Using SAS® and Other Tools to Move an Institutional Research (IR) Office from Hardcopy Reporting to a Web-Based Environment

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ABSTRACT

At a minimum, university constituents want timely and accurate data. The focus now is the demand for user-friendly reporting. More specifically, in today's fast-paced, technology-enhanced world, users want a friendly, web-reporting environment. As these demands increase, it presents challenges for the IR office. At the University of Central Florida (UCF), a major metropolitan university, we are meeting some of these challenges by converting legacy-based reports into dynamic and interactive Web applications using SAS® tools, specifically SAS/IntrNet®, and other desktop applications.

We will demonstrate two applications:

- The *Enrollment Profile* uses SAS/IntrNet, Base SAS, SAS/GRAPH, SAS/Macro Language, HTML, JavaScript, and Microsoft Access to provide the university community with current and historical student enrollment headcount information.
- The *Course Registration Profile* uses the above tools and SAS/ACCESS to Oracle to provide the university administrative personnel, faculty, and staff with near-live course registration data during registration periods. Historical data are maintained for trend comparisons with previous year's data.

WHO WE ARE

MISSION

The mission of the Office of Institutional Research (IR) is to support planning, decision-making, and assessment at the University of Central Florida by providing information that is timely and of the highest quality.

PURPOSE

The IR office is a service-oriented unit that provides information and proposes alternative solutions to support the decision-making process. The purposes of the Office of Institutional Research are to assist in the organization and maintenance of institutional data for decision-making, to analyze and interpret data, to provide information which is appropriate and useful in planning and decision-making, and to serve as a catalyst for institutional self analysis and improvement. The director and staff serve on numerous university-wide committees and workgroups and assist with the collection and interpretation of institutional data, assist in planning academic programs, and participate in the implementation of evaluative procedures. The functions of the office support the entire university enterprise.

BACKGROUND

The Office of Institutional Research (IR) has, as one of its primary responsibilities, the task of reporting all official data to internal and external constituents. Staff from the IR office routinely meet with end users and participate in workgroups and committees that deal with data needs and information access. This allows us the opportunity to interact directly with end users and determine, one-on-one, exactly what their data needs are and the format that would best meet their needs. This also has the added benefit of allowing IR staff to more immediately respond to needs and make changes to our new dynamic applications as they are requested.

INTRODUCTION

Throughout the year, numerous official data files and hard copy reports are produced. What we have found very recently is a trend that end-users want more and more data in varying formats. The legacy-based programs are cumbersome to change and the hard copy reports may not be as functional as the user needs. Having a more sophisticated and flexible reporting tool such as SAS/IntrNet has allowed the IR office to better respond to user's data and information needs.

UCF has been using SAS in the classroom for many years. Thus, IR was able to utilize the SAS knowledge of a member of the Statistics & Actuarial Science Department—Dr. Morgan Wang, Director of the SAS Data Mining Certificate program at UCF. With the assistance of several of his graduate students we began to explore applications built on SAS technology because of the ability to dynamically create and display tables and graphs or charts on the web. As a result of senior level administrators wanting more timely and easily accessible data it was decided that the IR office would lead an effort to use SAS in an "administrative capacity." Two applications were prototyped and will be discussed in this paper.

ENROLLMENT PROFILE

The Enrollment Profile site was originally conceived as a way for the IR office to be able to immediately respond to (daily) enrollment questions during key times of the year. The IR office was always the source for enrollment data and, before we had the capability to produce the data dynamically from a daily update process, we would have to wait until a hard copy printed out (often a day or two after the request was made). Since our census data file is not submitted until 6 weeks into the term, you can see where earlier data needed to be provided.

HARDCOPY REPORTING

Several hardcopy enrollment reports for each college and/or school at UCF are produced for each of an academic year's semesters—summer, fall and spring. A page of one hard to read, multiple-page report is shown in Figure 1. These reports were written in COBOL and are difficult to program and redesign. Based on space limitations, adding columns or rows would pose some challenges. One department may have 30, 40, or 50 pages in one reporting term and there are more than 60 departments at UCF. Thus, physical storage room to house these catalogued reports is at a premium and, if a college wanted to collect historical information for each of its departments, it would take a tremendous amount of time and effort just to photocopy that many pages. This prompted us to look for a better way to provide this information.

