

## Paper 231-25

### Web Based DSS Development

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#### ABSTRACT

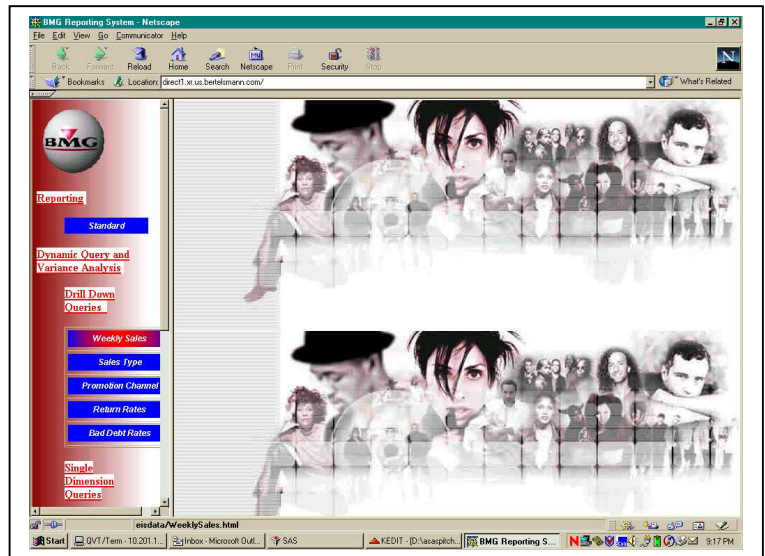
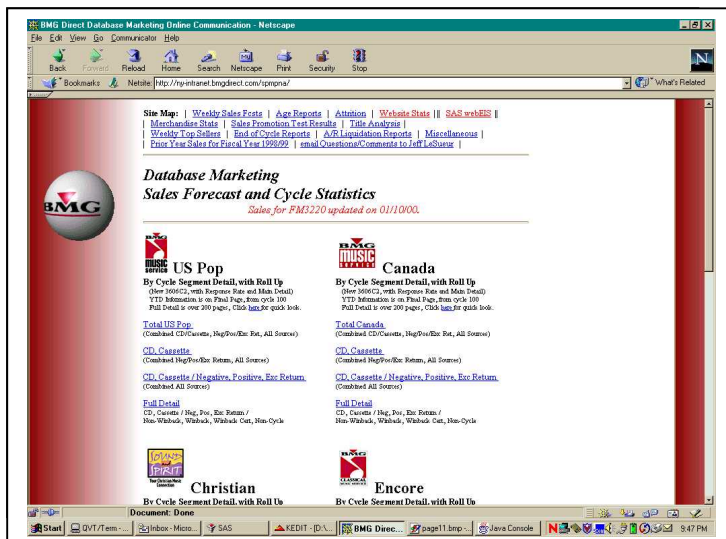
In the high paced marketing decision environment of today there is no room for complacency where information is concerned. Business decisions are being driven at ever faster rates, creating a more complex marketing environment, increasing demands for more information faster than ever before. Technology is evolving to meet this demand, providing the opportunity that valuable data will not remain buried somewhere in the information pipeline.

Through SAS/IntrNet™ and SAS/webEIS™ (a component of AppDev Studio™), BMG Direct, which operates the world's largest group of music clubs, including BMG Music Service, BMG Classical Music Service, BMG Jazz Club, Sound & Spirit, and Ritmo y Pasión, has evolved a DSS solution which allows marketing decision makers to access *and manipulate* business information; people with little or no database skills, working from different platforms, from different areas of the country. By directly empowering marketing strategists with control over information access, BMG Direct is pursuing a goal of making the information pipeline, and its concomitant bottlenecks and high cost infrastructure, a thing of the '90s.

Analysts, marketers, business managers and Information Infrastructure developers should benefit from a practical demonstration of a web based DSS, and how SAS Internet and WebEIS dramatically improve an organization's ability to respond to the increasingly complex and rapid demands of today's markets.

#### BACKGROUND

As the world's largest record club, BMG Direct markets CDs and music related products to over 10 million members in the US and Canada. As a direct marketer, BMG's success depends on the ability to communicate appropriate, appealing promotions to members and prospective members, through several channels: traditional direct mail, in the form of 16 to 64 page magazines mailed up to 20 times per year, through the more expensive channel of telemarketing, through its web site ([www.bmgmusicservice.com](http://www.bmgmusicservice.com)), and through the newer medium of 'direct email'.



