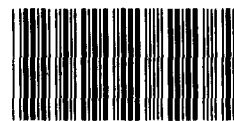
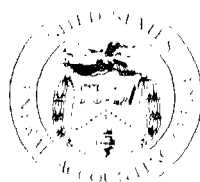


September 1990

# SECURITIES INDUSTRY

## Additional Testing Needed to Ensure Efficient Post-Trade Processing of Stocks



142303

---

---

**Information Management and  
Technology Division**

B-240523

September 26, 1990

The Honorable John D. Dingell  
Chairman, Committee on Energy  
and Commerce  
House of Representatives

Dear Mr. Chairman:

During the October 1987 market crash, the U.S. stock markets experienced backlogs in correcting problem trades, where buyers and sellers disagree on the terms of their transactions. The backlogs during the week of October 19, 1987, resulted in delays in determining market participants' financial obligations totalling over one billion dollars. This report responds to your June 27, 1989, request for information on (1) automated systems developed to correct problem trades more expeditiously; (2) the extent to which these systems have been tested to ensure that they can process increased work load volumes such as those experienced during the 1987 market crash; (3) the impact these systems will have on reducing the 5-day period needed to clear and settle stock trades; and (4) the role the Securities and Exchange Commission (SEC) played in reviewing and approving these systems.

As specified in your request, we reviewed the New York Stock Exchange's Overnight Comparison System, the American Stock Exchange's Intra-Day Comparison System, and the National Association of Securities Dealer's (NASD) Automated Confirmation Transaction System. As agreed with your office, we also reviewed the Redesigned Comparison System used by the National Securities Clearing Corporation (NSCC) because it plays a critical role in identifying problem trades and transmitting them to the stock markets for correction processing. These four systems are a collective effort by the exchanges, NASD, and NSCC to streamline the process for correcting problem trades. Details of our objectives, scope, and methodology appear in appendix I.

---

**Results in Brief**

The exchanges,<sup>1</sup> NASD, and NSCC are improving the post-trade processing of stocks. Specifically, they (1) implemented computer systems in the last year that process the results of each day's trading activity earlier than before, and (2) reduced reliance on inefficient manual correction

---

<sup>1</sup>For purposes of this report, the term exchanges refers to the New York Stock Exchange and American Stock Exchange.

---

processes. Consequently, these organizations have cut the time needed to correct problem trades from 3 days to 1 day. However, obstacles remain to reducing the overall time required to settle stock transactions. As a result, clearance and settlement still takes 5 days, and the risks to market participants and clearing organizations associated with waiting 5 days to receive payments remain.

We also found that the new systems used to improve clearance and settlement were not stress-tested to assess their capability to process anticipated peak work loads. Specifically, while these four organizations, to varying degrees, performed systems development tests prior to systems implementation, they did not fully test these automated systems in an operational environment that simulates extreme market conditions. For this reason, the securities industry and its participants cannot be completely assured that these new automated systems will be able to correct trades promptly and accurately during peak processing periods. However, since these systems were implemented, these organizations have tested or plan to further test their systems under high-volume transaction work loads.

With regard to SEC's role in reviewing the development and implementation of these systems, the commission has begun to strengthen its oversight. It has (1) issued an automation policy that recommends that the stock exchanges and NASD assess and test their systems' capacities and (2) established a group to assess compliance with the new policy. However, as we previously reported, the commission's oversight of automated systems remains superficial.<sup>2</sup> For example, SEC did not assess these systems during development and testing to ensure that the exchanges, NASD, and NSCC adhered to critical systems development practices. As a result, SEC cannot be certain that these systems can consistently process problem trades, especially during extreme market conditions.

---

## Background

Clearance and settlement takes place after trades have been executed and are the processes that traders use to complete their transactions. Clearance involves collecting and matching data on the terms of a trade—such as price—from traders who buy and sell stocks, and typically takes 1 day. Settlement is the process whereby buyers and sellers

---

<sup>2</sup>See *Financial Markets: Oversight of Automation Used to Clear and Settle Trades Is Uneven* (GAO/IMTEC-90-47, July 12, 1990), *Financial Markets: Tighter Computer Security Needed* (GAO/IMTEC-90-15, Jan. 5, 1990), and *Financial Markets: Preliminary Observations On The October 1987 Crash* (GAO/GGD-88-38, Jan. 26, 1988).

