchants to and from the trading floor.	System testing is complete. Currently marketing the system to members.	X			X
Chicago Mercantile Exchange CME Universal Broker System (CUBS)	Broker workstations are being developed to extend automated order-routing to and from the floor brokers or their assistants at the trading pits. Orders can be accepted and maintained until execution, and trade results can be recorded.	General system design is complete. Currently testing models. Implementation planned to start within 18 months.		X		X
Commodity Exchange, Incorporated	A hand-held trading terminal is being developed to record trade executions of floor brokers and floor traders.	In system testing. No date for implementation.				X

Although these initiatives could provide the exchanges with accurate trade timing data to detect abuses, the extent to which the systems will be used to record accurate times depends on how exchanges finally decide to implement the systems. For example, Chicago Mercantile Exchange officials said that the mandatory use of their systems is a policy issue that is under consideration. Also, Chicago Board of Trade officials are studying whether the automation initiatives can be effectively implemented in the pit where futures on U.S. Treasury bonds are traded because such initiatives could impair the existing process.

Four Automated Trading Systems Are Being Developed by Exchanges

Automated trading systems are being developed by the Chicago Board of Trade, the Chicago Mercantile Exchange, and the New York Mercantile Exchange for after-hours trading when their open-outcry markets close, and by the Amex Commodities Corporation in New York, for normal daytime trading hours.⁴ The records that the systems are intended to produce can help detect trading abuses. For example, exchange officials said that the systems can accurately record when users enter orders into the systems and can automatically time all trading transactions to within a second or fraction of a second. Although the systems are intended to provide accurately timed records, effectively detecting trade practice abuses will depend on how exchanges use such records. At the time of our review, not all the exchanges had finalized their plans to use the records these systems can provide.⁵ Information on the four automated trading system initiatives is provided in appendix II.

Other Exchanges Could Benefit From Ongoing Automation Initiatives

Although five exchanges are developing initiatives to automate trade records, the successful implementation of these initiatives could benefit others. Both Chicago exchanges have announced that other exchanges could share in the hand-held trading terminal technology they are developing. In addition, other exchanges are reviewing the feasibility of using one of the after-hours trading systems when they are implemented.

Some exchanges have affiliations or agreements with exchanges pursuing initiatives, and others are waiting to review the results of the current initiatives before they decide to use automation. The MidAmerica Exchange in Chicago, and the Chicago Rice and Cotton Exchange are

⁴Amex Commodities Corporation is a subsidiary of the American Stock Exchange, Incorporated.

⁵Although the exchanges were pursuing individual initiatives during our review, the Chicago exchanges announced their intentions to use the same after-hours trading system.

affiliated with the Chicago Board of Trade, and a representative of all three exchanges said that the Board's automation initiatives would also be applied to the other two exchanges. The Coffee, Sugar, and Cocoa Exchange in New York, the Commodity Exchange, Incorporated, in New York, the New York Cotton Exchange, the New York Futures Exchange, and the New York Mercantile Exchange have agreed in principal to combine efforts to finance research and development of hand-held trading terminal technology. To date, these efforts have included reviewing and monitoring the Chicago exchanges' and the Commodity Exchange's initiatives for hand-held terminals. Additionally, officials of the Kansas City Board of Trade and the Minneapolis Grain Exchange said that if the Chicago hand-held initiative is successful and the resulting system is affordable, the exchanges will consider the use of this automation on their trading floors.

The two remaining futures exchanges are not considering the use of automation initiatives. A representative of the Philadelphia Board of Trade said the Board has no automation plans for futures trading given the low volume traded on that exchange. At the time of our review, the Pacific Futures Exchange was not trading futures.

Exchanges Agree With the Need to Strengthen Security and Other Internal Controls

Our limited risk assessments of the automated trading systems and facilities planned for use by the Chicago Board of Trade and the Chicago Mercantile Exchange identified a number of areas where the exchanges needed to ensure that internal controls were strengthened before they implement their after-hours trading systems. The risks include weaknesses that could affect the security of the systems. In addition, the Commission also performed a limited risk assessment of the planned computer facility for the Chicago Mercantile Exchange's system and identified similar weaknesses. We have not disclosed the specific weaknesses in this report, because of the sensitive and proprietary nature of the systems, and because the systems were not fully developed.