Likely to be familiar are the CD club membership acquisition promotions, the ubiquitous "10 CDs for a Penny" or "11 CDs for the Price of 1, Nothing More to Buy Ever" print ads and mail promotions. These promotions can prompt recipients to question just how the clubs can be profitable with such an apparent give-away up front. Profitability is dependent on the success of the promotions that follow the initial 'deal'. BMG Direct's information infrastructure provides feedback on these promotions, as well as primary business indicators such as total sales, returns and payments, member longevity and retention rates, and active / dormant member trends. Long term success is equally dependent on the flow and analysis of information, the creativity of the marketing managers, and operational capabilities.

Based on these factors – information, creativity, and operational capacity – the membership has been segmented into categories based on music genre preferences and responsiveness to different promotional channels. With a membership as large as 10 million, the smallest segments are still quite large, and the segmentation process continues to evolve. Ten years ago there were 36 segments, based on music preference and length of membership. At the time, members received one of four 16 page two color magazines up to 20 times per year. Each magazine contained a page or two focusing on each of 9 musical genres, such as Soft Rock, Hard Rock and Classical.

Now there are unique magazines for each of 18 listening preferences: Soft Rock, Hard Rock, Classical, Country, Easy Listening, Metal, Jazz, Alternative, RnB, Dance, Rap, Contemporary Christian, Christian Rock Alternative, Gospel, Mexican and Mexican Pop, Tropical and Tropical Pop. Magazines are accompanied by music and merchandise flyers, both targeted to selected audiences. All told there are over 5,000 targeted segments compared to 36 ten years ago. Each of these groups is receiving a unique combination of promotions throughout the year, based on analysis, models and marketing acumen.

The volume of members, the volume of sales, the number of unique market segments, marketing programs, and individuals involved in developing the business combine to create a significant demand for information on a regular (weekly) basis. Over the past five years, a Web based Decision Support System (Intranet DSS) has evolved to meet and cope with this demand. The introduction of a high performance data warehouse, together with SAS Internet and SAS WebEIS in 1999 moved the process of providing business information to a new plateau in performance, flexibility and responsiveness.

## WEB BASED DSS DEVELOPMENT – STATIC REPORTS

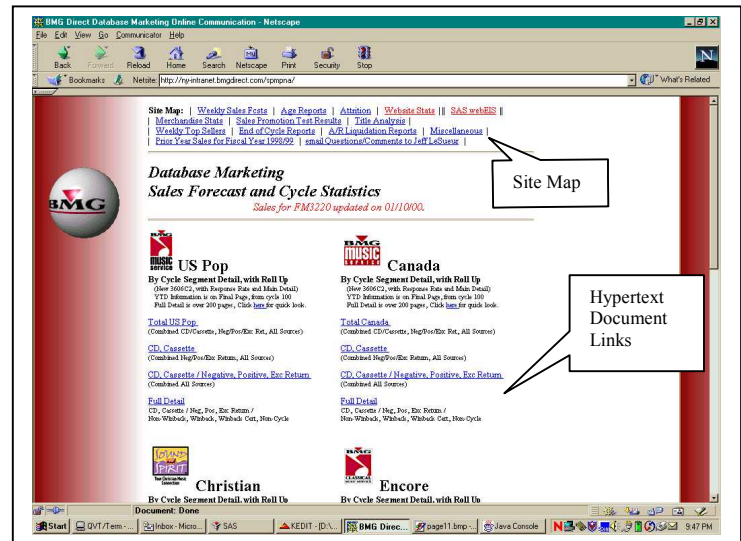
Web based DSS development takes two forms: static and dynamic. Static forms will be discussed first, as they still provide a specific utility, while clarifying implicit weaknesses which are overcome by dynamic forms.

Over six years ago it became obvious that the volume of information produced and desired could no longer be developed manually or communicated through hard copy or email. After introduction of an intra-company internet web server (intranet), the first challenge was to move reports then generated from PCs for output to laser printers, to the new staging point, the Intranet. It was clear at the time that a web based DSS had to satisfy several requirements. Viewed from the pipeline perspective, data would be summarized, formatted, and converted to an output file format compatible with a browser, all in batch mode. These reports (files) would in turn be surfaced through hypertext links hosted on an HTML page. An example is shown below left.