---

exchange funds for stocks traded, and generally takes 5 days. Because the two processes occur concurrently, completing them only takes 5 business days after the trade date. Prior to the implementation of the new automated comparison and correction systems, trades used to clear by the third day and settle on the fifth.

Clearance and settlement is performed by exchanges, NASD, and clearing organizations that work together to gather and compare trades and arrange for them to be settled by the traders. Most trades are successfully matched and settled without complications. Trades are matched using key elements of each transaction, such as stock price and quantity, to ensure that buyers and sellers each have accurate data and as such, agree to the terms of the trade. Disagreements between buyers and sellers on trade terms result in problem trades that must be resolved before the transactions can be cleared and settled.

The extraordinarily high trading volume during the 1987 market crash created backlogs and increased the number of problem trades. For example, before the crash, the normal percentage of unmatched trades on the New York Stock Exchange, the American Stock Exchange, and the NASD was 1.6, 2.4, and 5.7 percent, respectively. However, during the market crash, these percentages for the New York, American, and NASD more than doubled to 3.4, 5.5, and 12.8 percent, respectively. To resolve the October 1987 backlogs, the stock markets closed early for several days, and trading firms and exchange personnel worked evenings and weekends until the trade correction problems were eliminated. NASD also extended the operating hours of its automated correction system—the Trade Acceptance and Reconciliation System—to provide traders with more time to resolve their transactions, and NSCC provided trading firms with additional time to report corrected problem trades to the clearing corporation.

After the crash, the primary federal regulator of the stock markets (SEC); the President's Working Group on Financial Markets;<sup>3</sup> and an international private-sector group—called the Group of Thirty<sup>4</sup>—studied the manual trade correction processes and the 5-day period

---

<sup>3</sup>The Working Group on Financial Markets was created by the President in March 1988 to identify issues, make recommendations, and seek resolution of the complex problems raised by the crash. The Working Group is chaired by the Secretary of the Treasury, and its members include the Chairmen of the Commodity Futures Trading Commission, the Federal Reserve System, and the SEC.

<sup>4</sup>The Group of Thirty studied the clearance and settlement systems in the world securities markets and made recommendations to standardize these systems across international borders. The group's members are from the United States and other countries' financial services industries.

needed to clear and settle stocks and made recommendations for improving the clearance and settlement process in these two areas. SEC and the Working Group generally recommended that (1) exchanges automate their trade correction processes and (2) the securities industry shorten the 5-day period for stock clearance and settlement. The Group of Thirty recommended that, by 1992, trades be settled by the third business day after the trade.

## Securities Industry Has Implemented Computer Systems to Address Trade Correction Delays

In response to the trade correction problems experienced in October 1987, the stock exchanges, NASD, and NSCC developed and implemented computer systems that speed up the gathering, comparison, and correction of trade data. The four systems, their functions, and implementation dates are summarized in table 1 below.

**Table 1: Trade Comparison and Correction Systems, Primary System Functions, and Implementation Dates**

Organization	System name	Primary System Functions		Date of implementation
		Compares trade data	Corrects unmatched trade data	
American Stock Exchange	Intra-Day Comparison System		X	November 1989
National Association of Securities Dealers	Automated Confirmation Transaction System	X	X	February 1990
National Securities Clearing Corporation	Redesigned Comparison System	X		August 1989
New York Stock Exchange	Overnight Comparison System		X	July 1989

These systems enable these stock markets to compare and correct all trades, including problem ones, within 1 day after the trade date. NASD's system can perform these tasks even sooner in that trades can be compared and corrected on the same day they are executed.<sup>5</sup> By speeding up trade comparison and correction, these four systems offer the stock markets the capability to avoid the delays associated with correcting trades that were encountered during the 1987 crash. While these systems have yet to perform in an operational environment under extreme work load conditions, to date they have successfully processed problem trades within established time frames. A detailed description of how each system operates is included in appendix II.

