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Customer Success Is Our Mission

Building an Agile, Collaborative Environment for Capturing Productivity Based Cost Model Data

David Bloom, Mason Wexler, and Wanda Grant
Raytheon Space and Airborne Systems
3/24/2012

To drive standardization, integration, implementation, and optimization of SAS processes, measures, and resources to achieve proven Mission Assurance.

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Agenda

- What do I really want to do?
- What does “agile” mean?
- Is Microsoft really still significant?
  - Has anyone paid attention to Apple Stock?
  - I love Google Apps but …
- Let’s take this environment for a test drive!
- Now let’s take it to the Nurburgring!
- “I have a dream …”

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Abstract

Building an Agile, Collaborative Environment for Capturing Productivity Based Cost Model Data

By David Bloom
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Understanding and analyzing productivity within an Aerospace electronics development organization requires continuous oversight and adjustment. For example, in digital electronics, a corollary to Moore's Law says that the capability of digital processor components doubles every 18 months. This would imply that the cost to design a set of digital electronics products to deliver a specific state-of-the-art capability would change (become less) as a function of the ability to incorporate more features on any one component.

This paper will discuss how Raytheon Space and Airborne Systems (SAS) Electronics Center (EEC) built an extremely agile, collaborative environment in order to track in-process productivity of the development of electronics systems and sub-products of those systems. The fundamental basis of this discussion is that productivity will be defined as the number of labor hours to produce a product of certain size (hours/size), where the size of any particular product is encapsulated by a parameter called an "Effective Key Size Metric" (eKSM).

The collaboration technology platform that the Raytheon SAS Electronics Center built upon was Microsoft Sharepoint 2010, but other collaboration technologies like Google Docs could easily be applied. The most important pieces for the success of collecting the required productivity data are well defined data requirements, ease of access, data visibility and constant data review.

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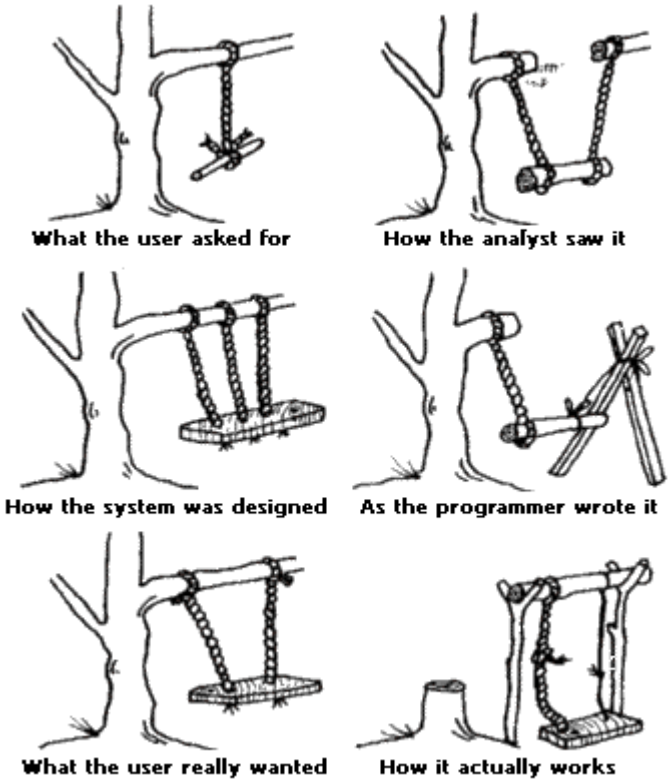
What Would the Requirements Look Like?

- Wouldn't it be amazing if we had a computing environment that is …
  - Web Based
    - Standard permissions
    - Open to everyone that needs it
  - Extensible
    - Collect cost data for any type of product
    - Data visible to corporate applications
    - 3rd Normal Form
  - Collaborative
    - 80 pairs of boots on the ground
    - No lockouts like eRoom
  - Self-Serve
    - Minimum IT involvement
    - Does not require full time administration
  - Agile
    - Data collection needs are always changing
  - Report productivity close to real time
    - Tell a story with charts
    - Tightly integrated with Microsoft Office



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What is Agile?

Source: agilemanifesto.org

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Why Agile - Principles behind the Agile Manifesto

- Satisfy the customer through early and **continuous delivery**.
- **Welcome changing requirements**, even late in development.
- **Deliver working software**.
- Business people and developers must work together.
- Build projects around **motivated individuals**. Give them the environment and support they need, and trust them to get the job done.
- Face-to-face conversation.
- **Working software** is the primary measure of progress.
- Agile processes promote **sustainable** development.
- Continuous attention to **technical excellence and good design**.
- **Simplicity**.
- **Self-organizing teams**.
- At regular intervals, the team reflects on how to **become more effective**.

