

GAO

Report to the Chairman, Securities and
Exchange Commission

January 1992

STOCK MARKETS

Information Vendors Need SEC Oversight to Control Automation Risks





United States
General Accounting Office
Washington, D.C. 20548

Information Management and
Technology Division

B-246404

January 29, 1992

The Honorable Richard C. Breeden
Chairman, Securities and Exchange
Commission

Dear Mr. Breeden:

This report is the result of our continuing work reviewing the automated operations that support our nation's financial markets. We previously reported on the need for stock markets to control the weaknesses found during our risk assessments of their automated operations, and for the Securities and Exchange Commission (SEC) to aggressively establish the technical oversight capabilities to oversee or perform assessments of controls over such operations.¹ This report addresses the results of our risk assessments of the automated operations of stock market information dissemination vendors, and SEC's involvement in assessing such operations.

Timely and accurate automated operations are vital to the fair and orderly functioning of the stock markets. The importance of these operations was powerfully demonstrated during the 1987 stock market crash, when trade execution system failures caused backlogged orders, resulting in investors' inability to trade at quoted prices. This led to needless market uncertainty and reduced investor confidence in the functioning of the markets. Although information dissemination vendors were not the cause of these market failures, they have a critical market role in using automation to transmit data on stock prices and quotes to investors. Because of their important role, we assessed how selected vendors' control automation risks that could disrupt the flow of vital stock market data to investors.

We focused our risk assessments on the automated operations of 7 of 33 large and small vendors who obtain data from the New York Stock Exchange and disseminate this data. Because of the competitive nature of the information dissemination industry and the sensitivity of weaknesses found, this report does not identify the vendors assessed. However, it does address vendors' vulnerability to automation risks and identify the types and numbers of weaknesses found. Appendix I provides details of our objectives, scope, and methodology.

¹Financial Markets: Active Oversight of Market Automation by SEC and CFTC Needed (GAO/IMTEC-91-21, Apr. 2, 1991) and Financial Markets: Computer Security Controls at Five Stock Exchanges Need Strengthening (GAO/IMTEC-91-56, Aug. 28, 1991).

Results in Brief

Our risk assessments of seven information dissemination vendors' computer facilities found all to be unnecessarily vulnerable to automation risks—risks that could obstruct the correct processing of data and the responsiveness, security, and continuity of their critical stock market operations. The 81 weaknesses uncovered raise concerns that vendors have not adequately controlled automation risks; further, such weaknesses call into question how high a priority the vendors are placing on identifying and controlling such risks.

While SEC has a responsibility to ensure the availability of stock market information to the investment community, it has, because of resource limitations, focused its attention on other segments of the market it believes are more important. These include the information dissemination activities of exchanges such as the New York Stock Exchange. Since the weaknesses we found in information dissemination vendors' systems could result in the obstruction of the continual flow of this information to investors, this report is recommending that SEC take steps to maintain this vital flow of information.

Background

The automated systems operated by information dissemination vendors provide stock market investors throughout the world with almost instantaneous access to price quotations for the purchase and sale of stocks, last sale prices, and number of shares traded. This information is used by the investment community—brokerage firms and institutional investors—to make investment decisions, such as when to buy and sell stocks.

Recognizing the importance of stock market quote and price data, the Securities Exchange Act of 1934, as amended, specifies that it is in the public interest to assure the availability of such data for the investment community. It also distinguishes between securities information processors, who have exclusive rights to collect data at an exchange, and nonexclusive processors—information dissemination vendors—who obtain the data from exclusive processors and distribute them to the financial community.

Under the act, exclusive processors must register with SEC.² Approval for registration requests is based on the applicants' ability to accurately, promptly, and reliably perform their functions.³ These processors are also subject to SEC's automation review policies, which encourage them to follow its guidance on controlling automation risks. Although the act notes that nonexclusive processors are exempt from SEC registration, the Commission has oversight authority over them. For example, the act authorizes the Commission to require such information dissemination vendors to register if it determines that registration is necessary or appropriate in the public interest, for the protection of investors. Registration, however, is not a prerequisite to other oversight activities. The Commission, for example, can promulgate automation policies for them as it does for the exclusive processors.