<sup>5</sup>The American Stock Exchange designed its system so it could be modified in the future to compare and correct trades on their execution day.

## Tests to Assess Performance at Peak Work Volumes Have Not Been Completed

Testing systems to assess their ability to process data during periods of peak work load, commonly referred to as stress testing, helps identify and correct system weaknesses before they cause data processing disruptions in a live operating environment. For this reason, in November 1989, SEC issued a policy statement recommending that the stock exchanges and NASD, among others, conduct such tests.<sup>6</sup> We evaluated the extent to which these organizations had conducted stress tests to validate that each system and its market participants could process, within established time frames, peak work loads anticipated by these organizations during extreme trading periods. In each case, anticipated extreme work loads were in excess of those encountered during October 1987.

We found that none of these organizations conducted stress tests to simulate the behavior of systems and market participants in an operational environment with anticipated peak work load levels. While each organization, to varying degrees, conducted tests that provided them indications that their systems could process volumes roughly equal to or in excess of those experienced during the October 1987 crash, this testing failed to provide complete assurance that these systems could process such work loads. Specifically, the tests either did not validate that (1) system performance (including, for example, its response time) was acceptable; (2) the system could handle the number of corrections anticipated under extreme market conditions; (3) the system could support all users expected to be on the system; or (4) the system could process trade data simultaneously with other applications expected to coexist on the system. For example, before its system became operational, NSCC successfully demonstrated that it could process work loads in excess of those experienced during the October 1987 market crash. However, in this test, the system was dedicated solely to comparing trades and did not run the other major systems applications it normally executes simultaneously.

Officials from the exchanges, NASD, and NSCC said they did not conduct such tests because it is extremely difficult to accurately predict and simulate the post-trade processing environment during stressful market conditions. Further, it is expensive and time-consuming to coordinate the participation of all securities industry organizations and personnel involved in the post-trade processing of transactions. We agree that rigorous stress-testing of automated systems is complicated and not without costs. However, until these organizations conduct thorough

<sup>6</sup>See Securities and Exchange Commission Release No. 34-27445, 54 Fed. Reg. 48703 (1989).

---

stress tests, they cannot give market participants complete assurance that the new automated systems will be able to efficiently compare and correct trades during periods of extreme market activity.

Since these systems have been made operational, the organizations have taken or plan to take steps they believe provide additional assurance that these systems can handle increased work loads. Specifically, NSCC conducted another test that demonstrated its system could successfully process three times the trade comparison volume experienced during the October 1989 market break. This test included the operation of other major applications, that run simultaneously on the computer, at normal operating levels rather than those anticipated during increased market activity. The American Stock Exchange processed 2 normal days of unmatched trade data during a Saturday work session. Although this exercise did not fully validate the system's ability to handle anticipated high volume work loads, exchange officials believe it showed their system should be able to process increased work loads, and added that the exchange also recently supplemented the hardware in its system to further speed up the processing of such trades. NASD has also conducted stress tests to determine whether its system can operate at required work load levels. To date, these tests have shown that vendor-supplied software cannot consistently process anticipated high volume work loads. NASD is working with the vendor to correct the problem and plans to retest the system in the near future. New York Stock Exchange officials also plan to stress test their system in mid-September 1990 at work load levels anticipated by the exchange during extreme market conditions.

---

## **Additional System Development Weakness**

Because of the importance of following a structured systems development approach, in gathering information on system testing, we also documented the systems development practices followed by these organizations. Failure to follow a structured systems development approach can contribute to the development of systems that do not perform needed functions or cannot operate at required work load levels.<sup>7</sup> In this regard, we found that one organization overlooked certain critical systems development practices. Specifically, the organization did not

---

<sup>7</sup>Generally accepted systems development practices involve a structured, step-by-step process for developing, operating, and maintaining automated systems over their whole life. By using a structured approach, organizations (1) help assure automated systems are developed, evaluated, and operated in an effective manner at the lowest overall cost; (2) assure management accountability for the success or failure of the system's development; and (3) reduce the risk that the system will not operate as intended.



fully (1) assess system requirements and (2) project future system work load needs. These steps were omitted to more quickly develop and deploy the system. However, the system's implementation was postponed several times because the system did not perform at levels considered acceptable. Organization officials recognized that these delays were attributable to lax compliance with their systems development procedures and are now requiring systems personnel to follow structured systems development practices in developing all future automated systems.

