#### SA118-2014

## SAS ODS HTML + PROC Report = Fantastic Output

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#### ABSTRACT

ODS (Output Delivery System) is a wonderful feature in SAS to create consistent, presentable reports. Using this feature in combination with the powerful PROC Report can give you a lot of control over the report structure, design and overall appearance. You can set the column width, font style and size, add colors where desired, and include a picture or a logo, just to name a few. This paper contains tips and tricks for producing a presentation-worthy HTML output making use of some of the key features available in ODS HTML, PROC Report and SAS Macros.

#### INTRODUCTION

Most companies strive to maintain uniformity and a certain level of consistency across the SAS reports they generate in order to align with corporate branding. Things such as the logo, colors, fonts, report structure etc., are some of the key details that define a corporate brand. In the data reporting world, it is common to see multiple developers/programmers creating reports separately. Sometimes these programmers are spread out across the country. In the case of global companies, they might even be located in different nations. The challenge is that management wants to see all of these individually developed reports rolled into one document. A unified document requires manual effort by developers or analysts to compile the individual outputs, and additional time and effort spent making each report look visually consistent with the corporate brand. This paper demonstrates how to automate the process by using pre-existing SAS tools and features. This paper also shows how to add additional functionality to a summary document such as point-and-click access into the granularity of each report, and a button to export data into Excel. Following this methodology, each time a new report is created it will append itself to the summary book and keep the compiled report current and consistent.

#### **ODS HTML + PROC REPORT = FANTASTIC OUTPUT: AN EXAMPLE**

Figure 1 is a screen shot of a data ETL (extraction transformation and loading process) quality check report. This report contains a content page and individual load quality control (QC) summaries. These summaries are available immediately after each data source loads. Because data comes from different sources at varying times throughout the month, we want to run a quality check each time a new data set is refreshed. Each individual report contains tables for the data source, the load type, whether table validation is required, and what the thresholds are for quality inspection. In this fictional example, a rolling three-month average of the data counts, including thresholds, is used to determine if new data is valid. New data's calculated validity is displayed with a value 'PASS' or 'FAIL' in the final column, QC\_Result. For quick and easy readability, the 'compute' option in PROC REPORT is utilized to change the color of the cell to be green for pass and red for the tables that failed QC inspection.