Source: agilemanifesto.org/principles.html

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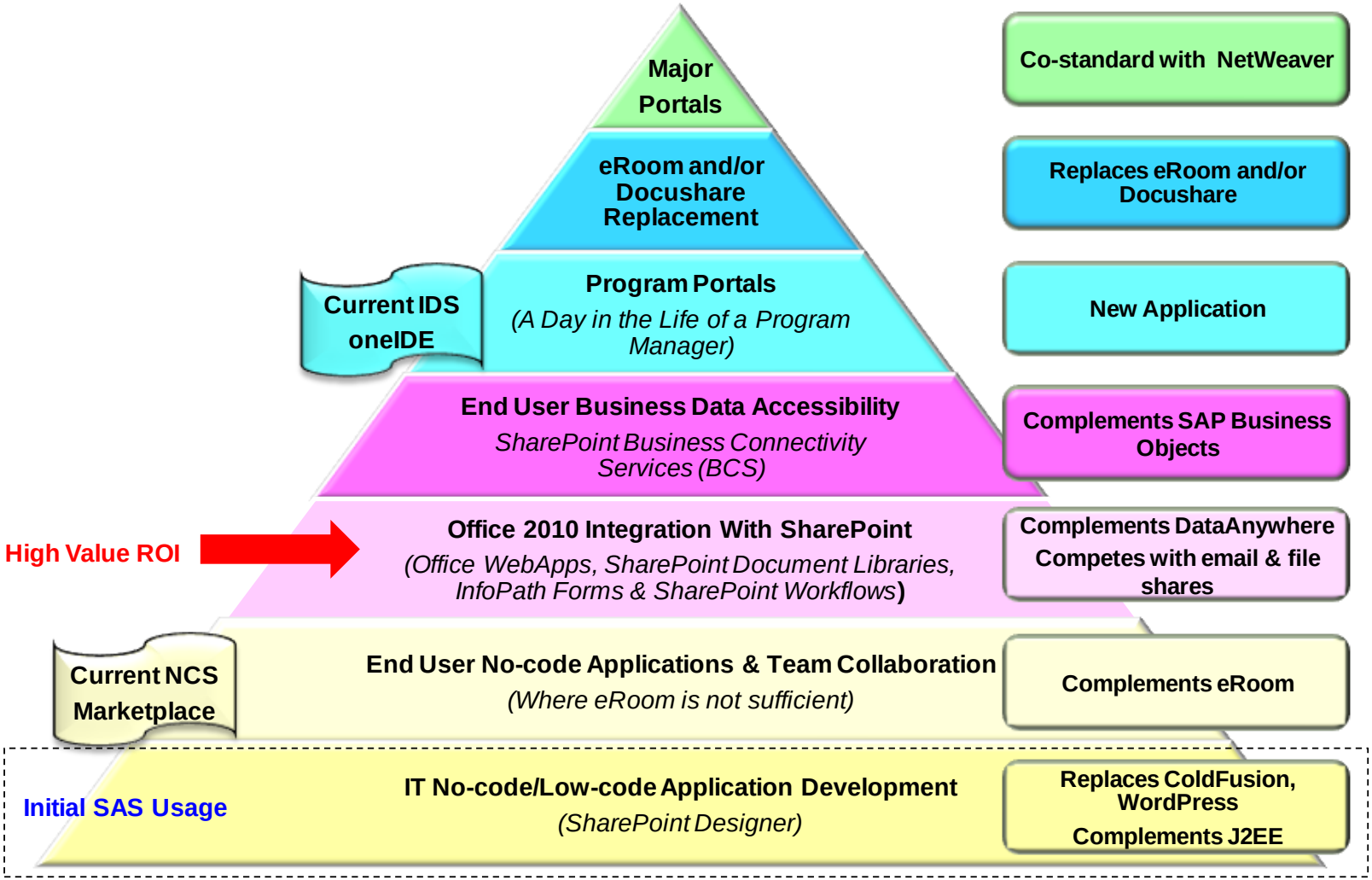
SAS SharePoint Functionality Fit