Up to the 'output' step, there were no issues, both SAS and MS Access had adequate batch capabilities. The central problem was the format of the output. The screen content had to meet mutually exclusive requirements: sufficient resolution for viewing clarity at 72 dpi (HTML and GIF), printable locally at 300dpi or better, and portable to other software packages (cut/paste).

At this stage, no one format meets these requirements. Adobe PDF format meets three out of four: Adobe® PDF Writer can be integrated into batch processes, and the PDF format provides excellent screen resolution (including zooming), and very high print resolution, including color. There is no question of trying to replicate the existing reports in HTML, the content is too rich, and printed HTML resolution is wholly unacceptable. Formatted excel spreadsheets could and often were communicated via email, but at high volumes is inefficient and impractical, and a reporting system based on excel spreadsheets is at best a temporary work around.

From a DSS design standpoint, HTML is simple and a reasonably complex site is easily 'mapped' for user edification, as well as exposition of the site's coverage. The site map for BMG is shown at the top of the site page following this paragraph, and identifies all accessible subject areas: Sales Forecasts (on this page), Sales Reports by length of membership (age), Member Attrition, Web Site Sales Statistics, Receivable Liquidation, Test Results, etc. A map should be available from each site location, in the same place on the page, to facilitate navigation.



The primary subject material – Sales Forecasts – is hosted on this 'home page'. There are hot links to several levels of sales variance reports for seven Clubs (*US Pop, Canada, Christian, Encore* (Classical), and below that, *Jazz, Latin and CDx*). Withing each Club area there are hyper text links to four PDF formatted reports, each report segmenting further into the membership within Club. The final report in each club is upwards of 300 pages in length.

A sample report page is shown below. As might be guessed, this is a data \_null\_ report, driven by a batch PC SAS program, featuring "X" commands for controlling PDF formatting from either Adobe® PDF Writer or a product called Gymnast®, which provides the Table of Contents frame on the left in this example. Output is sent to a pre-determined filename, consistent with the HTML "<href=>" tag. Once defined, the structure is virtually maintenance free, although the reports themselves are reasonably complex and time consuming to develop.

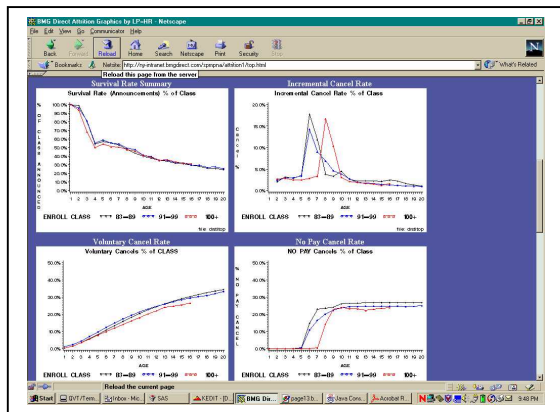
This report form, while fast and convenient for viewing, has several important shortcomings that handcuff analysts and marketers alike. The content is not portable to Excel or other presentation/analysis software; the format is frozen, different formats require more reports, and more pages; the report (and similar reports) are time consuming to develop and require a reasonably experienced person to change and maintain;

Sales Promotion Variance to Business Plan			
Actual	Budget	Variance	Ratio
4,898,555	4,876,101	22,454	4.5%
Sales Performance			
Sales	7,544,919	7,493,514	(51,405) -0.7%
Margin	1,954,495	1,921,947	(32,548) -1.7%
Profit	1,205,829	1,184,797	(21,032) -1.8%
Loss	1,205,829	1,184,797	(21,032) -1.8%

increasing the attributes, segments and dimensions results in ever larger, more cumbersome reports and/or increasingly complex HTML formatting of access points (hypertext links). Defeating these shortcomings requires the existence and maintenance of an alternative data table, and corresponding database skills (SAS or MS Access) for access and manipulation. This approach is prone to errors in data interpretation as well as coding, and is not, in my experience, a fundamental component within a marketer's skill set.