### Figure 1: ETL QC Report

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<ul> <li><u>Table 1</u></li> </ul>												
		TABLE_NAME		BOOK_MONTH			CURR_RECORD_CN				QC_RESULT	
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<ul> <li>SAPPHIRE</li> <li>ETL Load QC Summary</li> <li><u>Table 1</u></li> </ul>		OXF_CLAM_CONDITION OXF_CLAM_CONDITION OXF_CLAM_DETAL OXF_CLAM_DETAL_INE_CONTROL OXF_CLAM_HEADER OXF_CLAM_HTAKE OXF_CLAM_INTAKE_INE_CONTROL	MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY	AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14	Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14	3653065 25715 4162179 4486812 1497618 4461437 129608	3680057 23382 3953345 4231738 1390618 4223655 110998	Y Y Y Y Y N	12 10 15 15 15 15 0	0.7383884 9.0725256 5.01742 5.6849719 7.1446791 5.3297178 14.358682	PASS PASS PASS PASS PASS PASS PASS	
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<ul> <li>SAPPHIRE</li> <li>ETL Load QC Summary</li> <li>Table 1</li> </ul>		DXF_CLAM_COURTNENT DXF_CLAM_CONDITION DXF_CLAM_DETAL DXF_CLAM_DETAL_HIL_CONTROL DXF_CLAM_HTARE DXF_CLAM_HTARE DXF_CLAM_UTARE_HIL_CONTROL DXF_CLAM_UTARE_HIL_CONTROL DXF_CLAM_UTARE_HIL_CONTROL DXF_CLAM_VALUE	MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY	AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14	Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14	3653065 25715 4462179 4485812 1497618 4461437 129608 100610 55489	3680057 23382 3953345 4231738 1390618 4223655 110998 91359 51022	Y Y Y Y Y Y N Y	12 10 15 15 15 15 0 12 12	0.738884 9.0725258 5.01742 5.6849719 7.1446791 5.3297178 14.358882 9.194911 8.0502442	PASS PASS PASS PASS PASS PASS PASS PASS	
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<ul> <li>SAPPHIRE</li> <li>ETL Load QC Summary         <ul> <li>Table 1</li> </ul> </li> </ul>		OW_CLAM_ADUSTMENT OW_CLAM_CONTROL OW_CLAM_DETAL OW_CLAM_DETAL OW_CLAM_HARK OW_CLAM_HARK OW_CLAM_HARK OW_CLAM_HARK OW_CLAM_CONTROL OW_	MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY	AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14	Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14	3653065 25715 416(2179 446812 1497618 4461437 129008 100610 55489 395423 2575	3680057 23382 3983345 4231738 4223656 110998 91359 51022 396682 2813	Y Y Y Y Y Y Y Y Y Y	12 10 15 15 15 15 0 12 12 12 10 10	0.738884 9.0725258 5.01742 5.8649719 7.1446791 5.3297178 14.358882 9.194911 8.0502442 0.3183932 1.4757282	PASS PASS PASS PASS PASS PASS PASS PASS	
<ul> <li>SAPPHIRE</li> <li>ETL Load QC Summary         <ul> <li>Table 1</li> </ul> </li> </ul>		0x7_CLAM_ADUSTMENT 0x7_CLAM_DORTAL 0x7_CLAM_DETAL 0x7_CLAM_DETAL_LINE_CONTROL 0x7_CLAM_DETAL_LINE_CONTROL 0x7_CLAM_DETAL_LINE_CONTROL 0x7_CLAM_VTAL_LINE_CONTROL 0x7_CLAM_VTAL_LINE_CONTROL 0x7_CLAM_VTAL_LINE_CONTROL 0x7_LINE 0x7_LINE 0x7_LINE 0x7_LINE 0x7_LINE 0x7_LINE	MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY MONTHLY	AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14	Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14 Sep14	365365 28715 4162179 4468612 1497018 4461437 12908 100610 55489 395423 2575 547	3680057 23382 3953345 4231738 1390616 4223855 110998 91359 51022 396682 2813 547	Y Y Y Y Y Y Y Y Y Y Y	12 10 15 15 15 0 12 12 12 10 10 10	0.7388864 9.0725258 5.01742 5.6849719 7.1448791 5.3297178 14.356862 9.194911 8.0502442 0.3183932 1.4757282 0	PASS PASS PASS PASS PASS PASS PASS PASS	
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<ul> <li>a. SAPPHIRE</li> <li>a. ETL Load QC Summary</li> <li><u>Table 1</u></li> </ul>		0xr_LCAM_COUSTMENT 0xr_LCAM_CONTAL 0xr_LCAM_DOTAL 0xr_LCAM_DOTAL 0xr_LCAM_PERAL,SME_CONTROL 0xr_LCAM_PERALS 0xr_LCAM_PERALS 0xr_LCAM_OCCURRENCE 0xr_LCAM_OCCURRENCE 0xr_LCAM_OCCURRENCE 0xr_LCAM_OCCURRENCE 0xr_LCAM_OCCURRENCE 0xr_LCAM_OCCURRENCE 0xr_LCAM_OCCURRENCE 0xr_DOTAL 0xr_LCAM_OCCURRENCE 0xr_DOTAL 0xr_DOTAL 0xr_DOTAL 0xr_DOTAL 0xr_DOTAL 0xr_DOTAL 0xr_DOTAL 0xr_ROVERL 0xr	MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY MOILEY	AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14 AUG14	Sep14 Sep14	9653065 23215 4163179 4460812 1497018 4461437 129605 100610 5549 396423 2275 547 839 55 22025 1853 1853 1853 1853 1853 1853 1853 185	3680057 23352 395345 4221738 4222755 4222555 110966 9159 5159 547 648 55 22057 1844 543 648 55 25027 1844 54306 243375	A A A A A A A A A A A A A A A A A A A	12 10 15 15 15 0 12 12 10 10 10 10 10 10 10 10 10 10 10 10 10	0.738084 9.0725258 9.01742 5.6849719 1.350802 9.134617 1.4350802 9.134611 8.0502442 0.3185932 1.4757282 0 0.0086662 2.2128282 0.2239204 0.0477599 0.7502140 0.7502140 0.7502140	PA33 PA35 PA55 PA55 PA55 PA55 PA55 PA55	