Figure 1: OCR-B2 Student Enrollment Survey Report

UNIVERSITY OF CENTRAL FLORIDA

02/26/200 OCR-B2 STUDENT ENROLLMENT SURVEY PAGE: 27

18:24.03 MAJOR FIELD OF STUDY: 99.9999 (999999) - SUMMARY REPORT TERM: 08/2001

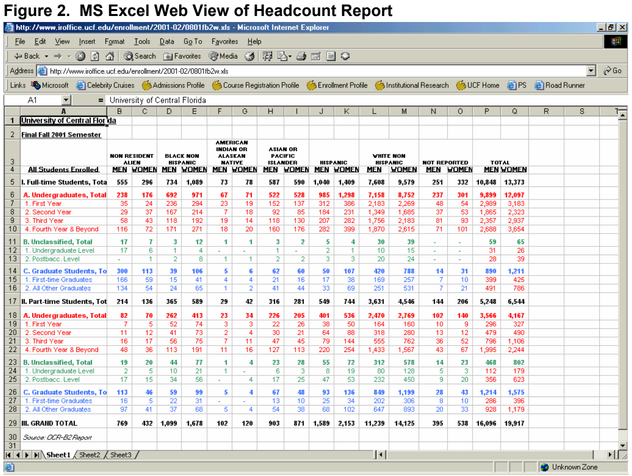
BROAD DISCIPLINES

ALL STUDENTS ENROLLED (FOR CREDIT)	LINE NO.	NON RESIDENT ALIEN MEN (01)	NON RESIDENT ALIEN WOMEN (02)	BLACK NON-HISPANIC MEN (03)	BLACK NON-HISPANIC WOMEN (04)	AMERICAN INDIAN OR ALASKAN NATIVE MEN (05)	AMERICAN INDIAN OR ALASKAN NATIVE WOMEN (06)	ASIAN OR PACIFIC ISLANDER MEN (07)	ASIAN OR PACIFIC ISLANDER WOMEN (08)	HISPANIC MEN (09)	HISPANIC WOMEN (10)	WHITE NON-HISPANIC MEN (11)	WHITE NON-HISPANIC WOMEN (12)	NOT REPORTED MEN (13)	NOT REPORTED WOMEN (14)	* TOTAL * SUM OF COLUMNS (1)-(12) MEN (15)	* TOTAL * SUM OF COLUMNS (1)-(12) WOME (16)
I. FULL-TIME STDS TOTAL	1	555	296	734	1089	73	78	587	590	1040	1409	7608	9579	251	332	10848	13373
A. UGRADS, TOTAL	2	238	176	692	971	67	71	522	528	985	1298	7158	8752	237	301	9899	12097
1. FIRST YEAR	3	35	24	236	294	23	19	152	137	312	386	2183	2269	48	54	2989	3183
A. FTIC CUR TRM	4	18	16	139	188	14	11	101	77	184	265	1247	1262	29	35	1732	1854
B. FTIC PRV TRM	5	5	2	25	28	5	5	24	29	53	47	357	531	4	8	473	650
C OTHER 1ST YR	6	12	6	72	78	4	3	27	31	75	74	579	476	15	11	784	679
2. SECOND YEAR	7	29	37	167	214	7	18	92	85	184	231	1349	1685	37	53	1865	2323
3. THIRD YEAR	8	58	43	118	192	19	14	118	130	207	282	1756	2183	81	93	2357	2937
4. FORTH YR BEYND	9	116	72	171	271	18	20	160	176	282	399	1870	2615	71	101	2688	3654
B. UNCLASF, TOTAL	10	17	7	3	12	1	1	3	2	5	4	30	39	0	0	59	65
1. UGRAD LEVEL	11	17	6	1	4	0	0	1	0	2	1	10	15	0	0	31	26
2. PBACH LEVEL	12	0	1	2	8	1	1	2	2	3	3	20	24	0	0	28	39
C. 1ST PROF STUDS	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. GRAD STDS TOTL	14	300	113	39	106	5	6	62	60	50	107	420	788	14	31	890	1211
1. FIRST TIME	15	166	59	15	41	4	4	21	16	17	38	169	257	7	10	399	425
2. ALL OTHER	16	134	54	24	65	1	2	41	44	33	69	251	531	7	21	491	786
II. PART-TIME TOTAL	17	214	136	365	589	29	42	316	281	549	744	3631	4546	144	206	5248	6544
A. UGRADS, TOTAL	18	82	70	262	413	23	34	226	205	401	536	2470	2769	102	140	3566	4167
1. FIRST YEAR	19	7	5	52	74	3	3	22	26	38	50	164	160	10	9	296	327
A. FTIC CUR	20	4	1	31	30	0	2	6	5	10	16	37	29	3	4	91	87
B. FTIC PRV	21	1	3	6	32	0	1	3	15	8	18	27	53	3	1	48	123
C OTHR 1ST	22	2	1	15	12	3	0	13	6	20	16	100	78	4	4	157	117
2. SECOND YEAR	23	11	12	41	73	2	4	30	21	64	88	318	280	13	12	479	490
3. THIRD YEAR	24	16	17	56	75	7	11	47	45	79	144	555	762	36	52	796	1106
4. FOURTH YR+	25	48	36	113	191	11	16	127	113	220	254	1433	1567	43	67	1995	2244
B. UNCLASF, TOTL	26	19	20	44	77	1	4	23	28	55	72	312	578	14	23	468	802
1. UGRAD LVL	27	2	5	10	21	1	0	6	3	8	19	80	128	5	3	112	179
2. PBACH. LVL	28	17	15	34	56	0	4	17	25	47	53	232	450	9	20	356	623
C. FIRST PROF	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. GRAD STUDS TL	30	113	46	59	99	5	4	67	48	93	136	849	1199	28	43	1214	1575
1. FIRST TIME	31	16	5	22	31	0	0	13	10	25	34	202	306	8	10	286	396
2. ALL OTHER	32	97	41	37	68	5	4	54	38	68	102	647	893	20	33	928	1179
III. GRAND TOTAL ALL	33	769	432	1099	1678	102	120	903	871	1589	2153	11239	14125	395	538	16096	19917

MOVEMENT FROM HARDCOPY REPORTING

In an attempt to make enrollment information more easily accessible to the UCF community and the general public, the IR office began creating MS Excel files for display on the web. Thus, each semester when the reports are printed, IR's webmistress manually creates spreadsheets that could then be accessed from the IR website and downloaded to a local machine. Figure 2 shows the web display of the report shown in Figure 1. A PDF file is also created manually for ease of printing. This process is repeated twice for the fall and spring semesters, as first a preliminary report is created and then a final report, and once for the summer semester. Although the IR office is now able to provide enrollment information to the masses, it is an extremely labor-intensive process to maintain these types of data sets and static web reports. Also, the type of information provided is limited; therefore, not all of the university's data needs are being met. Thus, what we need is a true dynamic web-based reporting environment.

Figure 2. MS Excel Web View of Headcount Report



University of Central Florida

Final Fall 2001 Semester

All Students Enrolled	NON RESIDENT ALIEN MEN	NON RESIDENT ALIEN WOMEN	BLACK NON HISPANIC MEN	BLACK NON HISPANIC WOMEN	AMERICAN INDIAN OR ALASKAN NATIVE MEN	AMERICAN INDIAN OR ALASKAN NATIVE WOMEN	ASIAN OR PACIFIC ISLANDER MEN	ASIAN OR PACIFIC ISLANDER WOMEN	HISPANIC MEN	HISPANIC WOMEN	WHITE NON HISPANIC MEN	WHITE NON HISPANIC WOMEN	NOT REPORTED MEN	NOT REPORTED WOMEN	TOTAL MEN	TOTAL WOMEN
I. Full-time Students, Tota	555	296	734	1,089	73	78	587	590	1,040	1,409	7,608	9,579	251	332	10,848	13,373
A. Undergraduates, Total	238	176	692	971	67	71	522	528	985	1,298	7,158	8,752	237	301	9,899	12,097
1. First Year	35	24	236	294	23	19	152	137	312	386	2,183	2,269	48	54	2,989	3,183
2. Second Year	29	37	167	214	7	18	92	85	184	231	1,349	1,685	37	53	1,865	2,323
3. Third Year	58	43	118	192	19	14	118	130	207	282	1,756	2,183	81	93	2,357	2,937
4. Fourth Year & Beyond	116	72	171	271	18	20	160	176	282	399	1,870	2,615	71	101	2,688	3,654
B. Unclassified, Total	17	7	3	12	1	1	3	2	5	4	30	39	-	-	59	65
1. Undergraduate Level	17	6	1	4	-	-	1	-	2	1	10	15	-	-	31	26
2. Postbacc. Level	-	1	2	8	1	1	2	2	3	3	20	24	-	-	28	39
C. Graduate Students, To	300	113	39	106	5	6	62	60	50	107	420	788	14	31	890	1,211
1. First-time Graduates	166	59	15	41	4	4	21	16	17	38	169	257	7	10	399	425
2. All Other Graduates	134	54	24	65	1	2	41	44	33	69	251	531	7	21	491	786
II. Part-time Students, Tot	214	136	365	589	29	42	316	281	549	744	3,631	4,546	144	206	5,248	6,544
A. Undergraduates, Total	82	70	262	413	23	34	226	205	401	536	2,470	2,769	102	140	3,566	4,167
1. First Year	7	5	52	74	3	3	22	26	38	50	164	160	10	9	296	327
2. Second Year	11	12	41	73	2	4	30	21	64	88	318	280	13	12	479	490
3. Third Year	16	17	56	75	7	11	47	45	79	144	555	762	36	52	796	1,106
4. Fourth Year & Beyond	48	36	113	191	11	16	127	113	220	254	1,433	1,567	43	67	1,995	2,244
B. Unclassified, Total	19	20	44	77	1	4	23	28	55	72	312	578	14	23	468	802
1. Undergraduate Level	2	5	10	21	1	-	6	3	8	19	80	128	5	3	112	179
2. Postbacc. Level	17	15	34	56	-	4	17	25	47	53	232	450	9	20	356	623
C. Graduate Students, To	113	46	59	99	5	4	67	48	93	136	849	1,199	28	43	1,214	1,575
1. First-time Graduates	16	5	22	31	-	-	13	10	25	34	202	306	8	10	286	396
2. All Other Graduates	97	41	37	68	5	4	54	38	68	102	647	893	20	33	928	1,179
III. GRAND TOTAL	769	432	1,099	1,678	102	120	903	871	1,589	2,153	11,239	14,125	395	538	16,096	19,917

Source: OCR-B2 Report

DYNAMIC WEB-BASED ENVIRONMENT

The decision was made to advance to a dynamic environment that provides information on student headcount enrollments in a myriad of different ways. For example, this application shows enrollments by college, undergraduate/graduate, full-time/part-time status, gender, ethnicity, classification and major in a drill-down fashion. For new students, headcount by student type is available at either the undergraduate or graduate level. This website was designed to replace and enhance numerous hard copy reports and be accessible via the web in a user-friendly, dynamic and interactive environment.