The most significant failing of the static page approach is its inability to cope successfully with levels of dimensionality beyond four or five. The dimensions in the above page are 5 and an entire HTML page containing 28 hypertext links is required to surface these five dimensions. As noted above, the business has grown more complex, with more marketing segments receiving unique promotions. A static reporting system as described above quickly becomes large and cumbersome, emphasizing the shortcomings of this approach: a new dimension triples the database size, increasing the demands on the hardware containing it, the number of pages increases, geometrically. With an increase in dimensionality, decisions have to be made on just how many static pages are useful or practical. The 28 hypertext links above allows access to thousands of pages: seven Clubs by 40 promotions (2 years) by two product types by three fulfillment types by three acquisition sources  $((7 * 40) + (7 * 40 * 2) + (7 * 40 * 2 * 3) + \text{and so on})$ .

Even with this limitation however, an elaborate and effective DSS can be developed which is relatively easy to augment and maintain. Two examples of 'web pages' from BMG's site are shown below (Graphs shown are generated as GIF images from SAS Graph, other reports are Data \_null\_ reports.)



BMG Direct Test Results Table of Contents

Monday, Oct 31, 1999

Use Links below to view Test Description/Summary Results and Test Detail Results

Convert All Tables (HTML) with comments/questions

Tests in bold are complete

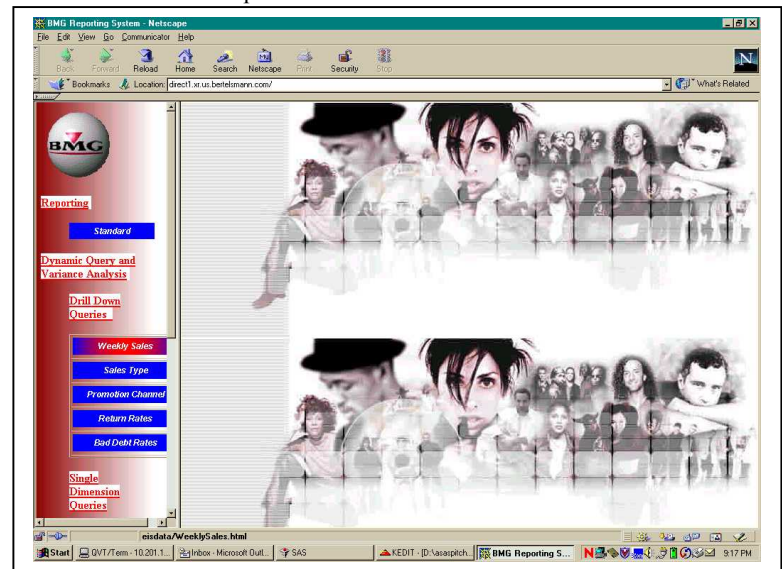
Date	Test Title	Description	Summary Results	Detail Results	Conclusions	Test/Ref	Starting Cycle	Ending Cycle
1 Oct 99	BMG A.S. Data Probe Test (0000)	Test	Results	Results	Results	0000	001	001
1 Oct 99	BMG A.S. Data Probe Test (0001)	Test	Results	Results	Results	0001	001	001
1 Oct 99	BMG A.S. Data Probe Test (0002)	Test	Results	Results	Results	0002	001	001
1 Oct 99	BMG A.S. Data Probe Test (0003)	Test	Results	Results	Results	0003	001	001
1 Oct 99	BMG A.S. Data Probe Test (0004)	Test	Results	Results	Results	0004	001	001
1 Oct 99	BMG A.S. Data Probe Test (0005)	Test	Results	Results	Results	0005	001	001
1 Oct 99	BMG A.S. Data Probe Test (0006)	Test	Results	Results	Results	0006	001	001
1 Oct 99	BMG A.S. Data Probe Test (0007)	Test	Results	Results	Results	0007	001	001
1 Oct 99	BMG A.S. Data Probe Test (0008)	Test	Results	Results	Results	0008	001	001
1 Oct 99	BMG A.S. Data Probe Test (0009)	Test	Results	Results	Results	0009	001	001
1 Oct 99	BMG A.S. Data Probe Test (0010)	Test	Results	Results	Results	0010	001	001
1 Oct 99	BMG A.S. Data Probe Test (0011)	Test	Results	Results	Results	0011	001	001
1 Oct 99	BMG A.S. Data Probe Test (0012)	Test	Results	Results	Results	0012	001	001
1 Oct 99	BMG A.S. Data Probe Test (0013)	Test	Results	Results	Results	0013	001	001
1 Oct 99	BMG A.S. Data Probe Test (0014)	Test	Results	Results	Results	0014	001	001
1 Oct 99	BMG A.S. Data Probe Test (0015)	Test	Results	Results	Results	0015	001	001
1 Oct 99	BMG A.S. Data Probe Test (0016)	Test	Results	Results	Results	0016	001	001
1 Oct 99	BMG A.S. Data Probe Test (0017)	Test	Results	Results	Results	0017	001	001
1 Oct 99	BMG A.S. Data Probe Test (0018)	Test	Results	Results	Results	0018	001	001
1 Oct 99	BMG A.S. Data Probe Test (0019)	Test	Results	Results	Results	0019	001	001
1 Oct 99	BMG A.S. Data Probe Test (0020)	Test	Results	Results	Results	0020	001	001
1 Oct 99	BMG A.S. Data Probe Test (0021)	Test	Results	Results	Results	0021	001	001
1 Oct 99	BMG A.S. Data Probe Test (0022)	Test	Results	Results	Results	0022	001	001
1 Oct 99	BMG A.S. Data Probe Test (0023)	Test	Results	Results	Results	0023	001	001
1 Oct 99	BMG A.S. Data Probe Test (0024)	Test	Results	Results	Results	0024	001	001
1 Oct 99	BMG A.S. Data Probe Test (0025)	Test	Results	Results	Results	0025	001	001
1 Oct 99	BMG A.S. Data Probe Test (0026)	Test	Results	Results	Results	0026	001	001
1 Oct 99	BMG A.S. Data Probe Test (0027)	Test	Results	Results	Results	0027	001	001
1 Oct 99	BMG A.S. Data Probe Test (0028)	Test	Results	Results	Results	0028	001	001
1 Oct 99	BMG A.S. Data Probe Test (0029)	Test	Results	Results	Results	0029	001	001
1 Oct 99	BMG A.S. Data Probe Test (0030)	Test	Results	Results	Results	0030	001	001
1 Oct 99	BMG A.S. Data Probe Test (0031)	Test	Results	Results	Results	0031	001	001
1 Oct 99	BMG A.S. Data Probe Test (0032)	Test	Results	Results	Results	0032	001	001
1 Oct 99	BMG A.S. Data Probe Test (0033)	Test	Results	Results	Results	0033	001	001
1 Oct 99	BMG A.S. Data Probe Test (0034)	Test	Results	Results	Results	0034	001	001
1 Oct 99	BMG A.S. Data Probe Test (0035)	Test	Results	Results	Results	0035	001	001
1 Oct 99	BMG A.S. Data Probe Test (0036)	Test	Results	Results	Results	0036	001	001
1 Oct 99	BMG A.S. Data Probe Test (0037)	Test	Results	Results	Results	0037	001	001
1 Oct 99	BMG A.S. Data Probe Test (0038)	Test	Results	Results	Results	0038	001	001
1 Oct 99	BMG A.S. Data Probe Test (0039)	Test	Results	Results	Results	0039	001	001
1 Oct 99	BMG A.S. Data Probe Test (0040)	Test	Results	Results	Results	0040	001	001