#### **STEPS INVOLVED**

Here are the nine steps I used to create the report illustrated in Figure 1 above. Each step is explained in greater detail in the subsequent sections.

```
/*_____
STEP-1: Create Summary Macro
-----*/
%macro generate summary ;
/*-----
STEP-2: Check for necessary directories, If they don't exist,
Create required directories, assign Library names etc.
----*/
%if %sysfunc (fileexist(load qc &run month.)) ^= 1 %then...
/*_____
STEP-3: USE PROC TEMPLATE to Customize Content Title
-----*/
Proc template;
. . .
/*_____
STEP-4: Initiate the HTML Report
----*/
ODS HTML ...;
```

```
/*-----
STEP-5: DRIVE macro to list all the Final Datasets
ready for reporting
         */
%MACRO DRIVE(dir);
  . . .
/*_____
STEP-6: Create any additional report components that are
  needed, store them into Macro Variables
                       _____* /
PROC SQL noprint; select distinct INTO: ...
/*_____
STEP-7: Output HTML File for each dataset in the output dir
_____*
ODS HTML FILE =...
/*_____
STEP-8: PROC Report to stylize the output report
_____*
PROC REPORT DATA = . . .
/*_____
STEP-9: E-Mail Component
_____*/
DATA NULL ;
 FILE mymail; ...
```

#### 1. STEP-1: CREATE A SUMMARY REPORT MACRO

The generate\_summary macro is central to the automation process. It consists of using a PROC TEMPLATE step, PROC REPORT step, ODS Statements, creating and executing other macros, email components etc. Depending on the situation, the macro can be utilized to meet the reporting needs of a single team with multiple users, or could be enhanced further to handle reports generated by multiple teams across a division or multiple projects in a company.



### 2. STEP-2: CREATE NECESSARY DIRECTORIES AND LIBRARY NAMES

The purpose of this step is to organize the directories by each run month. We use the 'sysfunc(fileexist)' function to determine if the necessary project directory structure is already set up or if it needs to be created. Because multiple members across a team can execute the summary macro, and each teammate uses this macro in a new run month (say, 201410), all the required directories wouldn't be in place. So, we create the needed folders and assign library names as shown. This step is an optional step, customized for the multiple person scenario.

### 3. STEP-3: PROC TEMPLATE PROCEDURE

I used PROC TEMPLATE procedure to customize the "Table of Contents": text that is the default; the result is shown in Figure 2. There are several ready-made styles to choose from. I changed the default style to 'seaside' to suit my needs. However, a deeper dive into PROC TEMPLATE can provide you with an even greater level of control over the general style, font, text, border and table attributes. For more information on editing styles please refer to 'SAS 9.2 Output Delivery System User's Guide, SAS Documentation' available at

http://support.sas.com/documentation/cdl/en/odsug/61723/PDF/default/odsug.pdf.





#### 4. STEP-4: INITIATE ODS HTML

The **ODS HTML** statement opens or closes the HTML destination. The **PATH**= option specifies the location of the HTML files. **FRAME** identifies the file that integrates the table of contents, the page contents, and the body file. '**CONTENTS'** opens the HTML destination and creates the file that contains a table of contents for the output. ODS HTML automatically creates an **ANCHOR** for every piece of output generated by the SAS procedures. An anchor specifies a particular location within an HTML file. In order for the links from the contents, page, or frame file to work, each piece of output in the body files must have a unique anchor to link to. For **STYLE**, we are choosing modified seaside style names as 'test' created in the PROC TEMPLATE step described above. ODS HTML syntax has improved. See '*ODS HTML Evolution: HTML that Scrolls, Panels, Floats, Reads, and Integrates*' by Eric Gebhart (Reference #3) for greater details.