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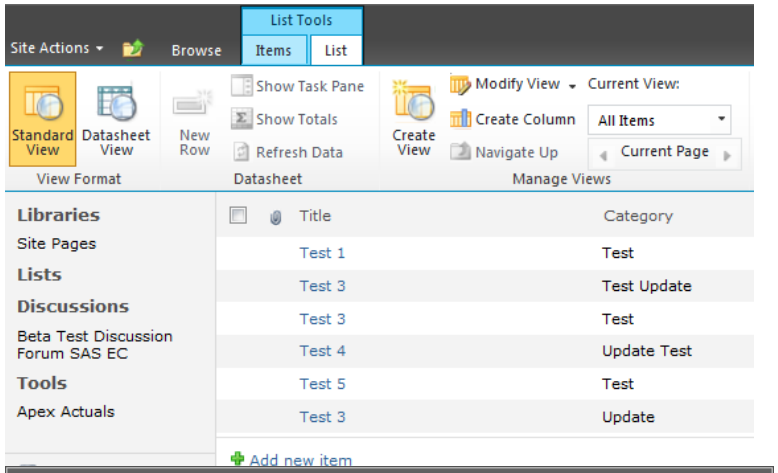
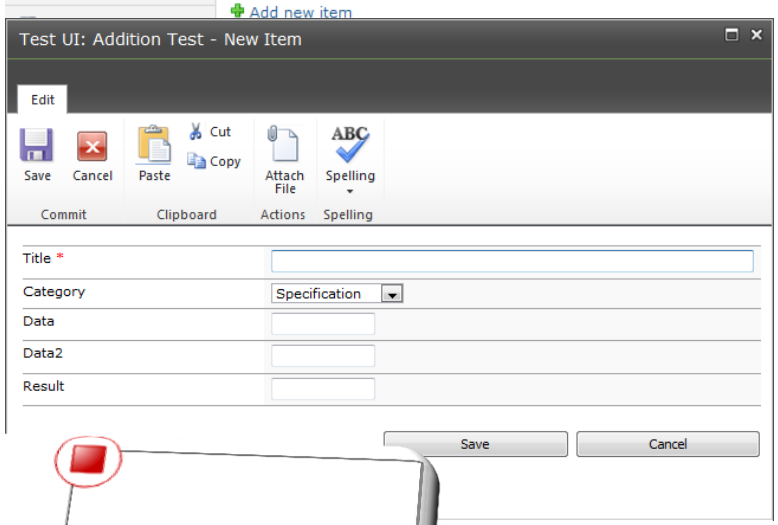
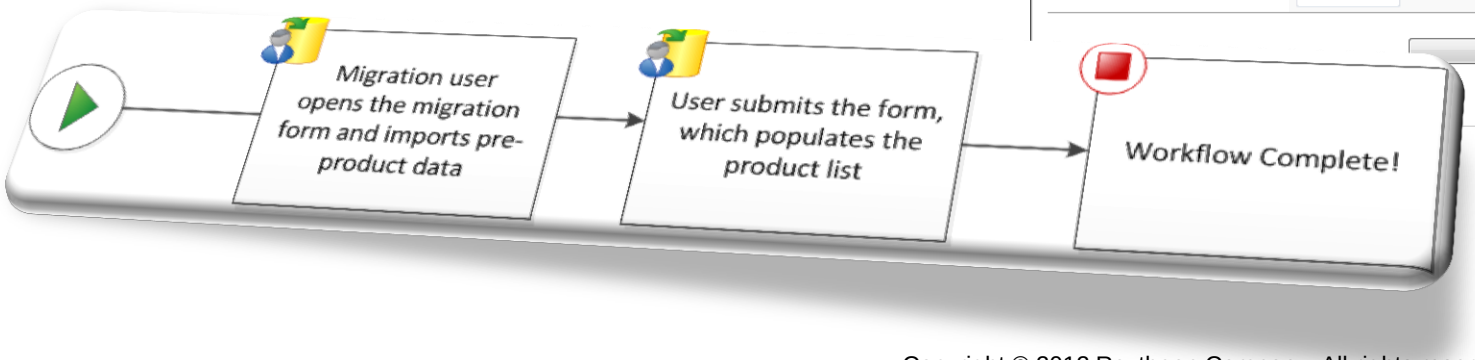
SharePoint Functionality That Enables No-Code Solutions

- Lists (like database tables) and libraries
  - Integration with Office client applications
  - Office Web Apps: Multi-user, co-authoring, browser-based editing
- Metadata: content management, document assembly, so much more…
- Workflow & business process automation
  - InfoPath forms & SharePoint Designer workflows
- Forms: list forms, InfoPath forms (browser-based fill-in)