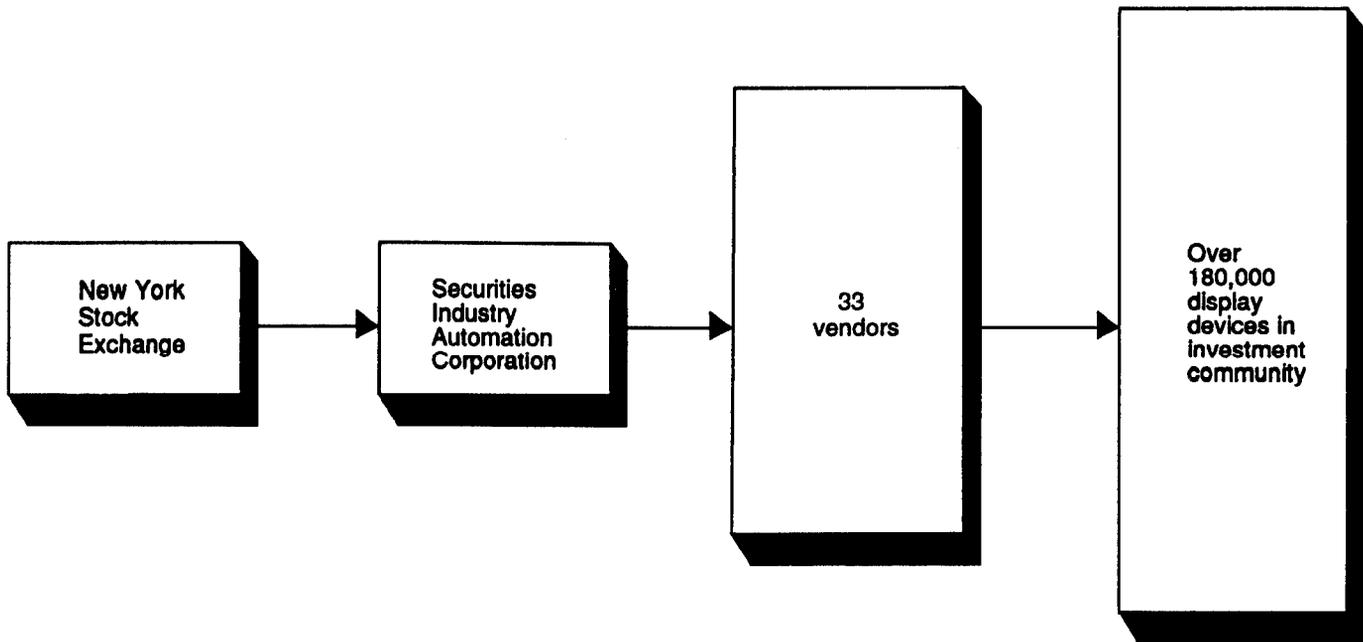
The seven vendors reviewed are among 33 that receive real-time market data provided by the Securities Industry Automation Corporation, the exclusive information processor for New York Stock Exchange-listed securities.⁴ This vendor community disseminates the real-time data to over 180,000 display devices and computers used by exchanges, brokerage firms, and others. It also disseminates data on other domestic and foreign markets. Figure 1 illustrates the flow of market information from the New York Stock Exchange to the investment community.

²Registration of securities information processors requires that processors provide SEC with detailed documentation on their business organization, financial condition, operational capabilities, and access to services.

³Other exclusive processors registered with SEC include the Securities Industry Automation Corporation, the National Association of Securities Dealers Automated Quotation Service, and the Options Price Reporting Authority.

⁴The Securities Industry Automation Corporation data also include information from other U.S. stock exchanges.

Figure 1: Dissemination Flow of Stock Market Information From the New York Stock Exchange To Investors

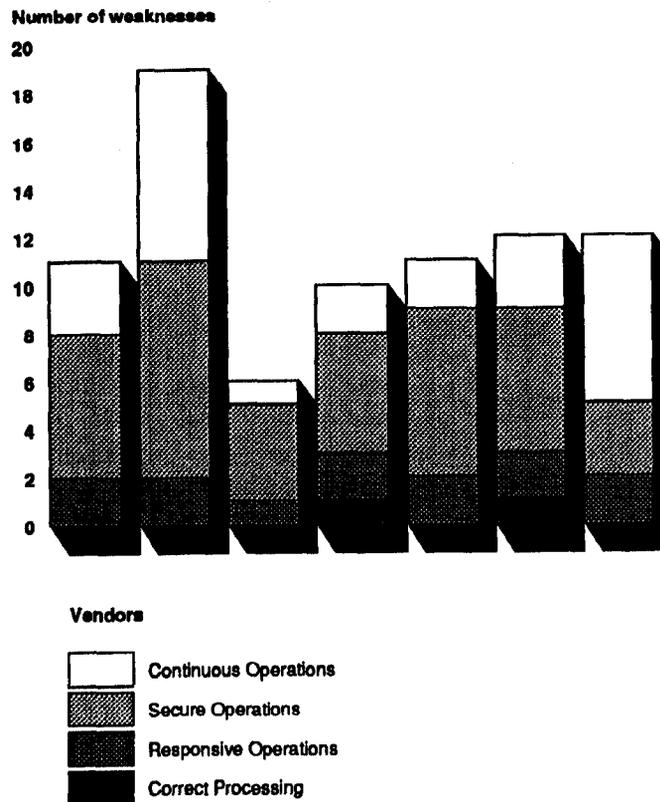


Weaknesses in Systems Used by Information Vendors

Our review of the automated operations of seven vendors found that each had six or more weaknesses that could impair (1) the correct processing of data, (2) the responsiveness of operations, (3) the security of operations, and (4) the continuity of operations.⁵ These weaknesses unnecessarily expose these vendors to risks that can threaten their ability to distribute accurate, reliable, and timely stock market data. Figure 2 illustrates the extent of the 81 weaknesses found, and the vendors' operations that are at risk.