### 5. STEP-5: MACRO TO PRINT ALL DATASETS OF A DIRECTORY

This macro is a ready-to-use portable macro available on the SAS support website, <u>http://support.sas.com/kb/25/074.html</u>. It enables you to print all files in a folder with a specified extension. This macro takes 2 parameters. The first parameter is the directory that contains the files. The second parameter is the file extension of the files you are looking for. I made a few modifications to this macro, included in steps 6, 7 and 8 described below to meet my report needs.

```
/*_____
STEP-5: DRIVE macro to list all the Final Datasets
ready for reporting
*/
%MACRO drive(dir,ext);
 %let filrf=mydir;
 /* Assigns the fileref of mydir to the directory and opens the
directory */
 %let rc=%sysfunc(filename(filrf,&dir));
 %let did=%sysfunc(dopen(&filrf));
/* Returns the number of members in the directory */
 %let memcnt=%sysfunc(dnum(&did));
 /* Loops through entire directory */
  %do i = 1 %to &memcnt;
 /* Returns the extension from each file */
    %let name=%qscan(%qsysfunc(dread(&did,&i)),-1,.);
 /* Checks to see if file contains an extension */
    %if %qupcase(%qsysfunc(dread(&did,&i))) ne %qupcase(&name)
%then %do;
/* Checks to see if the extension matches the parameter value */
/* If condition is true prints the full name to the log
                                                          */
     %if (%superq(ext) ne and %qupcase(&name) = %qupcase(&ext))
or
        (%superq(ext) = and %superq(name) ne) %then %do;
        %put %qsysfunc(dread(&did,&i));
     %end;
    %end;
  %end;
/* Closes the directory */
 %let rc=%sysfunc(dclose(&did));
%MEND drive;
/* First parm is the dir of where your files are stored.
                                                        */
/* Second parm is the extension you are looking for.
                                                         */
```

```
/* Leave 2nd parm blank if you want a list of all the files. */
%drive(c:\,sas)
```

#### 6. STEP-6: BUILD ADDITIONAL REPORT COMPONENTS AS NEEDED

While the summary report is great, sometimes it is useful to have access to other details. For example you can look up who ran the report, or open the work request pertaining to the report. We can include such details by creating macro parameters when the jobs are executed and use them in the report as clickable buttons, shown in Figure 3 below.

```
/*_____
 STEP-6: Create any additional report components that are
    needed, store them into Macro Variables
                ____* /
proc sql noprint;
     select distinct compress(fact, " ") into: factname
       from &librf..&fname. ;
     select distinct impact definition into: impact def
      from &librf..&fname. ;
     select distinct (developer) into: developer
       from &librf..&fname. ;
     select distinct (rundate) into: rundate
       from &librf..&fname. ;
     select distinct (fact request) into: fact request
       from &librf..&fname. ;
quit;
footnote4 J=l "<div align=""left""><input type=""button""</pre>
value=""Open Request""
onclick=javascript:window.open('&fact request')></div>";
footnote5 j=l '<input</pre>
onclick="document.execCommand(''SAVEAS'',true,
''c:\\temp\\test.xls'')" value= "Download To Excel"
type="button">';
```



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	HKG	5,687			5,687	0.00%	223,397	229,084				
	KIC	282			282	0.00%	6,440	6,722				
	NRE	4,951	76	40	4,915	( 0.73%)	98,023	102,938				
	Developer : GNARAYANDAS											
Open Request												
۰ III ا	Downlo	oad To Excel							-			

#### 7. STEP-7: WRITE HTML OUTPUT FILE FOR EACH DATASET OR PROCEDURE

The **FILE**= option identifies the file containing the HTML version of the procedure output. Use the ODS PROCLABEL statement to create customized labels in the table of contents. Since **PROCLABEL** affects only the SAS procedure immediately following it, it works great in this situation, since we need different labels to represent different data sources each time PROC REPORT iterates.

