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A Toolbox of Technologies: Integrating SAS Applications with Flash Multimedia Incorporating HTML, and JavaScript

Tony Goodman, Terry Miller, Requirements Integration Process Improvement Team, Wright-Patterson AFB, OH
Jeff Agnew, Software Consultant, Cincinnati, OH

ABSTRACT

The Requirements Integration Process Improvement Team (RIPIT) at Wright-Patterson Air Force Base utilized SAS language and procedures, coupled with Adobe Flash multimedia technology, to develop the Forecast Accuracy Comparison Tool or FACT Plus. This tool enabled Air Force inventory managers to reduce the time and cost of forecasting supply and maintenance needs for Air Force spare parts by 99.5%. The tool automated disparate legacy processes and methodologies and incorporated them into a one-stop centralized application. By drawing upon various web programming techniques, a developer can seamlessly integrate a SAS program into an application that functions via the Internet. SAS programmers can utilize modern technologies to retool their applications to provide clients with more accessible, user-friendly web-based solutions.

OVERVIEW

FACT Plus integrates a mix of technologies including Base SAS, SAS IntrNet, SAS GRAPH, htmSQL, JavaScript, and Adobe Flash. All of these technologies are intertwined and communicate with one another. We will demonstrate how these various technologies are utilized within one powerful application which we feel performs a valuable purpose for its users and is indeed unique in its field.

INTRODUCTION

In September 2006, RIPIT was approached by Secondary Item Requirements System (SIRS) (D200A) functional analysts and statisticians working supply chain management at Wright-Patterson Air Force Base. SIRS generates a quarterly computation process that provides the baseline for the Air Force spare parts buy and repair budget of roughly 6 billion dollars. The challenge: Could we use new technology to build a web-based application to help with forecasting supply and maintenance needs for Air Force

spare parts? Employing existing legacy tools, the process could typically take an item manager or equipment specialist hours per stock number to retrieve and analyze the information needed for each forecast. These processes were too complex for commercial off-the-shelf (COTS) tools to handle. D200A, consisting of approximately 120,000 stock numbers and thousands of data elements, called for the development of a custom web application to integrate these techniques and information.

In addition, D200A uses multiple forecasting methods to satisfy differing forecast requirements. In the past, an analyst would be forced to repeat tasks when moving from one method to the next. FACT Plus offers the users the capability to manipulate key elements within the interface via interactive Flash technology to make changes and execute "What If" scenarios for any given stock number. Users can toggle between methods and mix and match techniques on the fly. These results are automatically saved via Local Shared Objects in Flash. Along with increased efficiency, FACT Plus grants users the additional time to work on the problem. By examining how each of these components work together, we hope to provide SAS users a new approach and the tools to integrate existing SAS programs to function through the Internet.

FACT PLUS

FACT Plus provides the capability to compare the computed forecasted demands to the past actual demands that occurred in the last 12 time periods. FACT Plus also provides tailorable reports specific to defined business rules. Users may tailor reports to set standard selection, filter, and sorting parameters for all available data.