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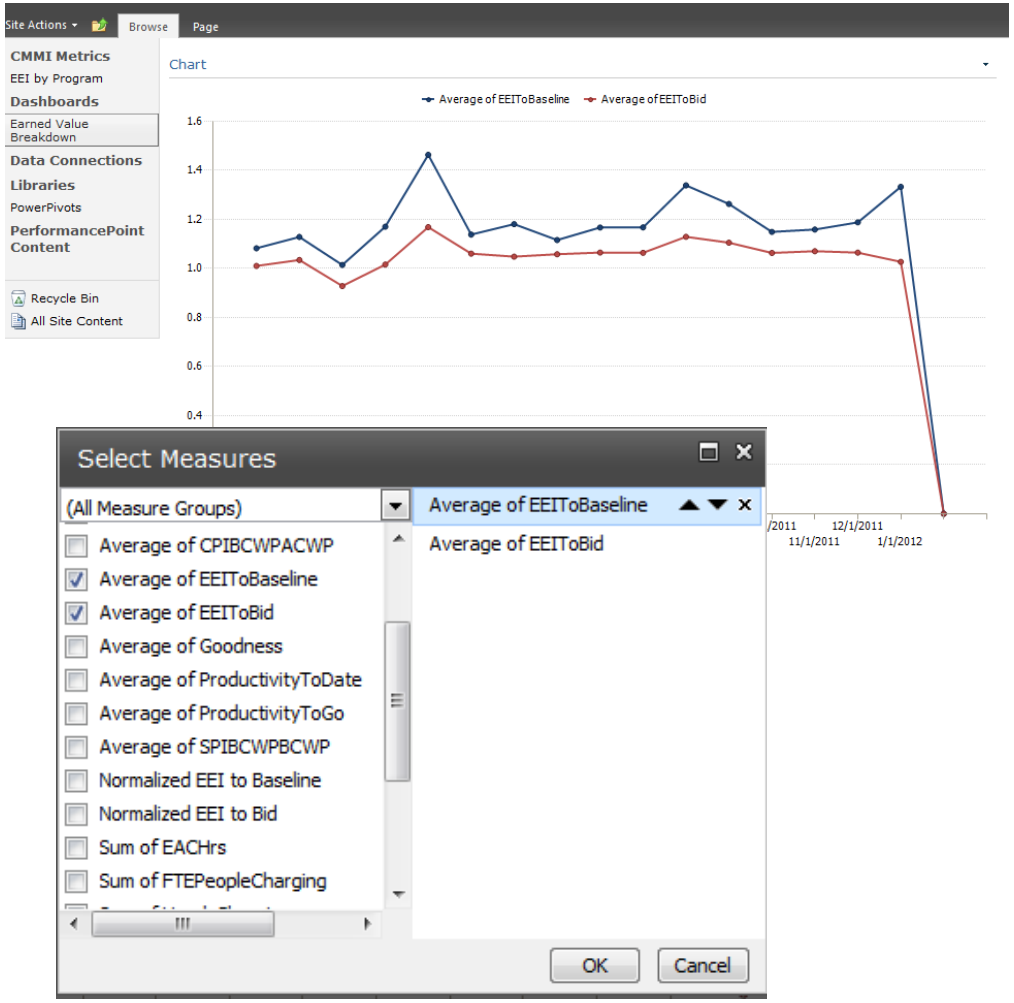
SharePoint Functionality That Enables No-Code Solutions

- Data analysis
  - Excel services, PowerPivot, SQL Server Reporting Services
- Data visualization
  - Web Parts: Excel Services, Chart, PerformancePoint, KPIs, Visio services
- Out-of-box lists & applications: Issue tracking, bugs, projects, etc.
- Rapid application development: Access services, InfoPath, Visio



