United States General Accounting Office

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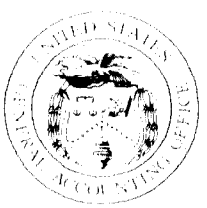
Report to the Deputy Commissioner, Operations, Social Security Administration

June 1989

SOFTWARE MAINTENANCE

SSA's Use of Its Software Measurement Package



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

Information Management and
Technology Division

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June 15, 1989

Mr. Herbert R. Doggette, Jr.
Deputy Commissioner, Operations
Social Security Administration

Dear Mr. Doggette:

We have completed a review of certain maintenance activities for the batch computer programs[1] supporting the Social Security Administration's (SSA) Retirement, Survivors, and Disability Insurance Benefit system. In October 1986, SSA set up a project to improve the quality of its batch programs. A key part of this project involved acquiring an automated software measurement package to help SSA evaluate the quality of these programs and to determine what changes, if any, subsequent maintenance[2] has on program quality. When properly implemented, the package can help managers and programmers by providing (1) comprehensive information to determine if programming standards are being applied and followed, and (2) feedback on the effects of maintenance. The package produces data on the current condition of programs and by periodically reviewing the same program with the package, managers and programmers can determine whether later maintenance has affected the program's quality.

Our objective was to determine how SSA was using the package to assess and improve software quality. We focused our review on SSA's use of the package to measure the quality of batch programs for three reasons. First, batch programs are an important part of SSA's computer systems and are central to processing millions of retirement checks every year. During fiscal year 1988, these programs processed retirement checks totaling about $215 billion to over 38 million people. Second, SSA has stated, and we have previously reported,[3] that the poor quality of these programs makes them difficult to understand and maintain. Third, SSA's plan to replace these programs has been delayed until the mid-1990s.

[1]The term batch refers to a system that collects transactions in groups for later processing.

[2]We use the term maintenance to refer to a wide range of changes made to programs including correcting errors, making changes required by legislation (for instance, changing the cost-of-living allowance in benefit calculations), upgrading to a newer version of the computer language used in the program, and improving the program so that it operates more efficiently.

[3]Social Security Administration's Computer Systems Modernization Effort May Not Achieve Planned Objectives(GAO/IMTEC-85-16, Sept. 30, 1985), and Software Systems: SSA Encountering Significant Delays in Its Claims Modernization Project (GAO/IMTEC-87-8, Dec. 22, 1986).

Because of this delay, SSA must maintain and improve its current batch programs.

The agency's stated objective in acquiring the package was to use it to help improve agency software. To meet this objective, SSA began using the measurement package in 1987 to periodically gauge the quality of its batch programs. Our analysis of the package's results show that, as of September 1988, 1,992 of the 2,441 retirement system programs evaluated did not meet SSA's quality standards for batch programs. The package found indications that programs were poorly organized and that their logic was complex, making them potentially difficult to understand, and increasing maintenance time and cost.

Although SSA has been using the package to identify problems, we found that the agency does not have specific guidance for using the package's results to help improve program quality. Specifically, SSA has not issued written guidance to help ensure that the package and its results are consistently used by managers and programmers. Rather than specific written guidance, SSA officials told us on May 8, 1989, that the agency has been incorporating goals for improving these programs into the merit pay contracts of officials responsible for these programs. Including improvement goals in merit pay should result in better and increased usage of the package and its results. However, in our opinion, developing specific written guidance offers the agency a better opportunity to consistently use the package to improve the agency's batch programs.

We also found that SSA has not developed a complete inventory of its batch programs, so it is not in a position to know if all batch programs are being measured by the package and whether programs in most need of improvement have been identified. Further, we found that SSA programmers were changing the names of batch programs when maintenance was performed on them. In order to measure changes in program quality, the package must be able to consistently track a program by name over time.

SSA managers generally agree with our assessment, with the exception of developing specific written guidance mentioned above, and have initiated a two-phased approach to improve the situation. First, complete information on all of the agency's batch programs is being developed so that the agency will have a starting point from which to measure changes in program quality over time. Second, a new agencywide naming standard for batch programs is being developed that will allow the agency to correlate and compare original program measurements with

subsequent program measurements. SSA expects the new standard to be implemented by September 1989. To assist you in your review of the agency's program to improve the quality of batch programs, we are providing some details on the issues summarized above.

Batch Programs Are Poorly Structured

One important measure of a computer program's quality is how well it is structured. A well-structured program is clearly organized; its logic is apparent and easily understood by a programmer. As a result, the program can be modified, enhanced, or corrected with reasonable cost, effort, and risk. By contrast, a poorly structured program is not well organized; its logic is complex, making it difficult to understand, and increasing maintenance time and cost.

Between June 1987 and September 1988, SSA periodically evaluated the quality of the batch programs supporting its retirement system using a software measurement package. We analyzed the package's evaluation of these programs as of September 1988, and found that 1,992 of the 2,441 retirement system programs evaluated appeared to be poorly structured.