## New Systems Will Help Shorten Stock Clearance and Settlement but Obstacles Remain

We also evaluated the role the automated comparison and correction systems will play in reducing the 5-day period for clearing and settling stock transactions. The potential benefits of reducing the 5-day cycle include (1) reducing payment risks and uncertainty by having the payment for and exchange of stock occur closer to the trade date; (2) coordinating the stock clearance and settlement process more closely with the 1-day clearance and settlement process in the options, futures, and government bond markets; and (3) increasing the efficiency and competitiveness of the U.S. securities industry in global financial markets. In this regard, the automated comparison and correction systems implemented by the exchanges, NASD, and NSCC represent progress toward this goal. Specifically, these systems have reduced the stock comparison and correction process from 3 days to 1. The 2-day reduction, fully implemented in February 1990, is attributable to (1) NSCC's faster processing system for matching trade data and (2) efficiencies gained by the exchanges' automating their trade correction processes and NASD's enhancing its automated trade correction capability.

However, while trade comparison has been reduced to 1 day, stock settlement still requires 5 days. Settlement remains at 5 days due to complex legal, financial, and other issues associated with shortening this process and reducing settlement risks. These issues include

- reducing the time required to bring physical stock certificates, especially those of small investors, to settlement by, for example, (1) accelerating the delivery of such certificates; (2) storing them in a central location and recording their movement among traders in book-entry form, or (3) eliminating the use of certificates entirely;
- cutting the time available to trading firms, large institutions (e.g., banks), and retail customers to arrange for (1) trade confirmations and (2) payments and bank financing of certain security purchases or delivery obligations;

- speeding up the availability of settlement payments by increasing reliance on same-day funds transfers, along with eliminating payments by checks that do not allow funds to be available until the next day; and
- determining whether related federal and state laws and regulations requiring the use of physical stock certificates and allowing a 5-day settlement period, for example, would need to be modified.

As of August 1990, a working committee of U.S. securities and banking representatives is studying these areas in detail, with the goal of proposing a strategic plan that the securities industry can follow to reduce the settlement process to 3 days.<sup>8</sup> Specifically, the working committee plans to survey stock clearance and settlement organizations to determine the feasibility and acceptability of modifying the stock settlement process, including analyzing the capability of certain existing automated settlement systems used in the clearance and settlement process to operate under an accelerated 3-day settlement schedule. The working committee expects to complete its study and strategic plan by late fall, at which time it hopes to involve the SEC, the Federal Reserve System, and the stock clearance and settlement organizations in implementing the necessary changes to reduce the entire process to 3 days. In this connection, the working committee briefed SEC on its efforts, and the commission is considering holding a conference in November 1990 with stock clearance and settlement organizations to discuss the issues associated with making the change to a 3-day settlement process.

## SEC Has Not Fully Ensured That Trade Comparison and Correction Systems Are Technically Sound

Active federal oversight of the use of computers is critical to ensuring that these systems have sufficient capabilities and controls in place to compare and correct trades promptly and accurately. In this regard, SEC has taken steps to help ensure that certain securities industry organizations establish capacity planning and vulnerability assessment programs for automated systems and networks. However, SEC's direct oversight in assessing automated systems remains superficial.

SEC officials informed us that when the comparison and correction systems were being developed, they (1) visited the involved organizations to gain a better understanding of how the systems would work and where the processing would occur and (2) requested from the exchanges and NSCC written certifications that their systems were designed to process work loads such as those experienced during the October 1987

<sup>8</sup>This committee is the U.S. contingent of the Group of Thirty and is working to implement the Group of Thirty's recommendations in the United States.

market crash. However, as we have previously found in related financial market reviews, SEC oversight excludes direct technical assessments of systems during critical development and deployment phases.<sup>9</sup> For the four systems we examined, for example, SEC's review was not designed to validate that these organizations had taken adequate steps to ensure that these systems (1) have the capacity to support timely operations under normal and high-volume conditions; (2) have controls in place to prevent unauthorized access and misuse; (3) are able to provide continuous service in the event of equipment and software failures, natural disasters, and intentional malicious acts; and (4) have adequate controls to ensure that the systems' hardware, software, and communications will perform as intended.

