ABSTRACT

Data often have a spatial dimension, whether it is a five-year financial plan and annual budget, or public health initiatives spanning several counties or states, differences in geographic areas inform healthcare providers or illuminate the differences between regional spending. SAS/GRAPH and GMAP provide a powerful entry point for investigation. When combined with the power of ODS, GCHART, SAS Macro Language, and Base SAS, data become more user friendly and informative. This paper demonstrates how to incorporate the power of ODS with SAS Graph to draw a map, insert annotation to select a location of interest, use ODS to create drill-down, and explore hyper-linked data tables and charts. Using SAS-supplied datasets to draw map boundaries, we create an annotation data set, use Macros to dynamically create high level and detail reports for each destination, add hyperlinks, and create graphs to turn data into information.

INTRODUCTION

You don't need much beyond basic SAS software to provide your organization with powerful analytic tools. With BAS SAS and SAS GRAPH, you can create web-based tools to provide your organization and clients insight that turns data into information.

We will use some of the most powerful elements in the SAS language to create a map, mark areas of interest and allow your audience to dig deeply into your data. You need the standard SAS Map datasets, some knowledge of the Output Delivery System, and SAS Macro language.

THE REALLY BIG PICTURE – A MAP!

Our organization is operating in the state of New Mexico. We have distribution centers in 23 towns across the state. With the annual budget and multi-year forecasting completed for the year, our town managers are ready to manage to their numbers. New Mexico being a sparsely populated state and the ability of each manger to get to the office is limited the most efficient way for our managers to see this information is to put it on our company web site for their remote access.

We use SAS Maps to draw the map of the state and annotate each city. We use a choropleth (two-dimensional) map as supplied by SAS and stored in the Map directory. If you are new to SAS Maps, the SAS Knowledge Base contains the information needed to draw the map boundaries, latitude and longitude, and necessary codes for selecting and identifying geographic locations. To draw our map of New Mexico, we use the USCOUNTY map.

New Mexico is State code 35 in the data set.

```sas
/*make map data          */
/* Choose county for NM  */
data nmcounty;
  set maps.uscounty;
  where state=35;
run;
```

Next we need to create the annotation for our towns and establish an html tag for each. We use the USCITY map to create the html tag for each of our service area locations. Additionally, we create an observation for the town marker; in this case, we are using a star. Style “special” with text “M” in the annotation file creates the star for each of our towns.

```sas
/* 2. get cities for test'2' */
data pubrpt.nmtowns;
  length function style color $ 8 position $ 1 text $ 20;
  retain function 'label' Xsys Ysys '2' hsys '3' When 'A' Position Style Text X Y;
  set maps.uscity (keep=x y city state);
  if state = 35;
  if city in('Alamogordo',...,'Grants');
```

/* add html reference for cities*/
HTML = 'href="'||trim( City )||'.html"';

/* create the city html * /
style='swissb'; text=city; color='black';
output;
/* create the star marker*/
style='special'; text='M'; color='morbr'; size=7; position='5';
output;
run;

Next we establish the ODS framework for our map. It is important to note, we are using an older SAS html tagset. This is because of the technological restrictions of our client, however, SAS has enhanced the html tagsets. To learn more about them see Eric Gebhart’s paper listed in the Suggested Reading section of this paper.

/*start fresh with ods                  */
ods html close;ods listing close;
/*create placeholders for ODS html information*/
filename odsout 'C:\@suzanne\Budget2013\reporting\HTML Presentation\';
ODS HTML body='drillmapbody.html'
   attributes="CODEBASE"="c:\program files\sas institute\applets"
   parameters="DRILLDOWNMODE"="URL"
   path=odsout;

Using the graphic options, we can establish the colors we want for our map. We choose colors that correspond to our company branding.