DATA ACQUISITION PROCESS

Using an Open DataBase Connectivity (ODBC) connection and a tool named Shadow Direct to access the student enrollment data on the mainframe, the data is brought into an MS Access database. Then SAS/ACCESS to PC File Formats is used to import the data into a permanent SAS data set. For the current term this process is repeated daily using "Windows Scheduled Tasks" to run two batch programs. The first program runs an MS Access macro to update the database, whereas, the second program runs a SAS program to import the data for use by the application. Historical data is captured in a similar fashion each time a new file is submitted to the state board of education.

RunAccess.bat

```
"C:\Program Files\Microsoft Office\Office\MSACCESS.EXE"
C:\Enrollment\Database\Enrollment.mdb /x Student
```

RunSAS.bat

```
"C:\Program Files\SAS Institute\SAS\V8\sas.exe" -sysin
C:\Enrollment\Database\importstudent.sas
```

import.sas

```
options sasautos='C:\Enrollment';
libname enroll 'C:\Enrollment\Database';
PROC IMPORT OUT= ENROLL.SUMMER03
            DATATABLE= "Coded Students"
            DBMS=ACCESS2000 REPLACE;
     DATABASE="C:\Enrollment\Database\
               Enrollment.mdb";
RUN;
```

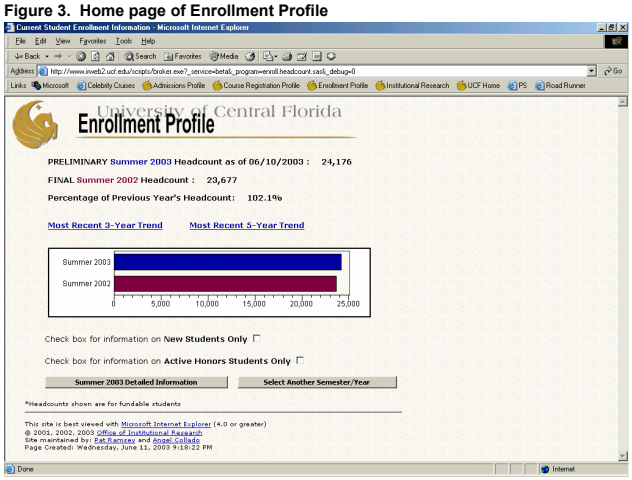
DEMONSTRATION

The following screen shots are a small representation of what is available on the Enrollment Profile site. Some of the SAS programs that produce these pages are very lengthy and, therefore, will not be reproduced in their entirety. Samples of code will be provided for key items or ideas.

Figure 3 shows the home page of the Enrollment Profile site. Instead of an HTML form, a SAS program is used to calculate the percentage difference and display a horizontal bar chart created using the Java device driver. The macro variables used in the program are passed in the URL as name/value pairs: http://www.irweb2.ucf.edu/scripts/broker.exe?_service=beta&_program=enroll.headcount.sas&_debug=0. A portion of "headcount.sas" shows how the options are set for SAS/GRAPH.

```
/*Set options for graph output device*/
goptions reset=all
         device=java
          border
          xpixels=525
          ypixels=110
           cback=white;

/*Set colors for graphs*/
pattern1 c=cx0000A0;
pattern2 c=cx800040;

/*Set axis options*/
axis1 label=none minor=(n=4);
axis2 label=none;

/*Tell SAS to output chart to the web*/
ods listing close;
ods html body=_webout rs=none
     archive="/sasweb/graph/graphapp.jar"
     attributes=("codebase"="/sasweb/graph")
     parameters=("userfmt1"="value $totfmt
'total1'=&tm &year 'total2'=&tm &preyr");
```

Figure 3. Home page of Enrollment Profile



Clicking on the "Summer 2003 Detailed Information" button brings you to the page shown in Figure 4. If you want to view information from a previous term and/or year, clicking on "Select Another Semester/Year" provides that option. On this page there are active links to drill-down deeper into the information. You can view trends as in Figure 5 by selecting a link under the "Trends" heading, or clicking a link under the "College" heading will display Figure 6, which breaks down the headcounts by classification, gender, undergraduate/graduate, and full-time/part-time status.

The following code makes the dynamic links by creating a format for the "Trends" and "College" variables that will be used later in the PROC TABULATE statements.

```
data acadfmt;
     length label $200;
     set temp(keep=aca acadgrp college);
     retain fmtname 'ACADFMT' type 'C';
     start=aca;
     label=trim('<A
HREF="http://www.irweb2.ucf.edu/scripts/broke
r.exe?'||
' service=beta&_debug=0&_program=enroll.coll_
trends.sas'||
     '&new='||"&new"||
     '&term='||&term||
     '&hon='||"&hon"||
     '&year='||trim(left(&year))||
      '&college='||trim(college)||'">'||
               trim(acadgrp)||'</A>');
run;

proc format cntlin=ACADFMT;
run;
quit;
data collfmt;
     length label $200;
     set temp(keep=col college college_name);
     retain fmtname 'COLLFMT' type 'C';
     start=col;
     label=trim('<A
HREF="http://www.irweb2.ucf.edu/scripts/broke
r.exe?'||
'_service=beta&_debug=0&_program=enroll.class
_lev_time.sas'||
     '&new='||"&new"||
     '&term='||&term||
     '&hon='||"&hon"||
     '&year='||trim(left(&year))||
      '&college='||trim(college)||'">'||
               trim(college_name)||'</A>');
run;
proc format cntlin=COLLFMT;
run;
quit;
```

The following portion of code tells SAS to close the output window and send the procedure output to the web browser.

```
ods listing close;
ods html body=_webout (notop nobot)
path=&_tmpcat (url=&_replay) rs=none;
```

The following is a portion of the PROC TABULATE code showing the format statement.

```
proc tabulate data=temp format=comma8.
     . . . other SAS statements
     format col $collfmt. aca $acadfmt.;
      . . . other SAS statements
run;
```

Then we need to stop the output to the browser and re-open the output window.

```
ods html close;
ods listing;
```