FACT Plus is composed of four primary web pages that users must navigate to select, process, and view a report. Those web pages include the reports generation page, the results page, the individual item drill down page, and the demand forecast worksheet. Both the results page and item drill down page will be dynamically generated with the information you are processing. The demand forecast worksheet allows users to alter values to instantly see the impacts of those changes.
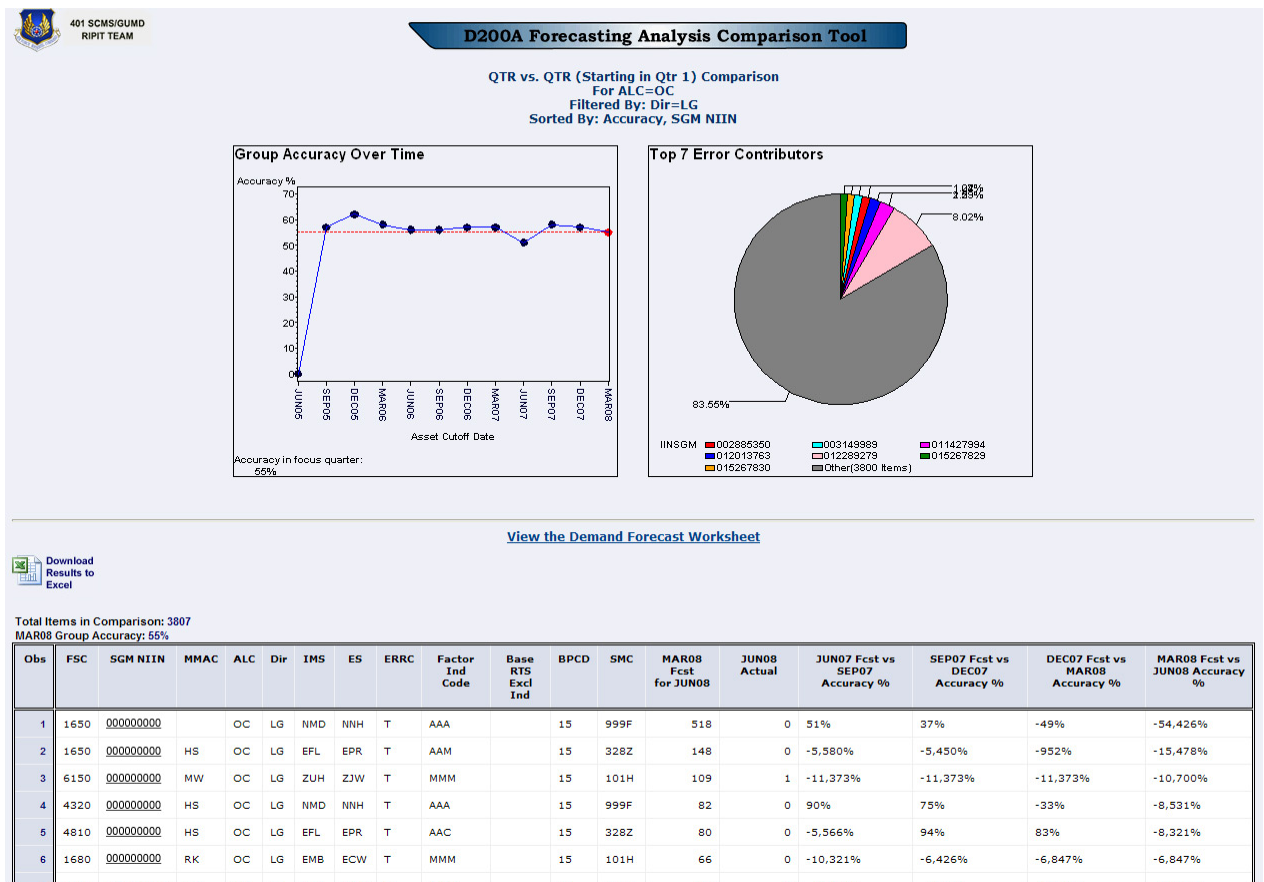
REPORT GENERATION PAGE

The report generation page is composed of four primary sections where users may tailor the selection, filtering, sort parameters, and display options. Command buttons at the bottom of this page include the Submit and Reset buttons.

All selection, filter, sort parameters, and display options will default to values specified in the business rules. If no tailoring is required, click on the Submit button located at the bottom of the page. This will submit your report for processing and return the results page with the report output.

RESULTS PAGE

The results page displays data into group accuracy over time, top error drivers, and detail data. The group accuracy over time graph, located in the upper left section of the screen displays the accuracy of the selected items as a whole over 12 forecast periods. The top error contributors graph, located in the upper right section of the page, displays the items with the least amount of accuracy compared to all items in the comparison. Below both graphs is the detail data, which is a list of detailed data for every item that comprised the total accuracy.

