The 3M Company is a highly diversified manufacturing company headquartered in St. Paul, Minnesota. Its 1977 sales totaled 3.98 billion dollars and its net income was 413 million dollars, ranking it 53rd nationally in terms of sales, and 29th nationally in terms of profits. The company is organized into nine major product areas or groups:

- Abrasives, Adhesives, Building Service, Chemicals
- Advertising Services and Protective Products
- Consumer Products
- Electrical Products
- Business Products
- Health Care Products and Services
- Photograph, Printing, Industrial Graphics, and Static Control Systems
- Recording Materials
- Tape and Allied Products

The company employs 81 thousand people worldwide (with some 33 thousand located outside the U.S.). It has 35 U.S. divisions and 12 U.S. subsidiaries with plants in some 79 communities in 28 states.

I manage the Department of Biostatistics which resides within Riker Laboratories, the pharmaceutical division, which in turn belongs to the Health Care Products and Services Group.

At the suggestion of my group, and with our financial support, Statistical Analysis System (SAS) was brought into the 3M Company about three years ago. Since this time, it has found such broad utilization within the company that the corporate computer group has assumed total operational and financial responsibility for SAS.

The main computer facilities at 3M are as follows:

Mainframes

<table>
<thead>
<tr>
<th>Mainframe</th>
<th>Number</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM-3032</td>
<td>1</td>
<td>Batch, Remote Batch, IMS, TSO</td>
</tr>
<tr>
<td>INM-370/168</td>
<td>2</td>
<td>Company Timesharing</td>
</tr>
</tbody>
</table>

DEC-20

<table>
<thead>
<tr>
<th>Minicomputers</th>
<th>Number</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEC-20</td>
<td>2</td>
<td>Company Timesharing</td>
</tr>
</tbody>
</table>

Until the arrival of the IBM-3032, SAS had been running on the 168s (and I might mention as an aside, that its transfer to the 3032 went ahead without any problems). SAS runs on either the 168s or 3032 (the 3032 is used for SAS via TSO, the 370/168s for RJE access to SAS). The IBM equipment runs under the control of MVS and offers, among other things, PANVALET, IMS, MARK IV, and TSO applications.

The department I manage has people trained in statistics, data handling, and computer systems applications, with heavy emphasis on biological and medical applications. While our main involvement has been with clinical trials of new pharmaceuticals, we have been recognized by many diverse groups within the company as possessing skills and resources that could be applied to the solution of their problems.

It is with these various applications, and how SAS has played a role in the data base, analytical, and report generation aspects of work on these applications, that I would first like to dwell. Secondly, I would like to make reference to other groups that have found SAS and its various features helpful to their applications.

Finally, I would like to discuss the future as regards our use of computers and how SAS fits into this future.

Since our group was instrumental in bringing SAS into the 3M Company, let me first describe our group and its activities.

My department provides statistical and computer services to a number of areas within the 3M Co. Our primary areas of expertise are providing these services to people involved in experimentation which is either biological or clinical in nature. With this as background, it is easy to see that a large part of our involvement is with biological and clinical data gathered in the process of drug development. However, due to our unique capabilities, we have also become involved with biological and/or clinical (and in a few cases marketing) investigations carried out by:

1. The Medical Products Division;
2. The Surgical Products Division;
3. McGhan Medical Corporation;
4. 3M - Central Research Lab;
5. Corporate Medical Department.

Before going into more detail regarding these areas, let me digress for a moment to make some general comments concerning the use of SAS in these applications.

SAS has been found to be extremely helpful in handling and analyzing the kind of data with which we are involved. A few reasons for this are:

1. File structure is compatible with the types of data generated in these experiments with which we are involved.
2. Variable naming convention is useful for:
   a) Naming data sets,
   b) Naming variables,
   c) Archiving data sets,
   d) Creating and maintaining various dictionaries.
3. Good data base management for large numbers of small files.
4. Fairly easy system to learn and use for:
   a) Data entry,
   b) Editing and correcting,
   c) Generating reports.

5. Good statistics packages (especially with the availability of BMDP through SAS).

6. Ease of adding to, or changing, existing PROCS.

7. Ease of incorporating new PROCs.

8. Ability to use output from procedures such as MEANS, FREQ, MATRIX, as data sets for inclusion into other procedures for further analysis or report generation.

9. Good MACRO definition feature.

10. Easy to develop user FORTRAN function calls.

11. Fairly good graphics capabilities.

12. Fairly good report generation capabilities.

Given the relatively small size of our group, the number of diverse areas with which we are involved, and the positive features of SAS (some of which were just delineated), we have come to rely on SAS to handle numerous different applications. Some of the areas of application are:

**Pharmaceuticals** - Storing, checking, analyzing and reporting of results from biological and clinical studies of analgesics, antiinflammatory, dermatologials, and antiarrhythmics, for example.

**Medical Products** - Storing, checking, analyzing and reporting of results from biological (in vivo and in vitro) and clinical studies of diagnostic Products, Veterinary Products, Dental Products, Patient Care Products, and marketing studies of tape performance.

**Surgical Products** - Storing, checking, analyzing and reporting results from clinical orthopedic studies, clinical intraocular lens studies, and marketing studies of drape performance.

**Corporate Medical Department** - Storing, checking, analyzing and reporting the results of employee screening exams, and epidemiologic studies of employee health.

In addition to my department, others within the 3M Company have found SAS to be useful. Some areas of application are:

**Information Systems and Data Processing (IS&D) Group**

- Monitoring of system performance (Systems Management Facilities - SMF) and evaluation of communications facilities.

**IS&D - Statistical Consulting Group**

- Accessing and evaluating various employee data files (extremely large file application). Storing, checking, analyzing and reporting results from a wide variety of O.K. type problems encountered throughout the rest of the 3M Company.

As regards the future, our major concern is to carefully coordinate any addition to our hybrid computer configuration. We acquire data at a variety of locations and do different things with each different type of data. Our hope is to close the communications links so that we can use SAS and its resources to:

1. Identify the data from each of these sources,
2. Edit the data,
3. Analyze the data,
4. Report the data,
5. Archive data from these sources.

Regarding these points, I would like to discuss in more detail what is meant. We are referring to the process of acquiring, checking, analyzing, reporting, and archiving of preclinical and clinical data from all studies in an NDA (7-10 years worth). Preclinical (Toxicology, pathology, drug metabolism, pharmacology) will - in some cases - be transferred to SAS via the DEC-20 communications link to the 370. The Dec-20 intervention is required because some of this data is either initially entered through our DEC-20 timesharing system, or is collected on real-time DEC computers in the laboratory and can only be transmitted to the 370 via other DEC equipment (i.e., the DEC-20). For other portions of the preclinical work and the clinical studies, creation of OS data sets can proceed directly either by batch on TSO mode. Once this data is available to SAS, the considerable analytic and report generation features of SAS can be used.

Finally, so as not to make everything seem as if it is going right, I have a list of things we wish SAS could do to help us in our tasks. Some of these things are:

1. SAS PROC EDITOR is not general enough in that it only allows search on "=" condition. It would be helpful to allow searches on an "OR" condition and to allow function calls (e.g., "FIND DATE = MDY(12,25,78)").
2. Truly interactive PROC MATRIX to more effectively emulate APL - used for special statistical analyses.
3. Ability to terminate output to TSO terminal without exiting from SAS.
4. Improving documentation and an easier cross-reference system between different manuals.

5. Allowing subscripted variables.