## SAS/IntrNet™ AND SAS/webEISTM

Dynamic HTML pages provide the key to getting to the next plateau in a Web based DSS, and SAS/IntrNet and SAS/webEIS provide that capability. With the introduction of CGI and Java capability in BMG's Web based DSS, information is provided on demand to anyone in the organization with access to a browser. The information is easier to generate, easier to maintain, and finally capable of porting to other applications such as Excel. SAS Internet eliminates the need to run voluminous reports and design extensive static HTML pages to surface the linkages. WebEIS provides access to data in a multi-dimensional form, with drilldown functionality, user defined variables, user determined content, in fact nearly total user control over content.

Several factors combined to provide the motivation (and funding) for moving to dynamic pages through SAS/IntrNet and SAS/webEIS: the conceptual simplicity of surfacing dynamic information from a browser, the elegant front end GUI potential of HTML screens, the potential for dramatic improvement in analysis offered by multi-dimensional forms, and the implication of instant access across the entire organization. In hindsight, the hurdles are primarily conceptual: learning the language of web implementation – CGI, Java, Javascript, Applets and Servlets – as well as installing webserver software in a Unix environment. These concepts and components have not previously been commonly associated with data access and queries.

Once the concepts became tangible in the form of a successful web server installation, appropriate browser set up (including Plug-Ins), and a fully registered MDDB table and corresponding WebEIS application, replication of the process against more tables proceeds quite rapidly. It is much easier than one might otherwise have expected.