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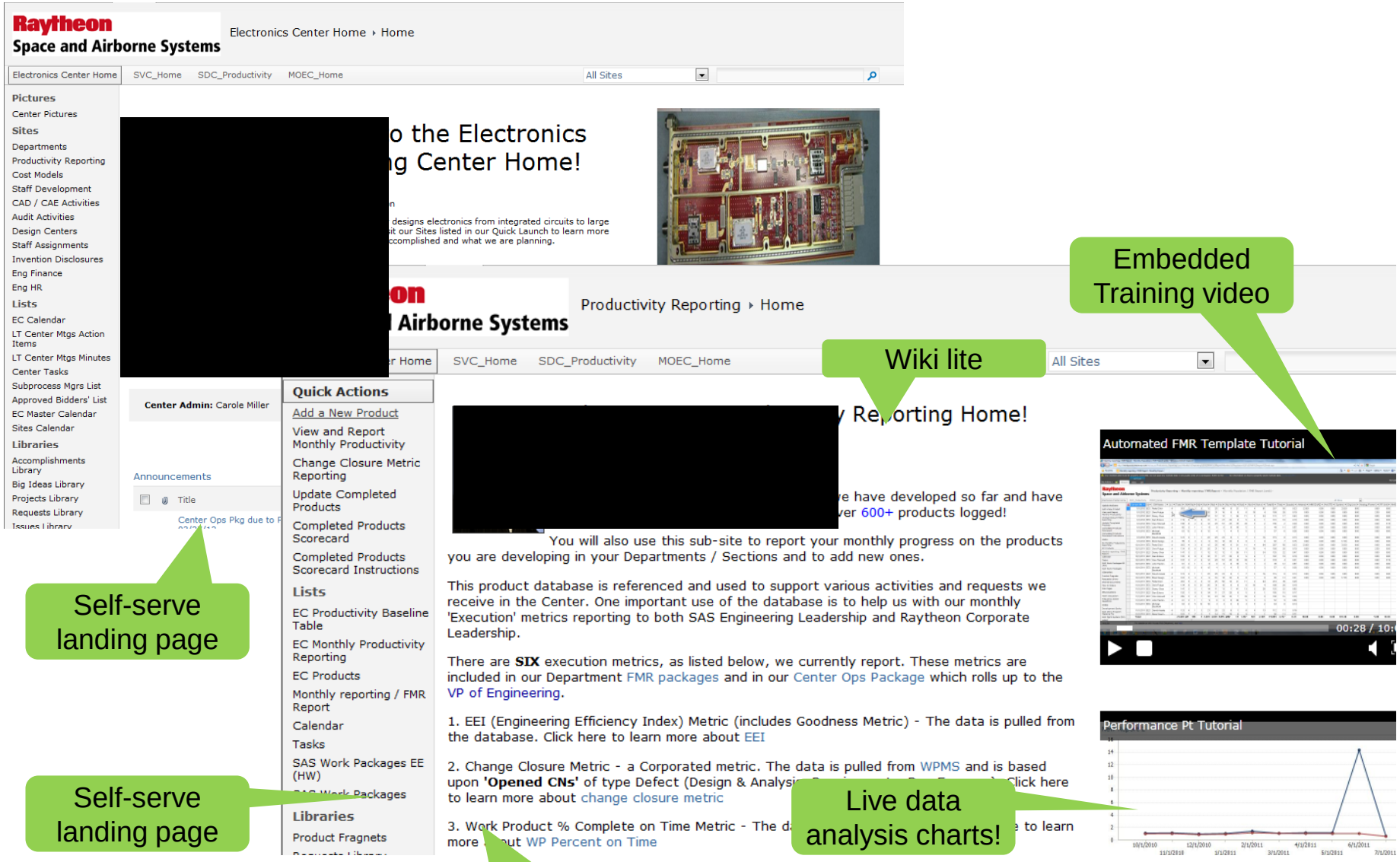
Sharepoint: Self-Serve Intranet Development