In discussing the need for more in-depth assessments, SEC officials explained that the commission does not have sufficient technical expertise and relies on the exchanges, NASD, and the clearing organizations to ensure the soundness and integrity of their own systems. This superficial systems oversight by SEC reduces the public's assurance that these systems have sufficient capabilities and controls in place to process trades in a prompt and accurate manner. In addition, it also raises questions about the strength of the federal regulator's oversight in this area and highlights the need for the commission to do more in the automated systems area.

Since these four systems were developed, SEC has begun to increase its ability to oversee the automated systems and telecommunications networks used by certain organizations in the securities industry. Specifically, the Commission issued an automation review policy in November 1989 that asks certain securities industry organizations to establish comprehensive capacity planning and vulnerability assessment programs for their automated systems and networks. In addition, SEC established an automation review group in April 1990 and plans to provide it with technical staff in the third quarter of 1990 with the expertise to (1) assess compliance with its automation policy and (2) assist commission staff, as needed, in addressing technical issues during oversight processes.

<sup>9</sup>See GAO/IMTEC-90-47, July 12, 1990; GAO/IMTEC-90-15, Jan. 5, 1990; and GAO/GGD-88-38, Jan. 26, 1988.

---

## Conclusions and Recommendations

Progress is being made in the stock markets to improve the efficiency and timeliness of post-trade processing activities. The exchanges, NASD, and NSCC have streamlined the trade comparison and correction process, which has enabled the securities industry to cut this process by 2 days. We are also encouraged by the efforts of the Group of Thirty, the securities industry, and the regulators to shorten the overall settlement process. However, until more action is taken, the payment risks associated with stock traders and clearing organizations waiting 5 days to exchange payments for stocks are still present. In addition, SEC is beginning to take positive steps to increase its oversight of the use of automation in the stock markets. However, more needs to be done to help assure market participants that trade comparison and correction systems are designed to operate smoothly during periods of market stress. Although these systems have operated well since they have been implemented, stress-testing has not been completed to ensure that they can handle extreme market activity, and one organization overlooked critical systems development practices when developing its system.

Accordingly, we recommend that the Chairman, SEC, ensure that (1) the New York Stock Exchange, the American Stock Exchange, NASD, and NSCC conduct complete stress tests to demonstrate that their trade comparison and correction systems can handle increased work loads anticipated during peak trading periods and (2) all organizations follow structured systems development practices when developing automated systems.

---

## Agency Comments and Our Evaluation

We discussed the contents of this report with senior officials from the New York Stock Exchange, the American Stock Exchange, NASD, and NSCC. We also discussed it with responsible SEC officials and a representative from the Group of Thirty's U.S. working committee. We have incorporated their comments where appropriate. Except as noted below, these officials generally agreed with the contents of our report.

SEC staff reiterated that the 1987 market break experience revealed the need for further automation of the trade comparison and correction processes. They added that acceleration of the trade comparison function to a next-day basis, coupled with automating the trade correction processes, significantly addresses the trade correction deficiencies identified during the 1987 break. Commission staff also believe that the implementation of these systems, based on reasonable development testing along with complete stress-testing after deployment, provides considerable immediate benefit to market participants at minimal

---

market risk. We agree that significant progress has been made in addressing the trade correction problems that occurred during the 1987 market crash. However, we believe that thorough stress-testing should be performed on new automated systems to help ensure that they are appropriately designed to handle work loads anticipated during extreme trading periods.