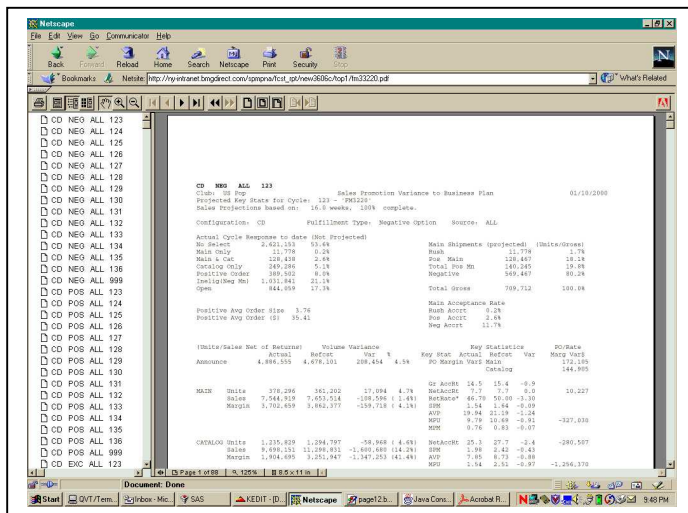
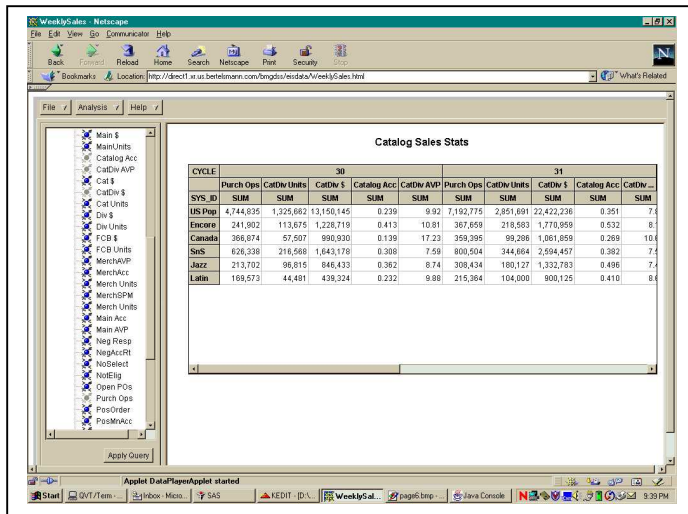


The new BMG Direct top level DSS screen is shown above. The blue boxes on the left are hypertext links. The topmost link returns the user to the static system (top level page described earlier which is located on another server). The next four links are to SAS/webEIS SAS/MDDB® applications. The final group of links (not shown above, but directly below the reference to "Single Dimension Queries") are to SAS/IntrNet driven reports, reports which require user specified segmentation prior to information retrieval. Segmentation is specified via drop down boxes.



Early user response to both the SAS/webEIS and SAS/IntrNet functionality is overwhelmingly positive. Even this initial effort provides access to an extensive volume of information, previously available only through special request to skilled analysts, requests which frequently went to the bottom of their priority list.

Compare the WebEIS display of Sales below with the PDF Report page which follows. There are more variables available on the latter, the format is more 'report oriented', but the resolution is no better or worse than the WebEIS screen.