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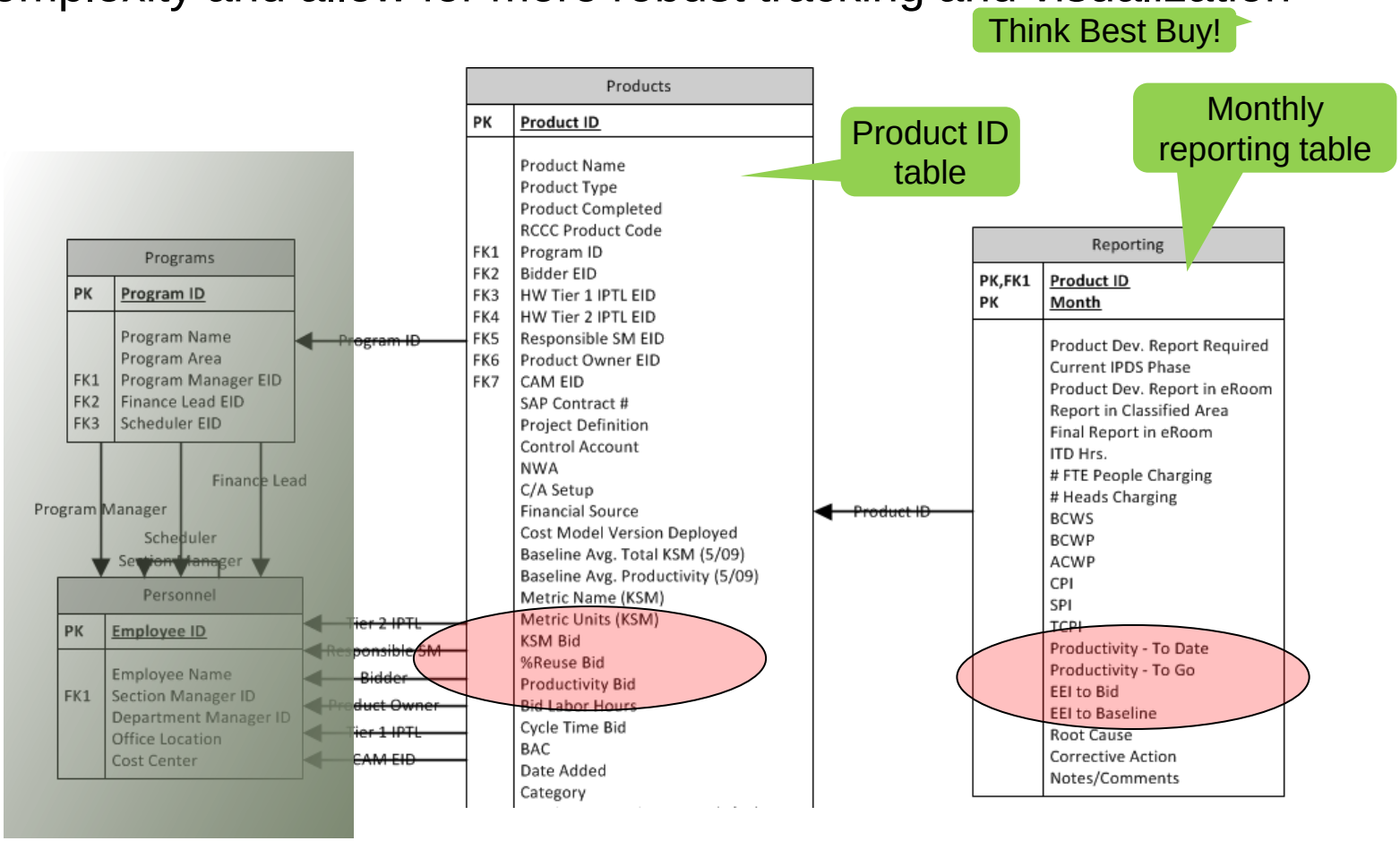
Product Tracking Schema