Officials representing the exchanges said they would be taking steps to address identified weaknesses as part of their continuing systems' development efforts, which were on-going during our review. For example, the Chicago Mercantile Exchange hired an independent outside auditor to evaluate the risks associated with the operations of its system.

The Commission Moves to Strengthen Oversight of Automation Initiatives

The Commodity Futures Trading Commission has recently initiated several actions that respond to the recommendation in our September 1989 report that it acquire the technical expertise needed to assess exchanges' automation initiatives.⁶ These actions include (1) conducting technical assessments of planned automated trading systems, (2) evaluating operational systems as part of its rule enforcement reviews, (3) establishing a federal interagency task force to help the Commission determine its role and approach in assessing systems, (4) initiating plans to develop a formal policy for automated system assessments, (5) increasing program staff's oversight of automation, and (6) seeking additional technical resources.

We believe these recent actions by the Commission are good steps toward strengthening its oversight of automated systems.

Conclusions and Recommendations

Futures exchanges are developing systems intended to automate trade records, which can be used to better detect trading abuses. In this connection, we endorse the requirement in Senate legislation (S. 1729), pending in the Congress, that futures exchanges maintain independent, precise, and complete times for all trades. The exchanges could meet this requirement by using automation. However, it is unclear at this time how extensively exchanges will implement these systems.

The Chicago Board of Trade and the Chicago Mercantile Exchange are taking steps to correct security and other internal control weaknesses identified in our limited risk assessments of their after-hours trading systems. Because these steps have not been completed, it is too early to assess their effectiveness.

Because automation can improve trade records, we recommend that the Chairman of the Commodity Futures Trading Commission ensure that exchanges maximize to the extent practicable the potential of automated systems to accurately record trade times. We also recommend that the Chairman ensure that the Chicago Board of Trade and the Chicago Mercantile Exchange strengthen the security and other internal controls we identified in our limited risk assessments before their systems become operational.

⁶GAO/IMTEC-89-68, Sept. 7, 1989.

We discussed the contents of this report with senior officials of the Commodity Futures Trading Commission and the 14 U.S. futures exchanges, who generally agreed with the accuracy of the information presented. We have incorporated their comments in the report as appropriate. We also discussed the specific control weaknesses identified in our limited risk assessments with officials of the Commission and the respective exchanges.

As arranged with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the date of this letter. At that time we will distribute copies of this report to the Commodity Futures Trading Commission, the 14 U.S. futures exchanges, other interested members of Congress, other executive branch agencies, and the public. We will also make copies available to others upon request.

This work was performed under the direction of Howard G. Rhile, Director, General Government Information Systems, who can be reached at (202) 275-3455. Other major contributors are listed in appendix III.



Ralph V. Carlone
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Abbreviations

GAO	General Accounting Office
GGD	General Government Division
IMTEC	Information Management and Technology Division

Objectives, Scope, and Methodology

Our objectives were to (1) identify and provide information on the 14 U.S. futures exchanges' automated initiatives that could provide accurately timed trade records, (2) perform limited risk assessments of the after-hours trading systems being developed by the Chicago Board of Trade and the Chicago Mercantile Exchange, and (3) identify the steps taken by the Commodity Futures Trading Commission to assess exchanges' automation initiatives.

We limited the scope of this review to exchanges' automation initiatives and did not assess other means by which exchanges could maintain independent, precise, and complete trade records. In conducting our work, we discussed automation plans with representatives from each of the 14 exchanges. Specifically, we reviewed documentation of systems being planned by the Amex Commodities Corporation in New York, the Chicago Mercantile Exchange, the Chicago Board of Trade, the Commodity Exchange, Incorporated, in New York, and the New York Mercantile Exchange. During these visits, we discussed how the exchanges plan to develop and use automation. In addition, we obtained and reviewed information on their plans to (1) obtain accurately timed trading records, (2) detect trading abuses with accurately timed trade records, and (3) make the systems' use mandatory or optional for trading participants. We also requested information on system descriptions and implementation schedules.