Obs	FSC	SGM NIIN	MMAC	ALC	Dir	IMS	ES	ERRC	Factor Ind Code	Base RTS Excl Ind	BPCD	SMC	MAR08 Fcst for JUN08	JUN08 Actual	JUN07 Fcst vs SEP07 Accuracy %	SEP07 Fcst vs DEC07 Accuracy %	DEC07 Fcst vs MAR08 Accuracy %	MAR08 Fcst vs JUN08 Accuracy %
1	1650	000000000		OC	LG	NMD	NNH	T	AAA		15	999F	518	0	51%	37%	-49%	-54,426%
2	1650	000000000	HS	OC	LG	EFL	EPR	T	AAM		15	328Z	148	0	-5,580%	-5,450%	-952%	-15,478%
3	6150	000000000	MW	OC	LG	ZUH	ZJW	T	MMM		15	101H	109	1	-11,373%	-11,373%	-11,373%	-10,700%
4	4320	000000000	HS	OC	LG	NMD	NNH	T	AAA		15	999F	82	0	90%	75%	-33%	-8,531%
5	4810	000000000	HS	OC	LG	EFL	EPR	T	AAC		15	328Z	80	0	-5,566%	94%	83%	-8,321%
6	1680	000000000	RK	OC	LG	EMB	ECW	T	MMM		15	101H	66	0	-10,321%	-6,426%	-6,847%	-6,847%

DRILL DOWN ON DEMANDS

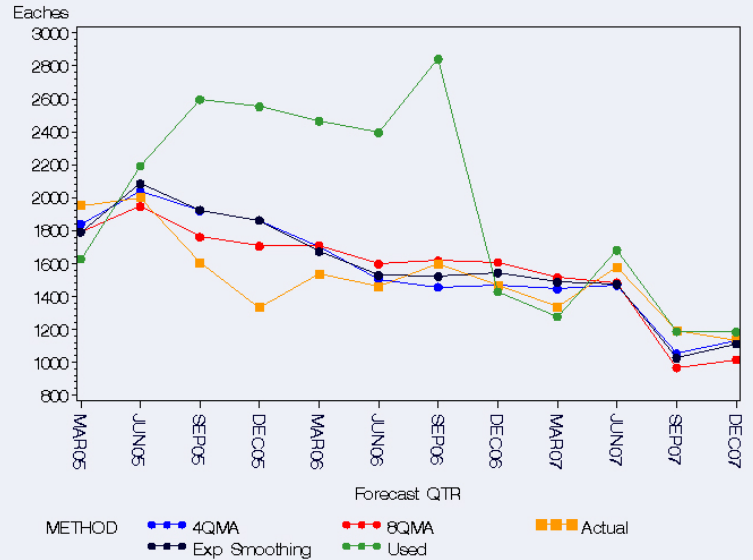Users who need more detailed data on the demands of an individual stock number may click the drill down link to view additional data elements. Users can also view what the forecasts would have been using different forecasting techniques for each of the time periods.

Forecasts & Actuals Over Time

Note: 4QMA, 8QMA, & Exp Smoothing forecasts not available prior to Sep03

View in Demand Forecast Worksheet

DEC07's Forecast for MAR08 vs the MAR08 Reported Value
? Detailed Forecast and Actual Demand for SGM NIIN
*To print this report, right click and select print   Factor Ind Code: BAA

| Total Forecasted Demand: | 1185 | Total Actual Demand: | 1133 |

Forecasted OIM Usage Data:

| Actual OIM Usage Data: ? |

Base Repair	11	Base RTS	8
+ OIM Rep Gens(NRTS)	1079	+ Base NRTS	1065
+ Base Condemnations	0	+ Base Condemnations	0
= Total OIM Oper Rqmt	1090	= Total Base Rep Gens	1073

Forecasted OIM Program Data: ?