⁵In assessing whether vendors had weaknesses that could impair their computer operations, we used as criteria our policy on assessing the reliability of computer-processed data, and federal standards and guidance from Federal Information Processing Standards publications of the National Institute of Standards and Technology.

Figure 2: System Weaknesses That Could Impair Seven Vendors' Operations and Processing



Although the seven vendors did not always agree that the weaknesses found were serious, they generally agreed with the need to control automation risks. Some were concerned that the weaknesses found could result in SEC's taking steps to require them to register with the Commission. They believe that this degree of oversight is not warranted, and that vendors should first be given the opportunity to voluntarily enhance their controls before being subjected to SEC's registration process.

Weaknesses Can Threaten Correct Processing of Data

Vendors need to ensure that their system hardware, software, and communications perform as intended. The lack of adequate controls in this area can result in data being processed incorrectly or being transmitted to selected users on a less timely basis. Two weaknesses were found in this area. One vendor did not adequately document and review changes to its operating system software; the other lacked the quality-assurance function needed to adequately test system changes. Such weaknesses can introduce

undetected software flaws that can affect the correct processing of stock market information.

**Weaknesses Can Obstruct
Responsiveness of
Operations**

Automated systems need to be properly sized and designed by vendors to support the timely dissemination of information under both normal and high-volume conditions. Weaknesses in sizing and designing systems could result in investors not being able to obtain the most recent stock prices and quotes, needed to make timely investment decisions. The seven vendors reviewed had 13 weaknesses that could obstruct responsive operations because they were exposed to risks associated with inadequate transmission, processing, and storage capacities. For example, none of the vendors conducted tests to simulate the behavior of their systems in an operational environment equivalent to the peak trading volumes anticipated by the New York Stock Exchange. Additionally, only one had a formal capacity plan to define maximum system work-load requirements, current system capabilities, and system enhancements needed to reach defined requirements.

**Weaknesses Can Inhibit
Security of Operations**

Controls must be established by vendors to protect their automated systems from unauthorized access and misuse. Forty weaknesses were found that pose threats to the security of vendors' operations. These weaknesses could result in the vendors being unable to adequately protect their automated operations from threats that could disrupt or discontinue normal operations. For example, only one of the vendors had adequate locks, guards, and surveillance cameras to control access to its computer facility. The other six did not have adequate controls to protect against such risks as sabotage, physical threat, and unauthorized data manipulation. In this regard, four of the vendors had neither risk assessments nor independent reviews performed on their automated operations.

**Weaknesses Can Disrupt
Continuity of Service**

In the event of equipment and software failure, natural disaster, or intentional malicious act, computer facilities should have controls in place to avert service disruption. In this area, 26 weaknesses were found. For example, six vendors lacked contingency plans needed to ensure that their systems could conduct normal operations under conditions such as flood, fire, or electrical outage. In addition, combustible or flammable materials were evident at three of the vendors' computer facilities. Further, only two vendors had off-site backup facilities in place to assume automated operations if their primary systems failed.

SEC Has Taken Little Action to Oversee Vendors

SEC has taken a hands-off approach to overseeing vendors' automated systems. Although SEC officials have informed selected vendors of the automation review policies it issued for exclusive processors, it has not taken steps to issue similar policies for vendors. We also found that SEC does not maintain a list of all vendors, and that not all vendors are aware of SEC's oversight authority.

SEC issued policy statements in November 1989 and May 1991 for stock markets and exclusive securities information processors that address the need for capacity and contingency planning, risk assessments, and independent reviews of automated systems. Although these policy statements were not specifically directed to vendors, an SEC official said that footnotes were included in these statements to forewarn vendors and other market organizations of the need to control automation risks. The official also noted that large vendors were sent copies of the May 1991 statement.

The footnote in the November 1989 policy statement notes that while the obligation of vendors and other market organizations is not directly discussed, these organizations should engage in systems testing and use the policy statement as a guideline, and that SEC would review their systems in the coming months. The May 1991 policy statement also has a footnote saying that the approach outlined in the statement merits consideration by these organizations.

SEC's Division of Market Regulation has not reviewed vendors' automated systems. Instead, its Office of Automation and International Markets has focused its staff resources on the automation policies of other market segments (i.e., stock markets and clearing organizations). Division officials said they have informally discussed the automation review policies issued to other market segments with some of the vendors during conferences and meetings. However, no attempts were made to discuss these policies with all vendors.