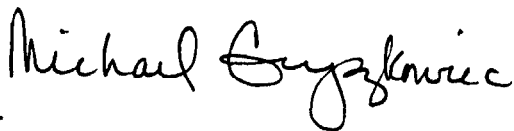
Additionally, SEC staff questioned the need for the commission to use its scarce resources to perform direct technical assessments described in this report and others when independent assessments and internal evaluations currently are performed by or on behalf of the exchanges, NASD, and the clearing corporations. We continue to believe that, given the important role automation plays in the securities markets, SEC needs to be more directly involved in reviewing and assessing the markets' use of automation.

---

We are providing copies of this report to other interested members of Congress, legislative and 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.

Sincerely yours,

  
for  
Ralph V. Carlone  
Assistant Comptroller General

---

# Contents

---

Letter	1
Appendix I Objectives, Scope, and Methodology	14
Appendix II Description of Comparison and Correction Systems	16
Appendix III Major Contributors to This Report	18
Table	4

Table 1: Trade Comparison and Correction Systems,  
Primary System Functions, and Implementation  
Dates

---

## Abbreviations

GAO	General Accounting Office
GGD	General Government Division
IMTEC	Information Management and Technology Division
NASD	National Association of Securities Dealers
NSCC	National Securities Clearing Corporation
SEC	Securities and Exchange Commission



---

# Objectives, Scope, and Methodology

---

Our objectives were to provide information on computer systems used to reconcile market participants' trades executed on three major U.S. stock markets—the New York Stock Exchange, the American Stock Exchange, and the National Association of Securities Dealers (NASD). Specifically, our objectives were to (1) provide information on automated systems developed by these stock markets to more easily correct problem trades; (2) assess the extent to which these systems have been tested to ensure that they can process increased work load volumes such as those experienced during the 1987 market crash; (3) determine the impact these systems will have in reducing the 5-day period needed to clear and settle stock transactions; and (4) assess the role that the Securities and Exchange Commission (SEC) played in reviewing and approving the use of these systems. Because of the important role the National Securities Clearing Corporation (NSCC) plays in gathering trade data from market participants trading on the stock markets and identifying those problem trades needing correction, we also reviewed a redesign of the automated comparison system used by the clearing corporation.

To determine the development status of these systems and to understand how they operate, we obtained available systems development documentation and met with senior officials at the New York Stock Exchange, American Stock Exchange, NASD, and NSCC. We also toured these organizations' computer and trade reconciliation facilities and observed demonstrations of the systems' capabilities. Further, we observed at the exchanges and NASD how traders use the systems to correct trades in a live working environment.

In looking at testing of these systems to ensure that they can process the increased work load volumes, we reviewed generally accepted systems development criteria and federal rules, regulations, and policies to determine the systems performance tests that should be performed when developing and implementing computer systems. We met with and discussed this issue with senior exchange, NASD, and NSCC officials. We also reviewed their systems development documents on testing, including any test plans, to assess the degree of testing performed to demonstrate that these systems would be able to process increased work loads in a prompt and accurate manner. Additionally, because of the importance of following a structured systems development process, we reviewed other systems development documentation to assess whether these organizations had adhered to generally accepted practices in developing their systems. In this connection, we reviewed and evaluated available performance statistics on these systems, such as response times and



volumes processed, to determine whether the systems were processing trade data at intended performance levels.

To assess the role of SEC in reviewing and approving these systems, we met with responsible commission officials to discuss and document how they processed the exchanges', NASD's, and NSCC's requests to develop and implement these automated systems, including what technical assessments they had performed before approving their use. We also reviewed the requests—called rules—submitted to SEC by the exchanges, NASD, and NSCC to develop and implement these systems, along with any relevant industry comments. In addition, we reviewed and discussed with appropriate SEC officials the commission's automation review policy and documented SEC plans to establish a group to oversee compliance with this policy.

With regard to the impact these systems will have on shortening the 5-day clearance and settlement period for stocks, we obtained information from senior SEC officials on how the systems will affect the 5-day period. In addition, we discussed this issue with representatives from (1) the Group of Thirty committee responsible for implementing in the U.S. the group's recommendation for shortening the clearance and settlement process and (2) the Securities Industry Association. Further, we obtained and evaluated the views of senior exchange, NASD, and NSCC officials.