Figure 4. Headcount by College

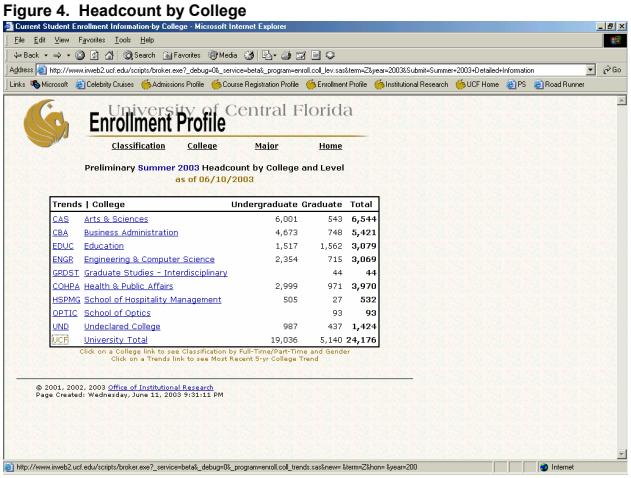
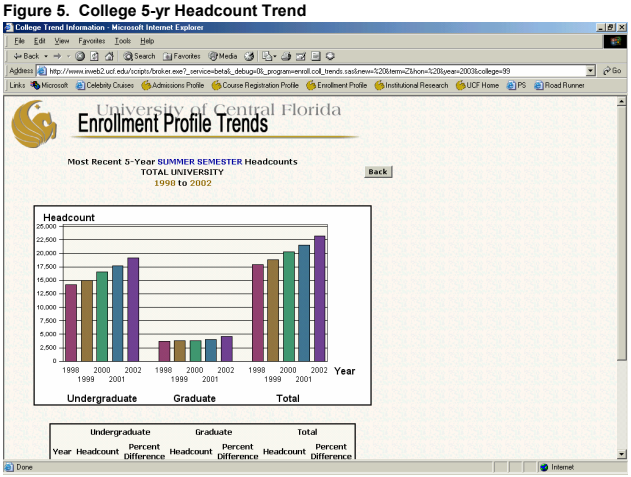


Figure 5 displays enrollment trends for summer semesters over the 5-yr period from 1998 to 2002. The Java device driver was used to create this grouped vertical bar chart.

Figure 5. College 5-yr Headcount Trend



There are two sets of active links in Figure 6. The blue links take you to the output shown in Figure 7 and the black links go to the glossary where an explanation is given of how we define the fields for this site.

Figure 6. Headcount by Classification, Gender and Enrollment Status

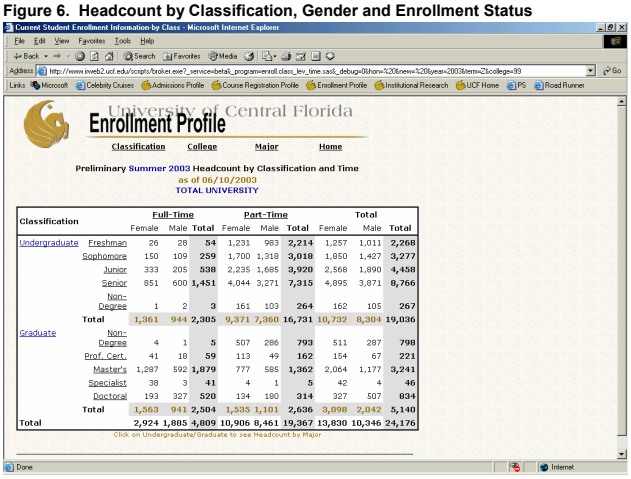


Figure 7 has dynamically generated links that will display the most recent 5-yr trend for the chosen major when clicked (Figure 8).

Figure 7. Headcount by Major, Gender, and Enrollment Status

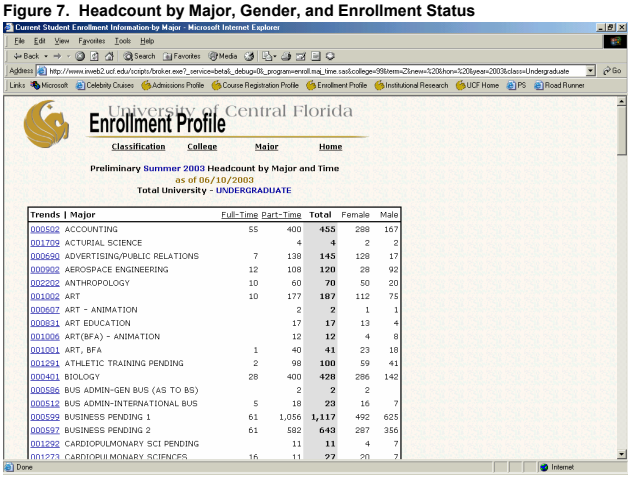
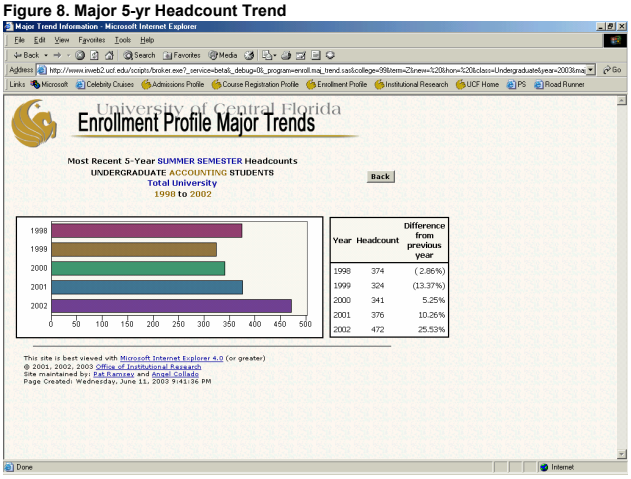
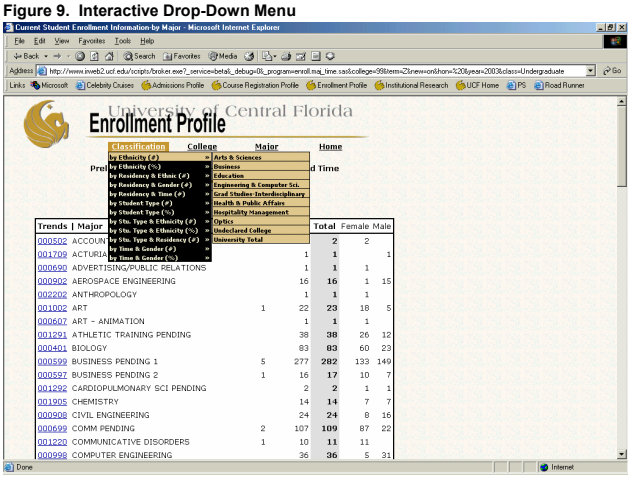


Figure 8. Major 5-yr Headcount Trend



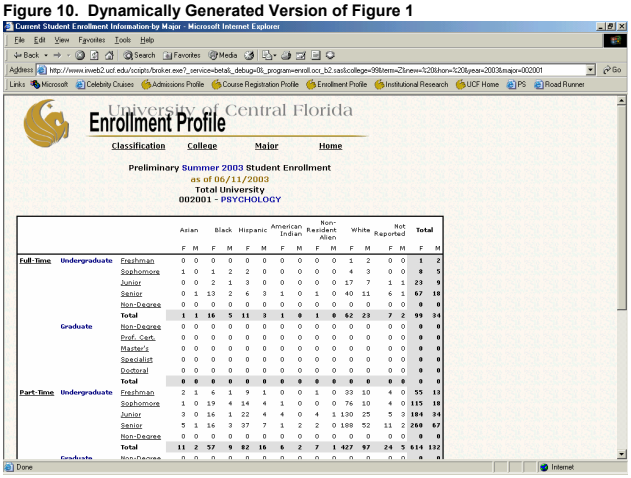
The drop-down menu displayed in Figure 9 is created using JavaScript and gives the user immediate access to a particular view without having to drill-down from page to page. Thus, the functionality is interactive—the users have more control over the data they specifically want to see. Each page (except the home page) displays this drop-down menu; thus, a separate macro program containing the script was written rather than repeat the same lengthy code in multiple programs.