### 8. STEP-8: PROC REPORT TO STYLIZE THE OUTPUT

There is a quite bit of material already available on PROC REPORT procedure if you want to understand all the intricate details, features and choices it has to offer. The intention of this paper is to illustrate just a few of these options, combined with ODS HTML and SAS utilities to develop a refined report. Below is the PROC REPORT statement that I used to make the output visually more appealing. I described the process in six parts, A-F, below.

```
STEP-8: PROC Report to stylize the output report
   ------
proc report data = &librf..&fname.
           split='*'
           contents = "ETL Load QC Summary"
 style(header) =
   [just = left
    font face = calibri
    font size = 3
                                                                 В
    foreground = white
    background = orange
    protectspecialchars=off] ;
 column Table name Load Type Book Month Run Month
                                                                 С
          AVG Count 3MON CURR Record CNT VALIDATE TOLERANCE
          ABS PCT DIFF QC RESULT ;
 define Table_name/display 'TABLE_NAME' style={just=l vjust =b };
 define Load Type / display 'LOAD TYPE' style={just=c vjust =b };
 define Book Month/ display 'BOOK MONTH'style={just=c vjust =b };
 define Run Month/ display 'RUN MONTH' style={just=c vjust =b };
 define AVG Count 3MON / display '3MON ROLLING AVG'style={just=c
vjust =b };
 define CURR Record CNT/ display 'CURR RECORD CNT' style={just=c
                                                                 D
vjust =b };
 define VALIDATE/ display 'VALIDATE' style={just=c vjust =b };
 define TOLERANCE / display 'TOLERANCE' style={just=c vjust =b };
 define ABS PCT DIFF / display 'ABS PCT DIFF'style = {just=c
vjust =b };
  define QC RESULT / display 'QC RESULT' style={just=c vjust =b };
 compute qc result;
    if qc result = 'PASS' then
      call define( col ,"style","style={background=limegreen}");
     else if qc result = 'FAIL' then
                                                                 Е
        call define( col ,"style","style={background=crimson}");
    else call define( col ,"style","style={background=crimson}");
 endcomp;
```

```
TITLE1 j=l '<IMG SRC="/location/OPTUM.gif" HEIGHT=80 >';
TITLE3 j=l c=white bcolor = orange font=calibri h=6 bold "ETL Load
QC Report";
TITLE5 j=l c=White bcolor = grey font=calibri h=4 bold "Data
Source: &Data_source";
TITLE6 j=l c=White bcolor = grey font=calibri h=4 bold "Run Month:
&run_month";
footnote J=l "<div align=""left""><input type=""button""
value=""Open Request""
```

- A. PROC REPORT has a regular DATA statement. SPLIT breaks a column heading when it reaches that character and continues the heading on the next line. The split character (\*) itself is not part of the column heading although each occurrence of the split character counts toward the 256-character maximum for a label. 'CONTENTS' specifies text for the HTML or PDF table of contents entry for the output.
- B. STYLE: option, or rather options, in the PROC REPORT statement can add a great amount of detail to the report. For example, we have listed six options in that statement. We are stating that the header be LEFT JUSTIFIED, font style = Calibri, font size =3, controlling background and foreground colors. When sending output to the HTML destination using PROC REPORT a number of the usual attributes are not available. The issue arises when you type something like '<MCA />' into your data then SAS will protect those characters and output will actually be converted into character entities that don't make sense. A simple fix for such situations is to turn off the 'protectspecialchars' attribute within style definitions, so SAS ignores special characters and output is exactly as entered.
- C. COLUMN: The primary function of the COLUMN statement is to provide a list of variables for REPORT to print in the order from left to right that they are to appear on the report. Though not demonstrated in this code, the COLUMN statement can be used to attach a statistic to the variable. It can also add headers to group variables.
- D. DEFINE: While COLUMN statement is used to declare the variables of interest, DEFINE statements provide the details of how to use those variables. In this particular report, we are using it for DISPLAY of the variable name. Additionally, other STYLE attributes such as horizontal (left or right or center) and vertical (top or bottom or center) justification could be chosen.
- E. COMPUTE: A compute block can be associated with a report item or with a location (at the top/bottom of a report/page). A compute block is created with the COMPUTE window or with the COMPUTE statement. There is enormous flexibility with the

COMPUTE statement. In our example, we are simply using a 'compute' statement to change colors of the cell based on the QC\_RESULT value of a data source table.

F. TITLE and FOOTNOTES: statements can be defined anywhere in the SAS program

## 9. Step-9: EMAIL COMPONENT:

This is a straight forward SAS utility that most SAS users may are already be aware of. Several email compositions could be written and used with appropriate conditional logic if a different email composition is needed to be sent to different team members based on the quality check result.

```
/*_____
STEP-9: E-Mail Component
_____*
filename mymail email to="userid@optum.com"
    subject="ETL Load QC Summary Report - &run month." ;
data null ;
 file mymail;
 put "Hi %upcase(&&sysuserid)," /;
 put "The ETL Load QC Summary Report for the month of
&run month. Completed processing."/;
 put "Please review the Load QC Summary Results at the link
below"/;
 put "File://X:&run month./output/Frame ETL QC Summary.htm" /;
 put "Thank you!"/;
 put " ";
 run;
```

### CONCLUSION

PROC REPORT is a very powerful report generating tool that is fairly easy to use once you get familiar with it. Initially, the key words and different syntax style may seem complex, but it becomes more manageable and even enjoyable as you become familiar with the flexibility and choices available to spruce up your reports. By combining PROC REPORT with ODS HTML, SAS MACROS and other SAS utilities, you can create impressive and versatile reports for your company.

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