We conducted our review in accordance with generally accepted government auditing standards, between August 1989 and July 1990.

---

# Description of Comparison and Correction Systems

---

The following describes NSCC's comparison system and the exchanges' and NASD's correction systems and includes a brief description of how the systems operate.

NSCC's redesigned system compares trades and identifies unmatched trades faster than its old system. Specifically, the redesigned system compares traders' transaction data, identifies unmatched trades, and transmits this information electronically to the exchanges' correction systems before the start of the next trading day.<sup>1</sup> In the past, NSCC could not complete these processing activities until the end of the day after the trade execution date. The redesigned system involved extensive modifications to the computer system and data processing schedule used by the clearing corporation to compare trades. The primary modifications involved (1) the development of new software to process post-trade data more quickly and efficiently and (2) new requirements placed upon traders to submit their data earlier than under the previous system.

The New York Stock Exchange's and the American Stock Exchange's correction systems—called the Overnight Comparison System and the Intra-Day Comparison System, respectively—are similar in that they consist of a network connecting a central computer to terminals. Specifically, the New York Stock Exchange system consists of a mainframe computer with 470 terminals, while the American Stock Exchange's system uses a minicomputer with 70 terminals. Located at the exchanges and at traders' offices, the terminals (1) receive unmatched trade data from NSCC before the start of the next trading day and (2) allow traders to more quickly correct unmatched trades. Once such data is successfully matched—that is, when traders agree to the terms of the transactions—the correction systems electronically transmit the trades to NSCC at the end of the day to be prepared for settlement.

NASD's system—the Automated Confirmation Transaction System—also consists of an extensive network of computer terminals and minicomputers that are used by NASD traders to correct unmatched trades.<sup>2</sup> However, unlike the exchanges, NASD's system can also compare and match trades within minutes after execution. Specifically, NASD requires

---

<sup>1</sup>NSCC used to compare trades executed on the exchanges and by NASD. However, since NASD's new system compares trades, NSCC no longer performs such comparison processing for NASD.

<sup>2</sup>NASD has over 3,000 terminals capable of accessing the Automated Confirmation Transaction system. These terminals can also be used to access other NASD automated trading and support systems. Conversely, the terminals of the exchange correction systems are devoted solely to trade correction activities.

---

**Appendix II  
Description of Comparison and  
Correction Systems**

---

traders, after executing trades, to enter their trade data directly into the new system for it to be compared and matched, rather than having NSCC perform this step. NASD rules require traders to enter their transactions into the system during the trading day, within 90 seconds of each trade's execution. The trade information is immediately transmitted to the other party for verification or correction. When no differences exist, or after traders resolve inconsistencies, the system automatically matches the trades, and NASD transmits daily the matched trade information to NSCC to be prepared for settlement.<sup>3</sup> As a result, NASD trades can be matched and compared on the same day they are executed.

---

<sup>3</sup>When differences exist, NASD requires traders to resolve them by 1:00 p.m. of the next trading day. Trades not responded to by the opposite party within this time frame are automatically matched by the system and transmitted to NSCC for settlement. Trades rejected by the other party are automatically deleted from the system.

---

# Major Contributors to This Report

---

**Information  
Management and  
Technology Division,  
Washington, D.C.**

**Richard J. Hillman, Assistant Director  
William D. Hadesty, Technical Assistant Director  
Gary N. Mountjoy, Project Manager  
Gregory P. Carroll, Staff Evaluator**

---

**New York Regional  
Office**

**Bernard D. Rashes, Senior Evaluator  
Garry Roemer, Deputy Project Manager  
Daniel P. Schultz, Staff Evaluator  
Diana Gershon, Staff Evaluator**

---

### Ordering Information

The first five copies of each GAO report are free. Additional copies are \$2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

U.S. General Accounting Office  
P. O. Box 6015  
Gaithersburg, MD 20877

Orders may also be placed by calling (202) 275-6241.

United States  
General Accounting Office  
Washington, D.C. 20548  
Official Business  
Penalty for Private Use \$300

First-Class Mail  
Postage & Fees Paid  
GAO  
Permit No. G100