Actual OIM Program Data:

| OIM Prog(1) | 8929 | Total OIM Past Installed Prog | 9755 |

Download Results to Excel

Total Items in Comparison: 3807
MAR08 Group Accuracy: 55%

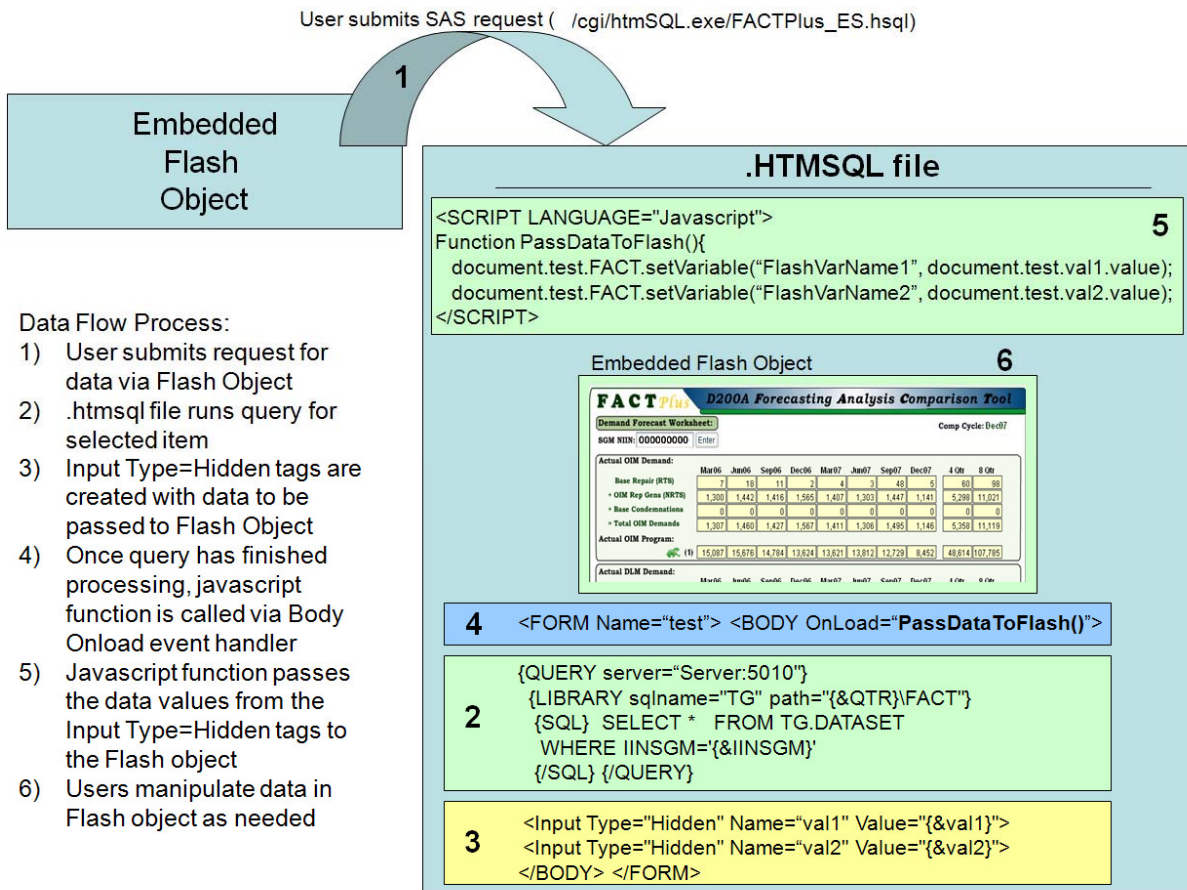| Obs	FSC	SGM NIIN	MMAC	ALC	Dir	IMS	ES
1	1650	000000000		OC	LG	NMD	NNH
2	1650	000000000	HS	OC	LG	EFL	EPR
3	6150	000000000	MW	OC	LG	ZUH	ZJW
4	4320	000000000	HS	OC	LG	NMD	NNH
5	4810	000000000	HS	OC	LG	EFL	EPR
6	1680	000000000	RK	OC	LG	EMB	ECW

DEMAND FORECAST WORKSHEET

The demand forecast worksheet allows users to change rates, percents, and program data in order to view the impacts of those changes. Using this tool, users can perform multiple scenerios prior to inputting their actual changes into the system. All the data from 8 quarters and 2 fiscal years is loaded into the form via SAS, saving equipment specialist time and reducing the chance of inputting the data incorrectly. All calculations are performed instantly after each keystroke.