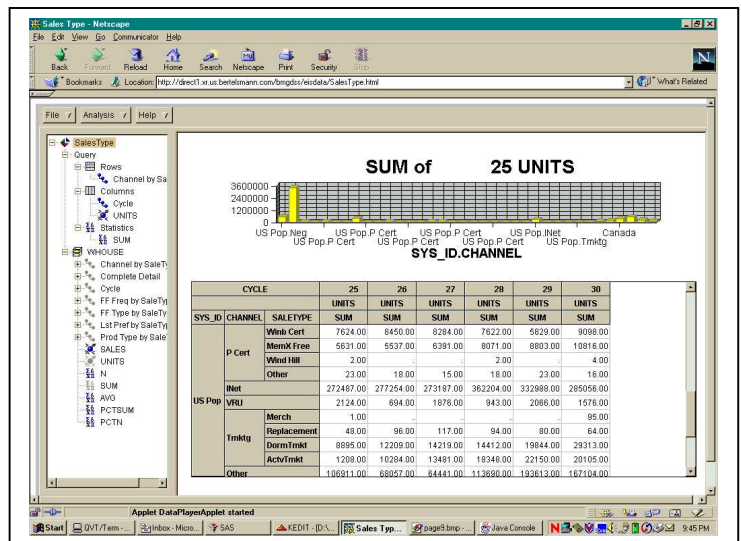
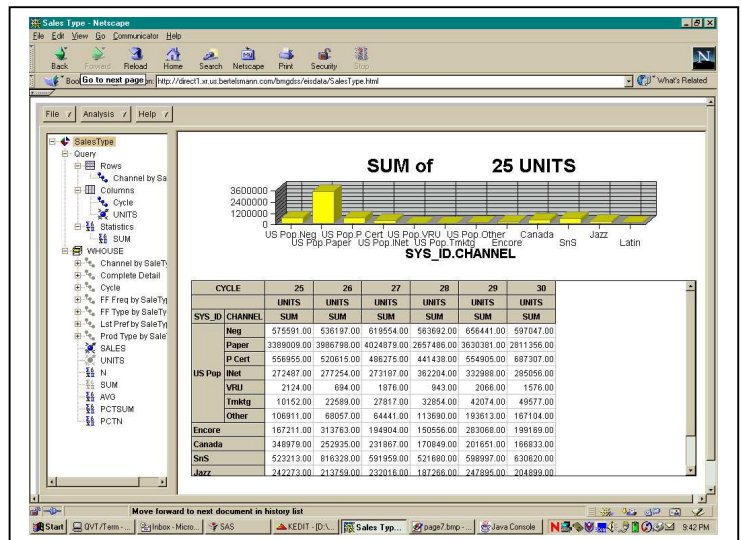


The SAS/WebEIS screen on the other hand has all of the same variables available to the user as the report – note the variable list on the left frame of the SAS/WebEIS screen above. Further, multiple 'cycles' (promotions) can be displayed side by side, as shown above, for easier comparison of time periods. Fully ten columns of data are currently displayed on screen, at a larger than necessary font size, i.e. more columns are feasible.

The analyst also has more dimensions available in the SAS/WebEIS environment than in the static environment. The SAS/MDDb table driving the SAS/WebEIS content above has two more dimensions than the report. Any of the dimensions can be selected, subsetted, summarized, portrayed across or

down. Once a desired 'layout' is achieved, the table can be exported to excel with a single right click.

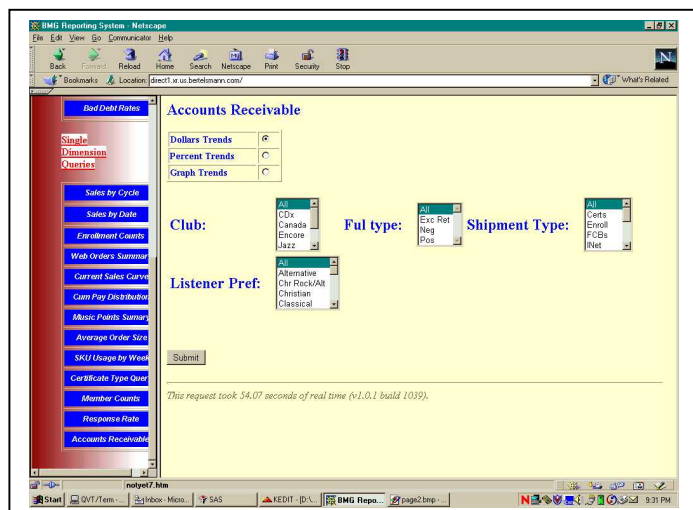
SAS/WebEIS was also applied to a second facet of the business which is more timely now and which represents a several new areas of the business. With the introduction of new promotional channels in Internet and Telemarketing, and the expanded use of savings certificates associated with new marketing programs, a reporting approach was required which showed the summary impact of these new channels, as well as the detail. While internet sales could be satisfied by a single sales type (at this time), and telemarketing could be summarized as "Active" and "Dormant", Certificate Type sales were already as high as twenty unique types. Here is where WebEIS, with dynamic drill down quickly satisfies all analytical requirements, as shown below:



