INTRODUCTION

The large quantities of measurement data collected in the average computer center presents a problem in selecting that information which is significant and organizing it into a logical order. A second problem is once the data is organized, how should it be analyzed and reported.

The purpose of this paper is to describe how Merck utilizes SAS and SASGRAPH to report computer performance in a clear and effective fashion and possibly to provide some ideas or approaches to others with similar requirements.

ENVIRONMENT

Processing at Merck's Corporate Data Center is on two 16 meg. 370/168-3 multi-processors. The operating system is MVS with SE-2. This center supports both the Corporate Headquarters at Rahway, N.J. and major operations at West Point and Pittsburg, Pa. The remote sites access the system via TSO, CICS, and RJE. Performance monitoring utilizes the following software:

<table>
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<tr>
<th>Software Function Measured</th>
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<tr>
<td>System Measurement Facility (SMF)</td>
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<tr>
<td>Resource Measurement Facility (MVS and Hardware)</td>
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<td>TSO/MON Time-Sharing (TSO)</td>
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<tr>
<td>CICS Monitoring Facility (CIFS)</td>
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<td>Network Performance Analyzer (NFA)</td>
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All the software listed above are IBM products except TSO/MON which was developed by Morino Associates. The monitors are in continuous operation with the exception of NFA which is used selectively due to limited teleprocessing resources. All output is written to the SMF datasets which are dumped daily. This provides a single source of raw measurement data simplifying its processing.

Initially information required for performance reporting was selected from the SMF files and spun off to small SAS files, one file for each parameter or related set of parameters. The reports were then generated from these files. As reporting requirements increased this approach became cumbersome and difficult to maintain. During 1980 the MVS Integrated Control System (MICS) software from Morino Associates was installed. Using MICS, the raw SMF data is processed and posted daily to a performance database. This database is a collection of SAS files organized by function with both detail and summarized information. The major functions carried in the database are TSO, CICS, hardware, MVS, teleprocessing and batch processing. All records are synchronized by date and time, have common identifiers, and carry all values in decoded form. The MICS database is the primary source for performance analysis, configuration planning and job accounting.

PERFORMANCE REPORTING

Presently performance reporting is implemented for TSO and batch processing. A report series is under development for CICS. The primary reports are produced monthly for TSO and batch with daily reports for significant TSO parameters also being produced. Specific reports produced for each series are:

MONTHLY TSO REPORTING

TSO performance is considered to be the critical component in our environment, therefore, this report series was the first developed and is the most comprehensive. Parameters reported on in their relative order of importance are:

1. Average response time.
2. Average concurrent users. (Figure 1)
3. Total connect hours. (Figure 2)
4. Total logons.
5. System availability.
6. Number of system IPL's.
7. Total non-terminal I/O.
8. Total commands.
9. Average CPU utilization/hour.
10. Non-terminal I/O per hour.
11. Commands per hour.
12. Connect hours per average user.
13. Non-terminal I/O per average user.
14. Logons per average user.
15. CPU utilization per average user.

The use of SAS and SASGRAPH makes it relatively easy to tailor reports to meet new or changing requirements. The report processing utilizes a basic set of SAS code which is easily modified as necessary for each report, usually the only change needed is in the variable name.

Processing steps for the monthly reports from the MICS database are:

1. Select the information for the last full month from the appropriate MICS database file and calculate the values needed. For example compute system uptime percentage for the month.
2. Merge the data from Step 1 with an
intermediate file containing information from prior months. The intermediate files are used as a convenience since the reporting period covers a time-span greater than that of the on-line MICS data (six months on-line vs. a report period of thirteen months).

3. Compute a rough projection of the parameter for the coming twelve months using proc AUTOREG.

4. Calculate an average for the past thirteen months reported on using proc MEANS.

5. Plot the report with proc GPLOT. All plots are for thirteen months with a projection for the coming twelve months. A horizontal reference with the MEAN for the report period as calculated in step 3 is plotted using the %INCLUDE routine described in the latest SAS communications.

**FIGURE 1.**
MONTHLY BATCH PROCESSING REPORT

The Monthly Batch Processing reports are a less complex series than those for TSO being purely accounting in nature without any analysis. This is due to the batch operations being less critical and not organized to a degree where analysis is effective. For example, all production work is classed only by the site originating it without further sub-division. Reports in the batch series include:

1. Total jobs (production & test).
2. Total jobs (submitted & completed).
3. Total jobs (testing & production by site).
4. Total jobs by termination code.
5. Total jobs by jobclass.
6. Total jobs by shift.
7. Printed output by total jobs.
8. Printed output by destination.
11. Printed output by shift & destination.

Batch Performance Reporting Steps Are:

1. Select the necessary information from the MICS database and summarize it as required.
2. Produce a plot or block chart as appropriate for the parameter(s) reported on.

A sample report for printed output is shown on the next page in Figure 3.
DAILY TSO REPORTS

In addition to the monthly management reports, plots of average response time and concurrent users, the two most critical TSO parameters are produced daily showing the previous days activity. The two plots are available as a hardcopy report and on-line. The on-line version is for the convenience of those individual's who may need the information immediately. The on-line reports are provided through the Structured Analysis Facility (SAF) of MICS. Under SAF the report programs are available as query against the MICS database using an IBM 3279 color terminal. The user simply executes the SAF clist, selects the report program, and executes it on-line.

The two on-line reports are illustrated on the next page.
AVERAGE RESPONSE TIME – PRIME SHIFT

FIGURE 4.

AVERAGE CONCURRENT USERS – PRIME SHIFT
SASGRAPH is utilized not only for the scheduled reports but also extensively for ad-hoc reports. Its ease of use makes it no more difficult to produce a graphic display than to produce a basic listing of the information. This capability to fill immediate requests with this type of report is quite impressive.

SUMMARY
The ease of use and the capabilities supplied by SAS and SASGRAPH have allowed Merck to develop a comprehensive and useful performance measurement application without expending a large amount of effort on it.