FACT *Plus*   **D200A Forecasting Analysis Comparison Tool**

Demand Forecast Worksheet: Comp Cycle: Mar08

SGM NIIN: 000000000   [Enter]

Actual OIM Demand:

	Jun06	Sep06	Dec06	Mar07	Jun07	Sep07	Dec07	Mar08	4 Qtr	8 Qtr
Base Repair (RTS)	18	11	2	4	3	48	5	8	64	99
+ OIM Rep Gens (NRTS)	1,442	1,416	1,565	1,407	1,303	1,447	1,141	1,065	4,956	10,786
+ Base Condemnations	0	0	0	0	0	0	0	0	0	0
= Total OIM Demands	1,460	1,427	1,567	1,411	1,306	1,495	1,146	1,073	5,020	10,885

Actual OIM Program:

(1)	15,676	14,784	13,624	13,622	13,812	12,745	8,873	9,755	45,185	102,891

Actual DLM Demand:

	Jun06	Sep06	Dec06	Mar07	Jun07	Sep07	Dec07	Mar08	4 Qtr	8 Qtr
Depot Rep Gens	75	31	30	55	28	80	45	60	213	404

Actual DLM Program:

	Jun06	Sep06	Dec06	Mar07	Jun07	Sep07	Dec07	Mar08	4 Qtr	8 Qtr
PDM Past Program	0	0	0	0	0	0	0	0	0	0
+ EOH Past Program	45	60	45	30	45	60	45	45	195	375
+ NHA MISTR Past Program	0	0	0	0	0	0	0	15	15	15
= Total Past Program	45	60	45	30	45	60	45	60	210	390

	Jun06	Sep06	Dec06	Mar07	Jun07	Sep07	Dec07	Mar08	4 Qtr	8 Qtr
Total Actual Demands:	1,535	1,458	1,597	1,466	1,334	1,575	1,191	1,133	5,233	11,289

☑ Interpolate OIM & DLM Factors

Computed OIM Rates & Percents: [Reset]   **Used D200A Rates & Percents**

	4QMA	8QMA	Exp	●D200A	What If:	Current	1st Fcst	2nd Fcst	3rd Fcst	4th Fcst	5th Fcst
TOIMDR	0.1111	0.1058	0.1090	0.0852		0.0852	0.1030	0.1151	0.1083	0.1212	0.1043
Base NRTS %	99	99	99	99		99	99	99	99	99	99
Base Condemnation %	0	0	0	0		0	0	0	0	0	0

Computed DLM Rates & Percents: [Reset]   **Used D200A Rates & Percents**

	4QMA	8QMA	Exp	●D200A	What If:	Current	1st Fcst	2nd Fcst	3rd Fcst	4th Fcst	5th Fcst
PDM JR Cndmn %	0	0	0	0		0	0	0	0	0	0
PDM NJR Repl %	0	0	0	0		0	0	0	0	0	0
PDM NJR Prgm %	0	0	0	0		0	0	0	0	0	0
EOH JR Cndmn %	0	0	1	0		0	0	0	0	0	0
EOH NJR Repl %	101	104	136	104		104	104	104	104	104	104
EOH NJR Prgm %	100	100	100	100		100	100	100	100	100	100
NHA MISTR JR Cnd %	0	0	1	0		0	0	0	0	0	0
NHA NJR Repl %	101	104	136	104		104	104	104	104	104	104
NHA NJR Prgm %	100	100	100	100		100	100	100	100	100	100

Forecasted OIM Demand (Used D200A Method):