Figure 9. Interactive Drop-Down Menu



As shown in Figure 10, the same data displayed in Figure 1, which was manually entered into an MS Excel spreadsheet, is now dynamically generated and displayed by the click of a hyperlink.

Figure 10. Dynamically Generated Version of Figure 1



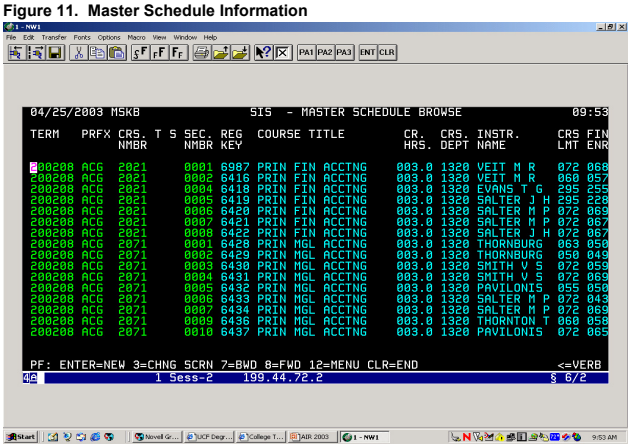
COURSE REGISTRATION PROFILE

Schedulers and course planners at UCF need a way to track daily course registration such as what courses are being offered, what the daily enrollments in courses are, who the instructor is, etc. in order to provide the university with the appropriate offering of classes. This information changes on a daily basis during the registration period but the previous day's data was overwritten. Thus, there was not a way to track registrations over time, which would facilitate a decision to open up a new section if needed.

HARDCOPY REPORTING

Legacy reporting can be challenging to work with. Many of our legacy applications used Customer Information Control System (CICS) screens, as shown in Figure 11, that are difficult to change or redesign the views. A specific example is the field length for FIN ENR is limited to three digits and we now have web-based courses with enrollments over 1000, so the first digit is chopped off in the display. Another difficulty is that there is no search functionality and it can be cumbersome to find information on the screen.

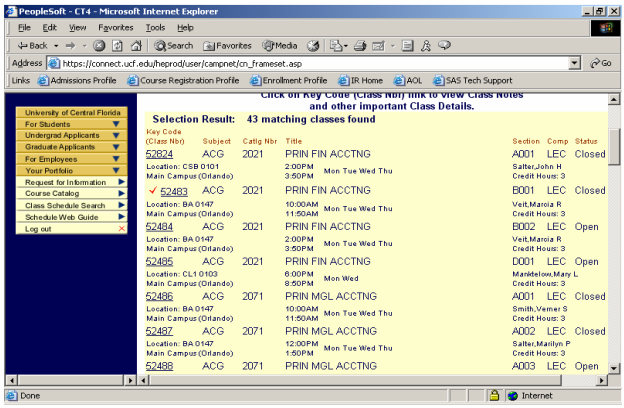
Figure 11. Master Schedule Information



MOVEMENT FROM HARDCOPY REPORTING

After the university went live with a PeopleSoft® Student Administration system, course planners and other people in the colleges and departments were having an extremely difficult time getting any reports containing course schedule information. A web-based class schedule search application was created (Figure 12), but it didn't provide all of the information that was available on the old CICS screens. At the same time, Dr. Taylor Ellis, Associate Dean of Undergraduate Programs in the College of Business, was developing a static HTML application using SAS for his own use to track course registrations. The programs were run manually and the pages stored on a local machine. Each semester, course information was manually entered to create the hyperlinks, which was labor-intensive for the programmer. What was needed was a tool that would allow anyone access to key registration data, give users control over what type and level of information they wanted to see, and not require extensive maintenance time.

Figure 12. Class Schedule Search Application



DYNAMIC WEB-BASED ENVIRONMENT

The Course Registration Profile is a web-based application that provides information on course registration based on criteria selected by the user. Graphical and tabular reports show how quickly classes are filling up by campus, college, course modality, undergraduate/graduate, or specific courses(s). Users can drill-down from course prefix to course number to course section. At the course and section level, the user can access a plot that shows course enrollment over time. As time progresses, we would be able to create historical data files for future trend comparisons. Much of the same technology used in the Enrollment Profile, specifically SAS/IntrNet, is used to dynamically generate the pages and hyperlinks.

DATA ACQUISITION PROCESS

This application needs to display more up-to-date information so it was decided to access the PeopleSoft data directly, which is stored in Oracle tables, using SAS/ACCESS to Oracle technology. During peak registration times the data would be refreshed 4 times daily so a "Windows Scheduled Task" was created with multiple running times to run a SAS program. Throughout the day the data are replaced and the data from the last run are saved and stored.

RunSASPS.bat

"C:\Program Files\SAS Institute\SAS\V8\sas.exe" -sysin C:\CourseReg\PSView\Database\getdata.sas

getdata.sas

```
%macro getdata(daily,all,tmid);
. . . other SAS statements

/*SAS/ACCESS to ORACLE*/
libname ps oracle user=userid
password=password path='data source name';
proc sql;
     create table psreg.&daily as
     select * from ps.PS_CF_CLASS_IR_VW
     where STRM=&tmid and CLASS_NBR ne . and
        CLASS_STAT in ('A','T','S') and
        COMPONENT in
        ('DIS','LAB','LEC','PER','SEM') and
        substring(CATALOG_NBR from 2 for 3)
        not in ('903','904','905','906',
        '907','908','909','912','917','918',
        '919','940','941','944','946','949',
        '957','958','970','971','973','980');
quit;
libname ps clear;

. . . other SAS statements
```

DEMONSTRATION

Since it was not required to display graphs or provide calculations on the home page of the Course Registration Profile a standard HTML form is used to collect the name/value pairs needed to begin the application. Figure 13 shows the home page where you can select filters for the information desired. If information for a specific course is desired, ENC1101 for example, a text box is present to type in your request.

Figure 13. Home Page of Course Registration Profile

After clicking the submit button on the home page, the next page (Figure 14) has options to filter the data for a specific department based on the college selected, term and year selections, an option to exclude the display of Honors courses, and the ability to see information for courses where enrollment is at a certain percentage.