GOPTIONS reset=all xpixels=650 ypixels=470 DEVICE=html;
   pattern1 v=s c=cream; pattern2 v=s c=cream; pattern3 v=s c=cream;
   pattern4 v=s c=cream; pattern5 v=s c=cream; pattern6 v=s c=cream;
   pattern7 v=s c=cream;

Now we have everything we need to draw our map. Proc GMAP option CHORO draws the choropleth map. We specified the color sequence in the GOPTIONS statement. The GMAP statement specifies the width and color of county boundaries.

proc gmap data=nmcounty map=nmcounty;
id county;
choro county/annotate=bud2013.nmtowns woutline=1 coutline=liolbr nolegend;
run;

This is our map!

Figure 1. Map of New Mexico with Markers at Service Areas
GATHER TABLE INFORMATION

Now that we have the map, we need to prepare the data to link to the towns. Our data is by product line and town. Proc SQL does a good job of creating our summary information. We use the same concatenation technique we used in creating the HTML tags for the map to create the HTML reference for each town.

```sql
create table monthly as
    select a.town, a.rs as budget, b.rsname as Desc,
        sum(a.m1) format=dollar12. as Jan,
        sum(a.m2) format=dollar12. as Feb,
        sum(a.m3) format=dollar12. as Mar,
        sum(a.m4) format=dollar12. as Apr,
        sum(a.m5) format=dollar12. as May,
        sum(a.m6) format=dollar12. as Jun,
        sum(a.m7) format=dollar12. as Jul,
        sum(a.m8) format=dollar12. as Aug,
        sum(a.m9) format=dollar12. as Sep,
        sum(a.m10) format=dollar12. as Oct,
        sum(a.m11) format=dollar12. as Nov,
        sum(a.m12) format=dollar12. as Dec,
    from pubrpt.rev2013a a, wobegone.productxref b
    where year eq 2013 and a.prodline eq b.prodline
    group by a.town, a.rs, b.prodname, a.year;
quit;
```

Next, we create the table of annual planning forecast data for the next several years:

```sql
create table aop as
    select year, salsloc, town as town, sum(b12) as b12, sum(prodtot) as prodtot, sum(mtot) as mtot
    from bud2013.rev2013,
    where year eq 2013 and a.prodline eq b.prodline
    group by year, salsloc, town;
quit;
```

A similar data table is created with data we use for a graph later on.

CREATE DRILL-DOWN TABLES FOR EACH LOCATION

We want each town manager to click the marker for their town and see the information we have assembled. Proc Report and the SAS Macro language together allow us to create the table for each town.

The SAS Macro “Group” writes a table for each town with the macro variable “&group”. Using styles within Proc Report, we format the tables according to our corporate standard. In the Compute block, we add the fly-over text to aid our managers to drill through the information.

The STYLE= option creates the value for the STYLE attribute. Here we use style=flyover="Click…") to get the screen tip click to go to the monthly budget.

```sas
%macro create(group);
ods html file="C:\@sample\Budget2013\reporting\HTML Presentation\&group..html" newfile=page;
title "&group" color=delog;
proc report data=work.monthly (where=(town="&group"))
   nowd wrap center ls=120 ps=40
   style(Lines)={background=white foreground=black font_face="Calibri" font_weight=bold}
   style(REPORT)={frame="border"}
   (...more style lines here...)
column town year b12 ttot mtot;
...(more code here to define the report lines)
break after year / skip color=white;
/*create hyperlink to 2013 files*/
compute year;
if year = 2013 then do;
    href=trim(town)||'Y13.html';
call define(_COL_,"URLP",href);
call define(_COL_, 'style', 'style=flyover="Click to go to 2013"');
quit;
```

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We run similar code to create the reporting format for the annual planning forecast data and include a hyperlink in the first year that allows us to drill to a chart.