	Jun08	Sep08	Dec08	Mar09	Jun09	Sep09	Dec09	Mar10	FY09	FY10
Base Repair (RTS)	11	12	11	11	11	12	12	11	46	45
+ OIM Rep Gens (NRTS)	1,061	1,183	1,085	1,112	1,124	1,164	1,171	1,157	4,600	4,451
+ Base Condemnations	0	0	0	0	0	0	0	0	0	0
= Total OIM Demands	1,072	1,195	1,096	1,123	1,135	1,176	1,183	1,168	4,646	4,496

Future OIM Program:

	Jun08	Sep08	Dec08	Mar09	Jun09	Sep09	Dec09	Mar10	FY09	FY10
[Reset]	12,578	12,705	10,642	10,588	10,410	10,491	10,278	10,292	41,279	39,756

Forecasted DLM Demand (D200A Used):

	Jun08	Sep08	Dec08	Mar09	Jun09	Sep09	Dec09	Mar10	FY09	FY10
PDM JR Conds	0	0	0	0	0	0	0	0	0	0
+ EOH JR Conds	0	0	0	0	0	0	0	0	0	0
+ NHA MISTR JR Conds	0	0	0	0	0	0	0	0	0	0
= Total JR Conds	0	0	0	0	0	0	0	0	0	0
PDM NJR Rqmt	0	0	0	0	0	0	0	0	0	0
+ EOH NJR Rqmt	62	47	47	47	47	31	31	47	171	141
+ NHA MISTR NJR Rqmt	156	203	405	484	515	1,045	499	484	1,966	1,996
= Total NJR Rqmt	218	250	452	531	562	1,076	530	531	2,137	2,137
= Total DLM Demands	218	250	452	531	562	1,076	530	531	2,137	2,137

Future DLM Program: [Reset]

	Jun08	Sep08	Dec08	Mar09	Jun09	Sep09	Dec09	Mar10	FY09	FY10
PDM Program (4)	0	0	0	0	0	0	0	0	0	0
+ EOH Program (6)	60	45	45	45	45	30	30	45	165	135
+ NHA MISTR Program (9)	150	195	390	465	495	1,005	480	465	1,890	1,920
= Total DLM Future Program	210	240	435	510	540	1,035	510	510	2,055	2,055

[Summary]

	Jun08	Sep08	Dec08	Mar09	Jun09	Sep09	Dec09	Mar10	FY09	FY10
Total Forecasted Demands:	1,290	1,445	1,548	1,654	1,697	2,252	1,713	1,699	6,783	6,633

NUTS & BOLTS

The purpose of this section is to provide some basic concepts of how SAS, Javascript, and Adobe Flash interact on the demand forecast worksheet. On this report, we use htmsql technology from SAS to extract the data, Flash to display the data, and Javascript to transfer the data from SAS to Flash. Below is a diagram depicting the data flow of this process.

User submits SAS request (/cgi/htmSQL.exe/FACTPlus_ES.hsql)

1

Embedded Flash Object

.HTMSQL file

```
<SCRIPT LANGUAGE="Javascript">                                              5
Function PassDataToFlash(){
   document.test.FACT.setVariable("FlashVarName1", document.test.val1.value);
   document.test.FACT.setVariable("FlashVarName2", document.test.val2.value);
</SCRIPT>
```

Embedded Flash Object   **6**

FACTPlus **D200A Forecasting Analysis Comparison Tool**

Demand Forecast Worksheet: Comp Cycle: Dec07

SGM NIIN: 000000000 Enter

Actual OIM Demand:

	Mar06	Jun06	Sep06	Dec06	Mar07	Jun07	Sep07	Dec07	4 Qtr	8 Qtr
Base Repair (RTS)	7	18	11	2	4	3	48	5	60	98
+ OIM Rep Gens (NRTS)	1,300	1,442	1,416	1,565	1,407	1,303	1,447	1,141	5,298	11,021
+ Base Condemnations	0	0	0	0	0	0	0	0	0	0
= Total OIM Demands	1,307	1,460	1,427	1,567	1,411	1,306	1,495	1,146	5,358	11,119