Figure 14. Department and Term Selection

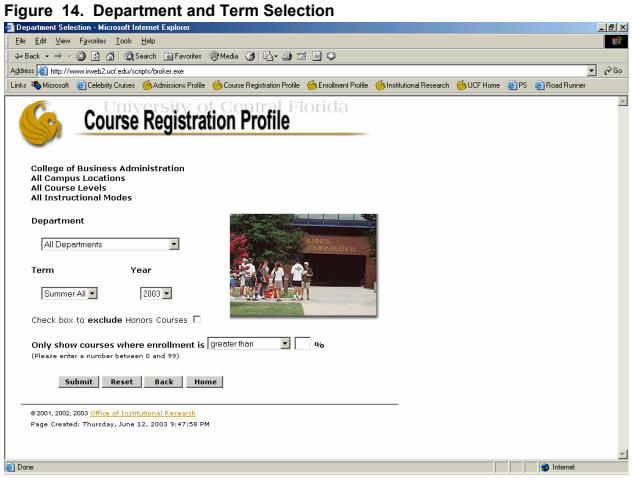
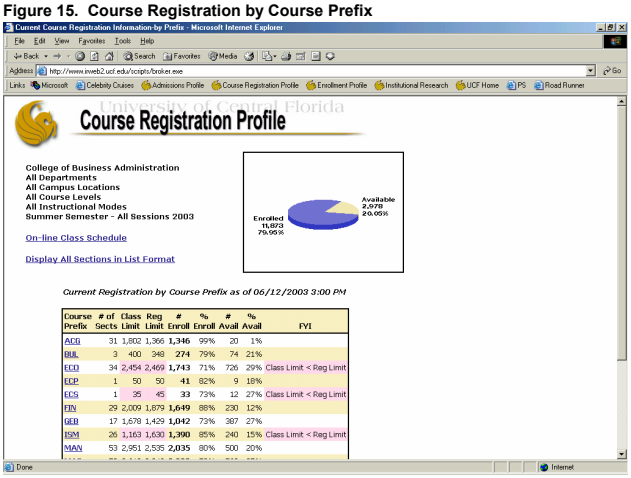


Figure 15 shows the course registration information by course prefix. SAS/GRAPH generates a pie chart using the GIF driver and the REPORT procedure generates the tabular display. Dynamic hyperlinks to drill-down to the next level are generated as detailed above in the Enrollment Profile. The ANNOTATE facility is used to generate custom displays for the pie chart. The ODS MARKUP destination (experimental in Version 8.2) is used to provide ALT information for the graph to comply with accessibility standards. There is a hyperlink available to display all the sections in a list format and another to go to the class schedule search shown in Figure 12.

```
proc template;
     define tagset tagsets.test;
            parent=tagsets.chtml;
            define event image;
                   put "<img";
                   put " border=2 alt=""SAS
                         Pie Chart""";
                   putq " src=" URL ">" NL;
            end;
     end;
run;

ods listing close;
ods markup tagset=test body=_webout (notop
nobot) path=&_tmpcat (url=&_replay)
style=styles.ucf rs=none;

/*Set Graphics Options*/
goptions reset=all
             device=gif260
             gunit=CELLS
             cback=white
             border
             ftext=swissxb
             ftrack=loose
             htext=1.5;

pattern1 value=psolid color=vlib;
pattern2 value=psolid color=CXFBEAB5;

data annotest;
   length function color style $ 8 text $ 25;
   retain function 'label' color 'black' when
         'a' style 'swissxb' xsys ysys '2'
          position '5' hsys '3' size 5.5;
   set temp3;
   if status='sumenr';
   midpoint=status;
   x=50;
   y=50;
   text=left(put(ratio,percent8.));
   output;
run;

data _null_;
     set temp3;
     if status='sumenr' and ratio>1 then
       call symput('grp','annotate=annotest');
     else
      call symput('grp','percent=outside');
run;

proc gchart data=temp3;
     where number>0;
     format status $statfmt. number comma8.0;
     pie3d status /sumvar=NUMBER
                   &grp
                   value=outside
                   slice=outside
                   angle=60
                   midpoints='Enrolled'
                         'Available'
                   nogroupheading
                   noheading
                   nolegend;
run;
quit;
ods markup close;
ods listing;
```

Figure 15. Course Registration by Course Prefix



The listing of all sections (Figure 16) is convenient for department heads who want to see all of a department's offered courses at once. However, printing an HTML table can sometimes be difficult. Sometimes, key information is chopped off at the bottom or top of the page. A hyperlink is available to dynamically generate a PDF file using the ODS PDF output destination available in SAS Version 8.2 (Figure 17). Another hyperlink is available to serve the temporary data set to the browser, first exported to an MS Excel file that can be saved on the user's local machine for data manipulation (Figure 18). A hyperlink is also available to display a data dictionary for some of the data fields in the table.

```
options orientation=landscape
papersize=letter pageno=1
     leftmargin=.5 rightmargin=.5 topmargin=.5
      bottommargin=.5;
ods listing close;
ods pdf file=_webout style=styles2.ucf
startpage=never;
```

```
      ods proclabel "Expanded Course Listing";

%let rc=%sysfunc(appsrv_session(create));
PROC EXPORT DATA=WORK.TEMP
     OUTFILE="C:\CourseReg\PSView\
                  temp&_sessionid..xls"
     DBMS=EXCEL2000 REPLACE;
RUN;
put '<a
href="http://www.irweb2.ucf.edu/scripts/broke
r.exe? service=beta& program=sashelp.webprog.
filesrv.scl& filetyp=e&_debug=0& file=c:\cour
sereg\psview\temp&_sessionid..xls"
target="blank">';
```