**ADD A CHART**

Sometimes a picture tells a more compelling story. Proc GCHART option PIE draws a pie chart of the revenue per product line. We create a data file product1 with html tags as we did for the annual operating plan and monthly budget for use in charting. When our town managers click on the product "Boots", they see a pie chart of the margin composition.

```
proc gchart data=product1;
Title "Margin Composition for &group";
where town="&group";
pie desc /noheading levels=3 sumvar=mtot name="&group"
run;
quit;
```

Finally, we use CALL EXECUTE to create the html files our web administrators need. When CALL EXECUTE runs, it sends the character string that is between the parentheses to the macro. From the data set q1, the CALL EXECUTE creates an html file for each of our locations.

```
Data _null_;
set q1;
  call execute('%create('||town||'))';
run;
```

**PUTTING IT ALL TOGETHER**

To explore the budget, our manager in Carlsbad, New Mexico clicks on the Carlsbad star on the map and sees this table. The flyover message “Click to go to 2013 Monthly Budget” appears when selecting the hyperlink at 2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>Outlets</th>
<th>Inventory</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>65</td>
<td>$1,356,501</td>
<td>$395,603</td>
</tr>
<tr>
<td>2014</td>
<td>101</td>
<td>$1,212,116</td>
<td>$395,600</td>
</tr>
<tr>
<td>2015</td>
<td>139</td>
<td>$2,621,070</td>
<td>$851,206</td>
</tr>
</tbody>
</table>

Table 2. Sample Annual Operating Plan for Carlsbad
Clicking “2013” takes us to the categorized monthly budget for the year.

### Carlsbad 2013 Budget

<table>
<thead>
<tr>
<th>ID</th>
<th>Desc</th>
<th>Jan</th>
<th>Feb</th>
<th>...</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Boot</td>
<td>$1,775</td>
<td>$1,775</td>
<td>.</td>
<td>$1,775</td>
<td>$1,775</td>
<td>$21,297</td>
</tr>
<tr>
<td>20</td>
<td>Men’s Casual</td>
<td>$5,267</td>
<td>$5,267</td>
<td>.</td>
<td>$5,267</td>
<td>$5,267</td>
<td>$63,206</td>
</tr>
<tr>
<td>30</td>
<td>Men’s Dress</td>
<td>$10,312</td>
<td>$10,312</td>
<td>.</td>
<td>$10,312</td>
<td>$10,312</td>
<td>$123,743</td>
</tr>
<tr>
<td>40</td>
<td>Sandal</td>
<td>$2,433</td>
<td>$2,433</td>
<td>.</td>
<td>$2,433</td>
<td>$2,433</td>
<td>$29,198</td>
</tr>
<tr>
<td>50</td>
<td>Slipper</td>
<td>$5,408</td>
<td>$5,408</td>
<td>.</td>
<td>$5,408</td>
<td>$5,408</td>
<td>$64,891</td>
</tr>
<tr>
<td>60</td>
<td>Sport Shoe</td>
<td>$218</td>
<td>$218</td>
<td>.</td>
<td>$218</td>
<td>$218</td>
<td>$2,617</td>
</tr>
<tr>
<td>70</td>
<td>Women’s Casual</td>
<td>-</td>
<td>-</td>
<td>.</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>80</td>
<td>Women’s Dress</td>
<td>$25,918</td>
<td>$25,918</td>
<td>.</td>
<td>$25,918</td>
<td>$25,918</td>
<td>$311,017</td>
</tr>
</tbody>
</table>

Table 3. Sample Annual Operating Plan for Carlsbad

Clicking on “Boot” takes us to a pie chart showing the margin contribution of each product line.

![Margin Composition Chart](image)

Figure 2. Sample Margin Composition Chart

**CONCLUSION**

It could take 5 different software applications to develop a drill down geographical presentation. SAS does it in a few easy steps. As shown in this simple example, time to implement a web-based solution can be minimized by using SAS MAP, ODS and Proc Report as you develop the reporting code. SAS continues to enhance web-based reporting and the SAS programmer has the ability to create sophisticated reporting. As businesses are forced to do more with less, SAS can alleviate some of the burden on web programmers by creating simple, drillable tables and graphs.

**RECOMMENDED READING**

- *Base SAS® Procedures Guide*
- *SAS Knowledge Base and SAS Support Communities*
• *Paper 005-2010 ODS HTML Evolution: HTML that Scrolls, Panels, Floats, Reads, and Integrates by Eric Gebhart, SAS Institute Inc., Cary, NC*

**CONTACT INFORMATION**

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