- Suggested relational database/SharePoint list schema
  - Organizes existing program data within multiple tables to reduce complexity and allow for more robust tracking and visualization



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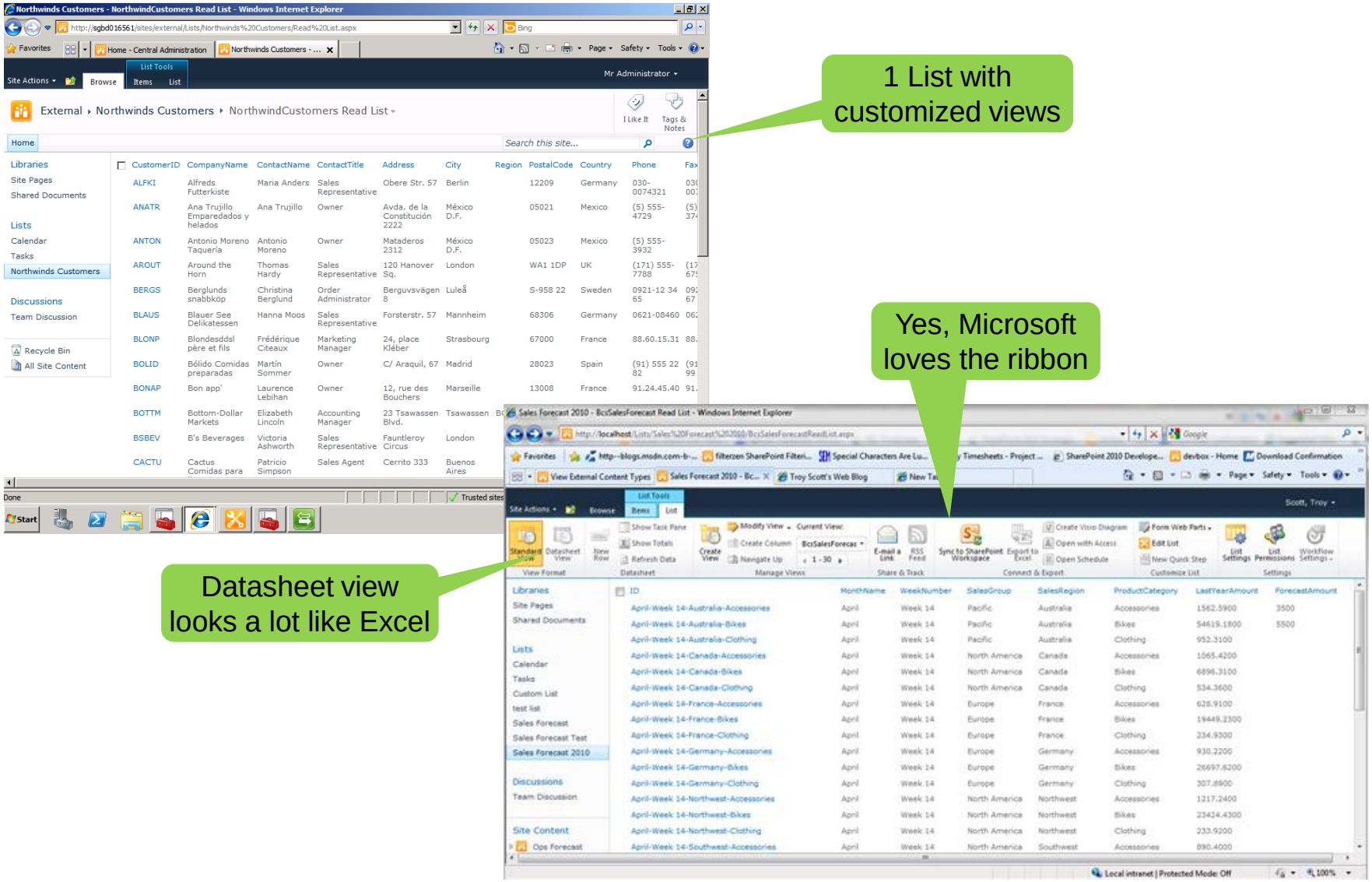
The Power of Lists!