SEC's efforts have been insufficient to ensure that all vendors are aware of SEC's oversight authority. Further, two vendors questioned whether SEC even had the authority to review their automated systems.

Conclusions

Timely, accurate, and reliable stock market data provide investors with a level of certainty about ongoing market conditions. This is especially important under volatile market conditions, when stock prices and quotes are rapidly changing. Although we did not review the vendor industry as a whole or the investor community's susceptibility to inaccurate, unreliable, and untimely data, the weaknesses we found during this review are disturbing. They suggest that vendors are unnecessarily vulnerable to automation risks that could result in the obstruction of the continual flow of this critical market data to investors. The SEC needs a better understanding of the effect of these vulnerabilities on the functioning of the markets.

Recommendations to the Chairman, Securities and Exchange Commission

Because of the importance of maintaining the flow of vital information between stock markets and investors, we recommend that, as part of its oversight responsibilities, the Commission:

- Identify all information dissemination vendors and inform them of the Commission's oversight responsibilities.
- Inform such vendors of the policies they should follow to address automation risks, including controls to ensure the correct processing of data and responsive, secure, and continuous operations.
- Determine whether vendors' automation practices are having an adverse effect on the investment community. This could be accomplished by such steps as analyzing the effect of system failures and potential system failures on investors and assessing whether investors view vendors' security weaknesses as posing a substantial risk to them.

Upon completion of these actions, SEC should decide whether further oversight actions should be taken.

Agency Comments and Our Evaluation

In a letter responding to a draft copy of this report, the Director of the Commission's Division of Market Regulation said the division would develop and maintain a list of all information dissemination vendors and provide them with the automation policies the Commission has issued thus far. Given its scarce resources, the Director stated, the Commission has focused its efforts to oversee the automated information dissemination and trading systems operated by the self-regulatory organizations (e.g., stock exchanges and clearance and settlement organizations) and exclusive securities information processors. He also said that the weaknesses at some vendors are not significant since they supply data to a limited number of customers.

The Commission's decision to first oversee the automated systems used by self-regulatory organizations and exclusive securities information processors is understandable. However, our review demonstrates a need for SEC to also oversee the automated systems used by information dissemination vendors, who provide a vital link to the investor community. Although some vendors may not be as significant as others to that community, system weaknesses can still affect investors who rely on their services. To protect investors, policies and procedures developed by SEC should stipulate when different vendors are allowed to operate with certain automation weaknesses, and make the investment community cognizant of these vendor limitations.

As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of this letter. A written statement must also be submitted to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of this letter.

We are providing copies of this report to the Chairman of the Senate Committee on Banking, Housing, and Urban Affairs and the Chairman of the House Committee on Energy and Commerce, and to other interested members of the Congress and the public. We will also make copies available to others upon request.

Our work was performed in accordance with generally accepted government auditing standards, between March and October 1991. This work was performed under the direction of Howard G. Rhile, Director, General Government Information Systems, who can be reached at (202) 336-6418. Major contributors to this report are listed in appendix II.

Sincerely yours,



Ralph V. Carlone
Assistant Comptroller General

Objectives, Scope, and Methodology

Our objectives were to assess the adequacy of controls in place to protect against automation risks at seven information dissemination vendors who transmit stock market data to investors, and to identify SEC's role in overseeing the automated operations of such vendors. To assess these controls, we conducted risk assessments and categorized the weaknesses into four general areas that can be impaired: (1) the correct processing of data, (2) the responsiveness of operations, (3) the security of operations, and (4) the continuity of operations. Our risk assessment incorporated questions and control tests from our policy on assessing the reliability of computer-processed data,¹ and federal standards and guidance from Federal Information Processing Standards Publications of the National Institute of Standards and Technology.

We judgmentally selected 7 of the 33 vendors who disseminate New York Stock Exchange data. Four were selected from the 10 largest vendors (i.e., these 10 account for over 80 percent of all terminals receiving New York Stock Exchange market data); the other 3 were selected from the remaining 23 vendors. Our objective was to choose a mix of large and small vendors.

Our work was performed in accordance with generally accepted government auditing standards, between March and October 1991. We obtained comments on a draft of this report from the Securities and Exchange Commission and the seven information dissemination vendors, and have incorporated those comments where appropriate.

¹Assessing the Reliability of Computer-Processed Data (GAO/OP-8.1.3, September 1990)

Major Contributors to This Report

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

Leonard Baptiste, Jr., Assistant Director
William D. Hadesty, Technical Assistant Director

**New York Regional
Office**

Garry Roemer, Evaluator-in-Charge
Bernard D. Rashes, Senior Evaluator
Jeffrey Shapiro, Staff Evaluator
Lynn P. Weiskopf, Staff Evaluator



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