The package indicated for example, that 1,962 of the 1,992 poorly structured programs contained fall-throughs. A fall-through is the transfer of processing control from one part of the program to a subsequent part, without an explicit instruction to transfer control. According to SSA's programming standards, programs should not contain fall-throughs. Fall-throughs confuse program logic and they make maintenance more difficult because, without an explicit instruction to transfer control, the person maintaining the program is not sure whether the transfer is intentional or not.

Implementation Problems Have Hampered SSA's Effort to Improve Program Structure

SSA had not taken full advantage of the benefits of the software measurement package because it has not developed a complete inventory of its programs, ensured that programs are consistently named, or issued specific written guidance to managers on using the package. First, without a complete inventory, SSA has no assurance that all of its batch programs will be assessed by the package or that the batch programs that most need improvement would be identified. During 1987, SSA tried to develop a complete inventory of its batch programs. In August 1988, an official in SSA's Office of Programmatic Systems estimated that about 80 percent of all SSA programs were inventoried during this effort. As a

part of this effort, the agency has taken steps to delete from the package's inventory obsolete programs and multiple versions of the same program. For example, between August 1988 and April 1989, SSA deleted about 1,400 obsolete programs and multiple versions of the same program from the more than 6,000 batch program names listed in the package's inventory. As of May 8, 1989, the director of SSA's Office of Programmatic Systems estimated that about 95 percent of all SSA batch programs have been inventoried.

Second, SSA had not ensured that programs are consistently named. SSA programmers were changing the names of batch programs when maintenance was performed on them. The package identifies a program by its name, and because SSA uses the package to study a program over time, the name of the program must be consistent or the package will not be able to compare its measurements to prior measurements. According to SSA's Associate Deputy Commissioner for Systems Support, as of May 1989, SSA had two efforts underway to address this problem.

Since April 1988, SSA's Software Technology and Engineering Center has been working to develop a new agencywide naming standard. As of April 1989, the center's staff was incorporating comments received from SSA's Office of Programmatic Systems and Office of Software Improvement and Engineering on a proposed naming standard that the center had circulated for review. The center's director expects the new standard to be implemented by September 1989. Also, SSA plans to acquire an automated package to help identify and monitor multiple names given to the same program.

Third, SSA has not issued specific written guidance to help ensure that the package and its results are consistently used by managers and programmers. The package provides useful information to software maintenance managers and programmers, which indicates whether programmers are adhering to structured programming standards. The absence of guidance is of particular concern because of the large number of programs that are unstructured and the agency's need to improve them. Because there was no specific written guidance, although managers had access to reports on the package's results, some managers were not using this information to monitor and enforce structured programming standards.

SSA division directors responsible for maintaining the retirement batch programs gave two reasons why SSA had not issued detailed guidance on using the package's results. One was that the agency has preferred to

allow maintenance managers and programmers to become familiar with the package and its benefits on their own. The other was that the agency does not want managers and staff to feel that the package is being used to "police" employees' work. Rather than issue specific written guidance, SSA has been establishing, on an annual basis, specific goals for monitoring and enforcing structured programming standards that Office of Programmatic Systems division directors are responsible for achieving. Specifically, the director of SSA's Office of Programmatic Systems is using the package's results to monitor the quality of batch programs, as well as to establish goals and time frames for the Office's division directors to improve program quality. These goals have been incorporated into the directors' merit pay contracts. For 1989, the director's goal is to make the agency's batch programs easier to maintain by requiring that the programs shown to be in most need of improvement are rewritten using structured techniques. This effort is to be completed by October 1989.

Conclusions

SSA has made positive efforts to improve the maintainability and quality of its batch programs until redesigned programs can be installed. The package can provide useful information on the condition of software programs that, when properly used, can help SSA measure the quality of its batch programs, assess the effects of software maintenance efforts, and ensure that the mission critical programs in most need of attention are identified. SSA has initiated actions to address some shortcomings in its use of the package—a complete inventory of batch programs is being taken and an agencywide naming standard is being developed. While SSA has included goals for using the package in merit pay contracts, it may wish to explore issuing specific written guidance that could provide a better opportunity for using the package on programs in most need of improvement.

Objective, Scope, and Methodology

The objective of our review was to determine how SSA was using the package to assess and improve the software quality of batch computer programs supporting the Retirement, Survivors, and Disability Insurance Benefit system. To accomplish our objective, we reviewed SSA manuals and documents related to the software measurement package; obtained and reviewed reports and other data produced by the software measurement package between June 1987 and September 1988; and interviewed SSA officials and staff in the Office of System Requirements, Office of System Operations, and Office of System Integration. We also

obtained SSA's proposed actions for improving how the software measurement package is used. We conducted our work between November 1987 and April 1989, in accordance with generally accepted government auditing standards. Significant events occurring since April 1989 are appropriately noted.

Agency Comments

We discussed the contents of this report with SSA's Associate Deputy Commissioner for Systems Support and other responsible SSA officials. They agreed with the report's contents and provided some additional technical information, which has been incorporated where appropriate.

We are sending copies of this report to the Director, Office of Management and Budget; the Secretary of Health and Human Services; and other interested parties. This report was prepared under the direction of Melroy D. Quasney, Associate Director. Other major contributors are listed in the appendix.

Sincerely yours,

Daniel C. White

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Assistant Comptroller General

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