Figure 16. Expanded Listing of All Sections

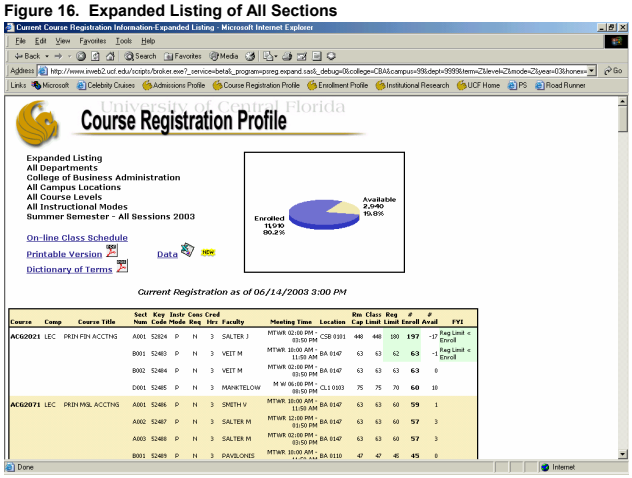


Figure 17. Dynamically Generated Acrobat PDF

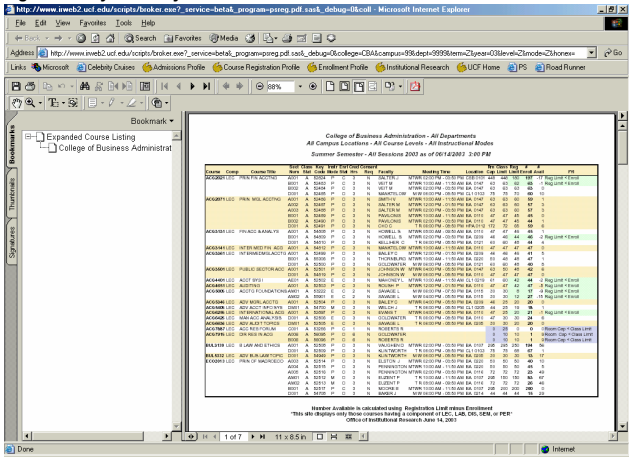
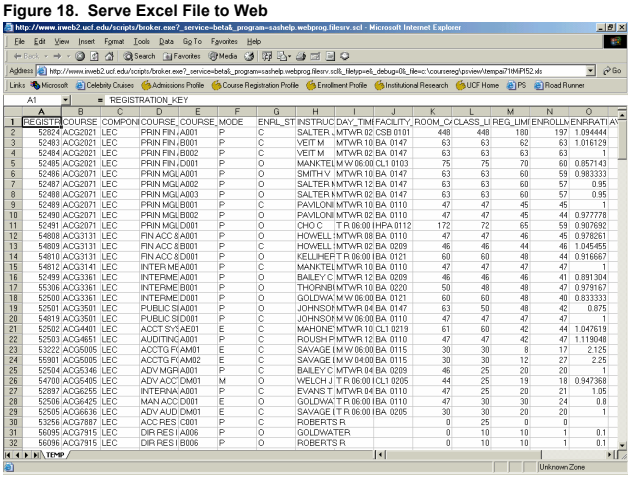
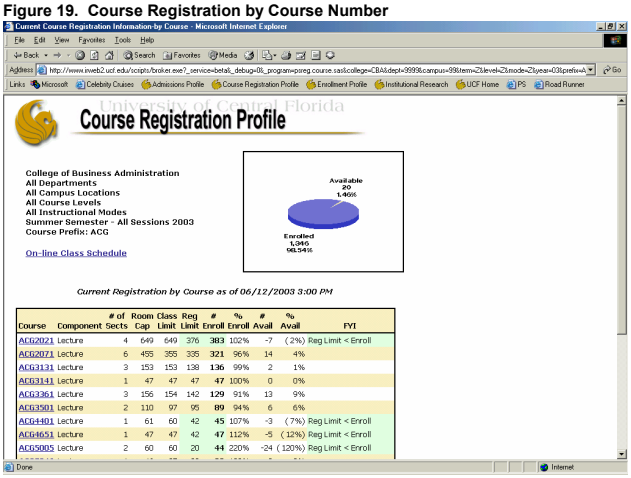


Figure 18. Serve Excel File to Web



Clicking on one of the prefix hyperlinks in Figure 15 will display registration information by course number for each of the courses beginning with the prefix selected (Figure 19).

Figure 19. Course Registration by Course Number



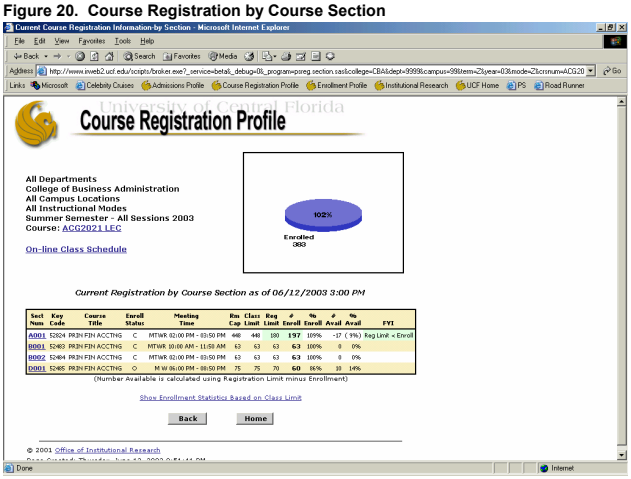
The TEMPLATE procedure is used to modify the style for the tabular display of the REPORT procedure. The following macro is called prior to the code that produces the table and the style declaration is added to the ODS HTML statement.

```
%macro stylel;
/*Create style sheet for browser output*/
ods path work.templat(update)
sashelp.tmplmst(read);
proc template;
   define style Styles.UCF;
      parent = styles.default;
      replace fonts
         "Fonts used in the default style" /
         'FooterFont' = ("Verdana, Arial,
            Helvetica, Helv",2,Bold)
         'TitleFont2' = ("Verdana, Arial,
            Helvetica, Helv",2,Bold Italic)
         'TitleFont' = ("Verdana, Arial,
            Helvetica, Helv",3,Bold Italic)
         'StrongFont' = ("Verdana, Arial,
            Helvetica, Helv",2,Bold)
         'EmphasisFont' = ("Verdana, Arial,
            Helvetica, Helv",1,Italic)
         'FixedEmphasisFont' =
            ("Courier",1,Italic)
         'FixedStrongFont' =
            ("Courier",1,Bold)
```

```
   'FixedHeadingFont' = ("Courier",1)
   'BatchFixedFont' = ("SAS Monospace,
      Courier",1)
   'FixedFont' = ("Courier",1)
   'headingEmphasisFont' = ("Verdana,
      Arial, Helvetica, Helv",2,Bold
      Italic)
   'headingFont' = ("Tahoma, Arial,
      Helvetica, Helv",2,Bold)
   'docFont' = ("Tahoma, Arial,
      Helvetica, Helv",2);
replace color_list
   "Colors used in the default style" /
   'fgB2' = cx0000ff
   'fgB1' = cx800040
   'fgA4' = cx000000
   'bgA4' = cxffffff
   'bgA3' = cxffffff
   'fgA2' = cx000000
   'bgA2' = cxffffff
   'fgA1' = cx000000
   'bgA1' = cxffffff
   'fgA' = cx000000
   'bgA' = cxffffff;
replace colors
   "Abstract colors used in the default
       style" /
   'headerfgemph' = color_list('fgA2')
   'headerbgemph' = color_list('bgA4')
   'footerfgstrong' =
       color_list('fgA2')
   'footerbgstrong' =
       color_list('bgA4')
   'headerfgstrong' =
       color_list('fgA2')
   'headerbgstrong' =
       color_list('bgA4')
   'headerfg' = color_list('fgA2')
   'headerbg' = color_list('bgA2')
   'datafgemph' = color_list('fgA1')
   'databgemph' = color_list('bgA3')
   'datafgstrong' = color_list('fgA1')
   'databgstrong' = color_list('bgA3')
   'datafg' = color_list('fgA1')
   'databg' = color_list('bgA3')
   'batchfg' = color_list('fgA1')
   'batchbg' = color_list('bgA3')
   'tableborder' = color_list('fgA1')
   'tablebg' = color_list('bgA1')
   'notefg' = color_list('fgA1')
   'notebg' = color_list('bgA')
   'bylinefg' = color_list('fgA2')
   'bylinebg' = color_list('bgA')
   'captionfg' = color_list('fgA1')
   'captionbg' = color_list('bgA')
   'proctitlefg' = color_list('fgA')
   'proctitlebg' = color_list('bgA')
   'titlefg' = color_list('fgA')
   'titlebg' = color_list('bgA')
   'systitlefg' = color_list('fgA')
   'systitlebg' = color_list('bgA')
   'Conentryfg' = color_list('fgA')
   'Confolderfg' = color_list('fgA')
   'Contitlefg' = color_list('fgA')
   'link2' = color_list('fgB2')
   'link1' = color_list('fgB1')
   'contentfg' = color_list('fgA2')
   'contentbg' = color_list('bgA2')
   'docfg' = color_list('fgA')
   'docbg' = color_list('bgA');
style Body from Body /
      pagebreakhtml =
      %nrstr("<p style=""page-break-after:
        always;""> </p><HR size=2>");
   style SystemFooter from SystemFooter /
      foreground = black
      font = fonts('footerFont');
   style FooterStrong from Footer /
      background =
        colors('footerbgstrong');
   replace Output from Container
      "Abstract. Controls basic output
       forms." /
      background = colors('tablebg')
      rules = GROUPS
      frame = BOX
      cellpadding = 7
      cellspacing = 1
      bordercolor = colors('tableborder')
      borderwidth = 1;
   replace RowHeader from Header
      "Controls row headers." /
      foreground = color_list('bgA1');
end;
run;
%mend style1;

ods html body=_webout (notop nobot)
            style=styles.ucf
            rs=none;
```

Selecting a course number hyperlink displays each section offered as shown in Figure 20. Clicking the “Course:” hyperlink will produce Figure 21.