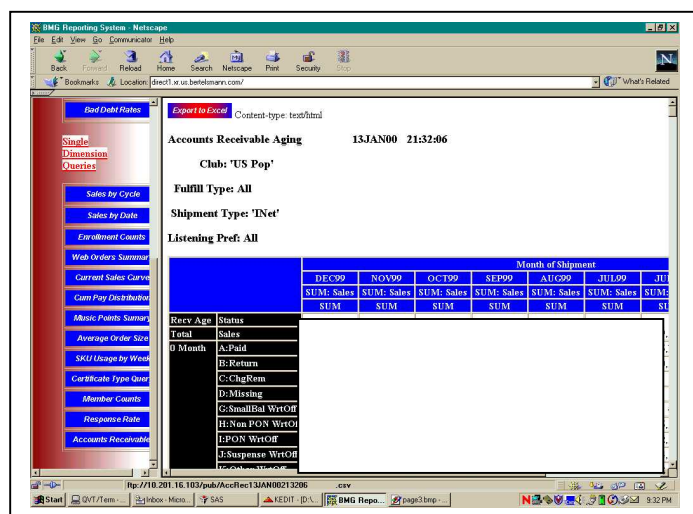
## SAS/INTRNET

The combination of dynamic access to multi-dimensional data in a more fixed, report format can be made available through SAS Internet. Data Null or procedural output (Proc Freq, Proc Tabulate) can be driven by user specified parameters, much the way macro variables are used. Shown below is an example of the HTML parameter page which drives an Accounts Receivable Liquidation Report. This could have been an alternative

solution to the Weekly Sales Report 'excessive dimensions' issue. In this case, four dimensions are available, and any number of members within any dimension can be combined in the final report.



The final report (shown below) is not flexible, it cannot be manipulated on screen as in SAS/WebEIS. But it does include an 'Export to Excel' button (upper left of screen below) for further manipulation 'off screen'.



## FURTHER CONSIDERATIONS

With continued development of the process, including modification of the data refresh process, it became clear that there were unexpected additional benefits. The code for implementing/building a SAS/MDDB table was simple, short and elegant, by any comparison. Compared to the code which generated the static reports shown above, and the corresponding HTML (400 lines), it promised a reduction in maintenance activity as well as much more rapid deployment of information. For example, the weekly sales forecast *static* reports referred to earlier in this paper required several weeks of effort and comprise hundreds of lines of code. The corresponding SAS/MDDB / SAS/WebEIS implementation was effected in an afternoon and evening, and comprises all of forty lines of code, including the data step required at the first stage. The table contains nine total dimensions ! Most of the time spent in

development was in the metadata registration stage, specifying the variable relationships and dynamic EIS calculations, calculations such as Average Price = Sales / Units.

Once defined within the metadata table, such calculations are consistently applied across all dimensions, subsets and summary combinations which a user might possibly conceive.

Security steps can be implemented within the browser and the SAS/webEIS environment, to limit visibility of more sensitive content.

Some users have commented that the content they want is hard to find, and they don't know when to look for the latest update. This is a legitimate observation which will be handled by e-mailing update status and site / hypertext links, from within the refresh process. Upcoming releases will provide 'bookmarking' of SAS/webEIS screens, an alternative approach. The Institute has also evolved a still more interesting solution, which allows the user to "subscribe" to reports and content, in turn receiving notification of new and updated information automatically.

## SUMMARY

Automation of data manipulation and reporting, combined with a well organized hypertext based intranet site, allows an extraordinary amount of constantly updated information to become available to business managers through a browser within the corporate intranet. The application of SAS/IntrNet, and SAS/MDDB structures as viewed through SAS/webEIS eliminate the many weaknesses of static reports.

In turn, the flexibility of SAS/webEIS effectively shortens the information development process, by bringing the end user into the pipeline itself. The users are able to manipulate, re-arrange, re-summarize the information, as well as port the result to other applications, functions which previously required a higher level skillset. This allows the organization to leverage the skills of its database developers and analysts, in surfacing a greater breadth of information, in less time, through an intuitively simple yet sophisticated graphical user interface.

## ACKNOWLEDGEMENTS

Mark Barry and Bob Szczerba of the SAS NYC office continue to provide guidance and direction in exploiting the many evolving facets and features of the SAS suite of products. Theresa Lautato as well as David Driggs, Greg Lehner, and Yvonne Selby of The Institute answered many questions during the difficult conceptual stage of development. Chuck Palmer of Intellicisions, a SAS Quality Partner located in Cary, was responsible for implementing the first pilot program in two weeks, followed by the Unix implementation four weeks after. Many thanks for your contributions to the success of this project.

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