We requested through telephone interviews information from officials of the nine other futures exchanges: the Chicago Rice and Cotton Exchange, the Coffee, Sugar, and Cocoa Exchange in New York, the Kansas City Board of Trade, the MidAmerica Commodity Exchange in Chicago, the Minneapolis Grain Exchange, the New York Cotton Exchange, the New York Futures Exchange, the Pacific Futures Exchange in Los Angeles and San Francisco, and the Philadelphia Board of Trade. We discussed their future plans for automation, including their interests in other exchanges' automation initiatives.

To perform our limited risk assessment of the after-hours trading systems under development by the Chicago Mercantile Exchange and the Chicago Board of Trade, we reviewed available systems' documentation, interviewed officials responsible for the facilities about planned internal controls including system security provisions, and performed an assessment of the facilities. We discussed the results of each assessment with officials of the Commodity Futures Trading Commission and the respective exchange.

We also interviewed the Chairman of the Commodity Futures Trading Commission and senior officials within the Commission's Division of Trading and Markets, Office of Information Resources Management, and Office of the Inspector General, and obtained available documentation in our review of the Commission's efforts to acquire the technical expertise needed to oversee exchanges' automation initiatives.

Our work was performed from November 1989 through July 1990, in accordance with generally accepted government auditing standards.

Four Exchanges' Planned Automated Trading Systems

Our review of automated trading systems being developed by four U.S. futures exchanges showed that three exchanges plan to use their systems for after-hours trading when their open-outcry markets close, while the fourth exchange plans to use its system during normal daytime trading hours. The systems are similar to the six foreign systems we reported on in April 1990, in that they are used to match and execute buy and sell orders received from exchange members and report the results of such trades.¹ As was the case with the foreign systems, we found that some differences exist in how systems receive customer orders and match trades.

The Chicago Mercantile Exchange and the New York Mercantile Exchange are developing systems that automatically execute trades submitted on system terminals by members when buy and sell prices coincide. These systems are designed to sort unexecuted buy and sell orders by price and time of receipt so that when the market moves to an available order price, the orders at this price are executed in the same sequence received by these systems. The systems will then automatically transmit trade results back to the members. The Amex Commodities Corporation and the Chicago Board of Trade plan similar processes, but each has some differences.

The Amex Commodities Corporation plans to use clerks at exchange locations to enter trade data received from exchange members rather than having the members directly enter their own data. This plan, however, is on hold because the firm originally selected to provide and manage the clerks has decided not to assume this role.

The system planned by the Chicago Board of Trade is not based on the automatic matching of orders at a common price, but instead is being developed to replicate the Board's open-outcry trading process. Buy and sell orders at the best prices are available for other members to execute against, and members can choose whom they execute against once the first order available at the best price is filled.

Table II.1 provides additional information obtained from the exchanges on the status of the four planned automated trading systems.

¹Futures Market: Information on Six Foreign Automated Trading Systems (GAO/IMTEC-90-43FS, Apr. 27, 1990)

**Appendix II
Four Exchanges' Planned Automated
Trading Systems**

**Table II.1: Four Exchanges' Plans for
Fully Automated Trading Systems**

Exchange name and system name	Status of development
Chicago Board of Trade Aurora	Planning to start software testing and user training, but the Board is also negotiating a unified system with the Chicago Mercantile Exchange. The unified system is intended to include a special role for Aurora and utilize the network and technology of Globex.
Chicago Mercantile Exchange Globex	Testing software and negotiating a unified system with the Chicago Board of Trade. According to the latest estimate, operation will begin in November 1990.
New York Mercantile Exchange Computer Assisted Trading System	Completed functional specifications. Requested proposals from vendors to develop the system.
Amex Commodities Corporation Amex Commodities Corporation Electronic System (ACCESS)	Completed development. Quality assurance testing and real-life testing are planned after selection of a firm to enter trade data received from exchange members.

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