Figure 20. Course Registration by Course Section



To change the background color of a cell in the REPORT procedure if certain conditions are met we define a compute variable named “FYI” and then provide the if-then logic.

```
compute FYI /character length=40;
if (_C6_ < _C7_) and (_C7_ < _C8_) then
  do;
  FYI = "RmCap < ClsLim < RegLim";
  call define(_COL_,"STYLE",
       "style(CALLDEF)=
       {background=CXD8D8D8
       foreground=black}");
  call define('_C6_',"STYLE",
       "style(CALLDEF)=
       {background=CXD8D8D8
       foreground=black}");
  call define('_C7_',"STYLE",
```

```
            "style(CALLDEF)=
            {background=CXD8D8D8
            foreground=black}");
      call define('_C8_',"STYLE",
            "style(CALLDEF)=
            {background=CXD8D8D8
            foreground=black}");
      end;
    else if _C6_ < _C7_ then
      do;
         similar statements as above
      end;
    else if _C8_ < _C9_ then
      do;
         similar statements as above
      end;
    else
      FYI="";
    endcomp;
```

PROC GPLOT is used to produce the plot in Figure 21 and the ANNOTATE facility is used to put the date of registration below the horizontal axis and to display the numbers above each point.

```
data annotest;
     length function color style $8 text $10
        position $1;
     retain function 'label' when 'a' xsys '2'
        hsys '3' position '6';
     set temp;
     if number>0 &shw;

     /*Put dates on axis*/
     style='"Arial"'; color='black'; x=day;
      y=4; text=put(prev,mmddyyd8.);
     ysys='3'; angle=90; size=&sz; output;

     /*Label data points with numbers*/
     style='swissb'; color='blue'; x=day;
      y=number; text=put(number,5.);
     ysys='2'; angle=90; size=&dt; output;
run;
```

A hyperlink is provided to compare the course registration with the previous year (Figure 22). Two plots, one for the current year and one for the previous year, are shown using the OVERLAY option of the PLOT statement. Clicking on "Registration Calendar" will display Figure 23 and clicking on a course section hyperlink shown in Figure 20 will produce a plot of course registration over time for that section (not shown).

Figure 21. Course Registration Over Time for a Specific Section

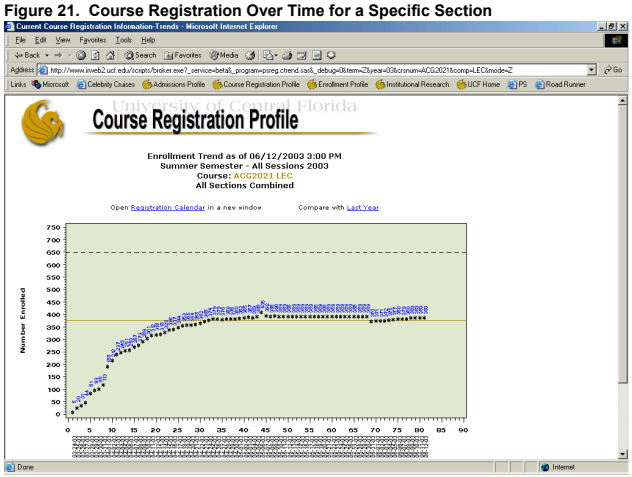


Figure 22. Trend Comparison with Previous Year

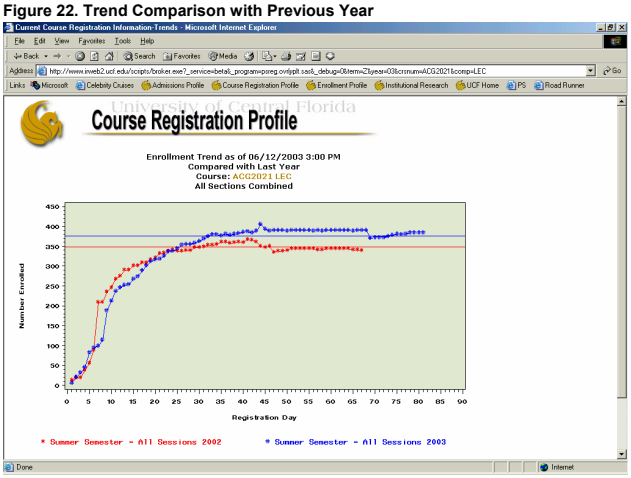
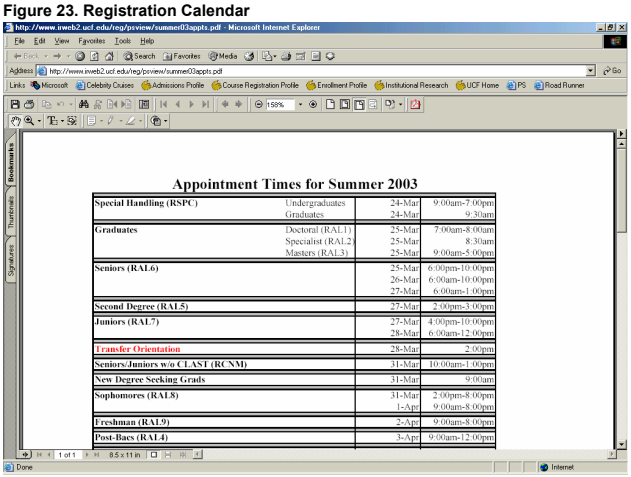


Figure 23. Registration Calendar



CONCLUSION

Constituents at UCF have a strong desire for dynamically accessible data. New applications were developed to meet user needs, prototyped to the University of Central Florida community, and extremely well received. SAS technology, specifically SAS/IntrNet, has provided the IR office with the tools needed to deliver timely and accurate data in a user-friendly dynamic web-based reporting environment. Once the initial programs are built, there is much less programmer time involved to maintain these types of applications. The IR office intends to continue the movement using SAS to develop administrative applications and serve as a leader in this area of database design and application.

REFERENCES

The following SAS publications were invaluable tools used extensively during the creation of these two applications.

SAS Institute Inc. (1998), *SAS® Macro Language, Course Notes,* Cary, NC: SAS Institute Inc.

SAS Institute Inc. (2000), *SAS® Web Tools: Advanced Dynamic Solutions Using SAS/IntrNet Software, Course Notes,* Cary, NC: SAS Institute Inc.

SAS Institute Inc. (2000), *SAS® Web Tools: Static and Dynamic Solutions Using SAS/IntrNet Software, Course Notes,* Cary, NC: SAS Institute Inc.

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TRADEMARK CITATION

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