Actual OIM Program:

| (1) | 15,087 | 15,676 | 14,784 | 13,624 | 13,621 | 13,812 | 12,729 | 8,452 | 48,614 | 107,785 |

Actual DLM Demand: Mar06 Jun06 Sep06 Dec06 Mar07 Jun07 Sep07 Dec07 4 Qtr 8 Qtr

4   `<FORM Name="test"> <BODY OnLoad="PassDataToFlash()">`

2
```
{QUERY server="Server:5010"}
  {LIBRARY sqlname="TG" path="{&QTR}\FACT"}
  {SQL} SELECT *  FROM TG.DATASET
    WHERE IINSGM='{&IINSGM}'
  {/SQL} {/QUERY}
```

3
```
<Input Type="Hidden" Name="val1" Value="{&val1}">
<Input Type="Hidden" Name="val2" Value="{&val2}">
</BODY> </FORM>
```

Data Flow Process:
1) User submits request for data via Flash Object
2) .htmsql file runs query for selected item
3) Input Type=Hidden tags are created with data to be passed to Flash Object
4) Once query has finished processing, javascript function is called via Body Onload event handler
5) Javascript function passes the data values from the Input Type=Hidden tags to the Flash object
6) Users manipulate data in Flash object as needed

SUMMARY

RIPIT utilized a mix of technologies including Base SAS, SAS IntrNet, SAS GRAPH, htmSQL, JavaScript, and Adobe Flash to build a web-based application called FACT Plus to help with forecasting supply and maintenance needs for Air Force spare parts. In addition to forecasting spare parts, users can execute "What If" scenarios for any given stock number. Users can toggle between forecasting methods and mix and match

techniques on the fly. These results are automatically saved via Local Shared Objects in Flash. Along with increased efficiency, FACT Plus grants users the additional time to work on forecasting problems. FACT Plus enables Air Force item managers to reduce the time and cost of forecasting supply and maintenance needs for Air Force spare parts by 99.5%. For the period March 2007 through March 2008, FACT Plus had 11,500 hits or visitors to the site. Assuming that each hit represents one analyst acquiring forecast information, with an analyst pay rate of $26.56 per hour and about one hour to gather all the salient data, we calculate a yearly manpower cost of $305,440. With FACT Plus offering the same information in only 15 seconds, or .00416% of the time it would have taken using legacy methods, the cost has been reduced to $1,273 for the same period, for an estimated cost avoidance to the Air Force of $304,167.

CONCLUSION

We have detailed how SAS software can be used with Adobe Flash to create a web application to help with forecasting supply and maintenance needs for Air Force spare parts. The advantages of this approach are no plug-ins need to be installed and it is more flexible than if coded in HTML. The disadvantages of using this approach include more complex coding and thus more development time, and the purchase of a software license for Flash.

This mix of technologies will be applied to the development of future web tools, and serves to bridge the gap when moving from legacy systems to Enterprise Resource Planning (ERP) systems since FACT Plus could be viewed as a sort of ERP module, and gets users to begin thinking about ERP approaches to problem solving and increasing productivity.

Using the FACT Plus approach, application developers can create web tools which streamline work processes and free users to do what they were trained to do. FACT Plus offers a good example of leveraging SAS with other technologies to achieve business results, and improving companies bottom lines by reducing costs.

ACKNOWLEDGMENTS

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TRADEMARKS

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AUTHOR INFORMATION

Comments, questions, and additions are welcomed.
Contact the authors at:

Tony Goodman
Dynamics Research Corporation
2900 Presidential Dr, Suite 100
Fairborn, OH 45324
(937)904-0105, (937)405-6249
Anthony.Goodman@wpafb.af.mil

Terry Miller
Dynamics Research Corporation
2900 Presidential Dr, Suite 100
Fairborn, OH 45324
 (937)256-0276
Terrence.Miller2@wpafb.af.mil

Jeff Agnew
Software Consultant
(513)622-4923
StLou99@yahoo.com