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Electronics Product List (2012)

Category	Product Type	RCCC Product Code	KSM Name	Units	Responsible DM	Subprocess Mgr	Baseline Avg Total KSM (01/2012)	Baseline Avg Labor Hrs - PCL no Pools (01/2012)	Baseline Avg Duration (01/2012)	Baseline Avg Productivity (01/12)	Baseline Avg Productivity (01/12) for Corporate Reporting (hrs/x)	Blended Productivity (based Digital Module eTerms)	Blended Productivity Factor (eTerms)
Component	AMIC (Analog ASIC)	DU	#Transistors	Hrs/Tran	Jane Doe	John Doe	77.00	48.00	3.00	34.00	20.00	83.00	96.00
	AMIC (MMIC)	DV	#Stages	Hrs/Stage	Jane Doe	John Doe	86.00	71.00	8.00	24.00	87.00	6.00	87.00
	AMIC (SOC)	DC	#EASF	Hrs/EASF	Jane Doe	John Doe	60.00	59.00	39.00	86.00	22.00	7.00	1.00
	Digital ASIC	DH	#Gates	Gates/Hr	Jane Doe	John Doe	45.00	62.00	48.00	86.00	45.00	7.00	100.00
	Digital ASIC (Obsolesence)	DH	#Gates	Gates/Hr	Jane Doe	John Doe	52.00	62.00	11.00	85.00	38.00	90.00	87.00
	FPGA (Firmware)	DJ	#eLOCs	eLOCs/Hr	Jane Doe	John Doe	68.00	61.00	58.00	10.00	47.00	64.00	8[illegible]
	FPGA	DJ	#eLOCs	eLOCs/Hr	Jane Doe	John Doe	78.00	83.00	19.00	63.00	69.00	32.00	100.00
	Antenna Components (Radomes)	DZ	eDrawings	Hrs/eDrawings	Jane Doe	John Doe	13.00	45.00	17.00	53.00	62.00	55.00	42.00
	Antenna Components (Radiators)	DZ	eDrawings	Hrs/eDrawings	Jane Doe	John Doe	24.00	42.00	25.00	37.00	58.00	7.00	35.00
	Antenna Components (TRMs)	DZ	eDrawings	Hrs/eDrawings	Jane Doe	John Doe	49.00	58.00	28.00	41.00	19.00	64.00	29.00
	Antenna Components (Feeds)	DZ	eDrawings	Hrs/eDrawings	Jane Doe	John Doe	62.00	74.00	92.00	88.00	45.00	26.00	53.00
	Antenna Components (Circulators)	DZ	eDrawings	Hrs/eDrawings	Jane Doe	John Doe	72.00	35.00	4.00	1.00	71.00	22.00	54.00
Module	Analog Module	DT	#Terms	Hrs/Term	Jane Doe	John Doe	77.00	29.00	32.00	93.00	28.00	51.00	30.00
	Analog Power Module	DS	#Terms	Hrs/Term	Jane Doe	John Doe	93.00	40.00	37.00	34.00	24.00	63.00	79.00
	Digital Module	DG	#eTerms	Hrs/eTerm	Jane Doe	John Doe	64.00	51.00	72.00	43.00	67.00	95.00	93.00
	MMOD (RE)	DE	#Components	Hrs/Component	Jane Doe	John Doe	100.00	41.00	75.00	69.00	18.00	28.00	24.00
	MMOD (AE)	DW	#Components	Hrs/Component	Jane Doe	John Doe	37.00	67.00	17.00	64.00	84.00	54.00	5.00
	RF Module	DB	#Stages	Hrs/Stage	Jane Doe	John Doe	33.00	1.00	75.00	55.00	11.00	78.00	83.00
STE	STE (Digital Unit)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	78.00	74.00	75.00	94.00	78.00	63.00	12.00
	STE (Digital Module)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	12.00	36.00	55.00	68.00	77.00	81.00	17.00
	STE (EO)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	86.00	[illegible]	[illegible]	[illegible]	[illegible]	89.00	81.00
	STE (RF Unit)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	91.00	81.00
	STE (Analog Unit)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40.00	53.00
	STE (Analog Mod)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	97.00	[illegible]	[illegible]	[illegible]	[illegible]	33.00	79.00
	STE (Antenna)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	69.00	[illegible]	[illegible]	[illegible]	[illegible]	59.00	47.00
	STE (RF Mod)	DR	#Drawings	Hrs/Drawings	Jane Doe	John Doe	37.00	[illegible]	[illegible]	[illegible]	[illegible]	34.00	85.00
Support	System (RF Prime)	DY	#CCAs	Hrs/CCA	Jane Doe	John Doe	21.00	[illegible]	[illegible]	[illegible]	[illegible]	37.00	31.00
	System (RF STE)	DY	#CCAs	Hrs/CCA	Jane Doe	John Doe	27.00	[illegible]	[illegible]	[illegible]	[illegible]	15.00	47.00
	System (EO Prime)	DY	#lbs	Hrs/lbs	Jane Doe	John Doe	5.00	57.00	49.00	5.00	3.00	11.00	24.00
	System (EO STE)	DY	#lbs	Hrs/lbs	Jane Doe	John Doe	74.00	87.00	2.00	47.00	41.00	29.00	79.00
Unit	Analog / Power Unit	DP	#Unit Terms	Hrs/Unit Term	Jane Doe	John Doe	46.00	10.00	53.00	35.00	73.00	39.00	36.00
	Antenna (PA-AESA-Tile)	DD	#eDrawings	Hrs/eDrawings	Jane Doe	John Doe	69.00	93.00	32.00	48.00	65.00	32.00	20.00
	Antenna (PA-AESA-Panel)	DD	#Drawings	Hrs/Drawings	Jane Doe	John Doe	46.00	39.00	73.00	46.00	54.00	4.00	58.00
	Antenna (PA-AESA-Brick)	DD	#Drawings	Hrs/Drawings	Jane Doe	John Doe	62.00	37.00	1.00	97.00	89.00	10.00	20.00
	Antenna (PA-AESA-TRIM)	DD	#Drawings	Hrs/Drawings	Jane Doe	John Doe	1.00	67.00	3.00	39.00	22.00	66.00	27.00
	Antenna (Fixed Beam)	DD	#Concepts	Hrs/Concepts	Jane Doe	John Doe	17.00	15.00	27.00	16.00	55.00	60.00	53.00
	Digital Unit	DF	#eTerms	Hrs/eTerms	Jane Doe	John Doe	51.00	87.00	55.00	31.00	88.00	11.00	86.00
	RF Unit	DA	#CCAs	Hrs/CCA	Jane Doe	John Doe	17.00	44.00	70.00	31.00	22.00	92.00	19.00

These numbers are random, but we have a table with the real ones!

These names are fictitious, but we have a table with the real ones!

Start FMR Tool

Refresh Graph Data

Refresh List Data

Upload to SharePoint

Macros must be enabled before using the autoFMR tool.

You must be in *Slide Show mode* to use the command buttons on the left.

DO NOT DELETE THIS BOX! DOING SO WILL BREAK THE UPLOAD TO SHAREPOINT FUNCTION. Uploading to Sharepoint will automatically hide this box and all of the buttons in the uploaded version.

IMPORTANT:

SAVE and CLOSE all open MS Office documents/windows before using the tool.

EXTREMELY IMPORTANT:

When saving versions of your FMR, make sure that PowerPoint Macro-Enabled Presentation (.pptm) is selected in the "Save As" window! (SAVING AS .PPTX WILL RENDER THE TOOL USELESS)

If the EEI graphs look like they have the wrong numbers, first try double-clicking on the graph and accepting the macro warning from Excel, then click anywhere else on the slide to continue. This should refresh the numbers and often corrects the issue.

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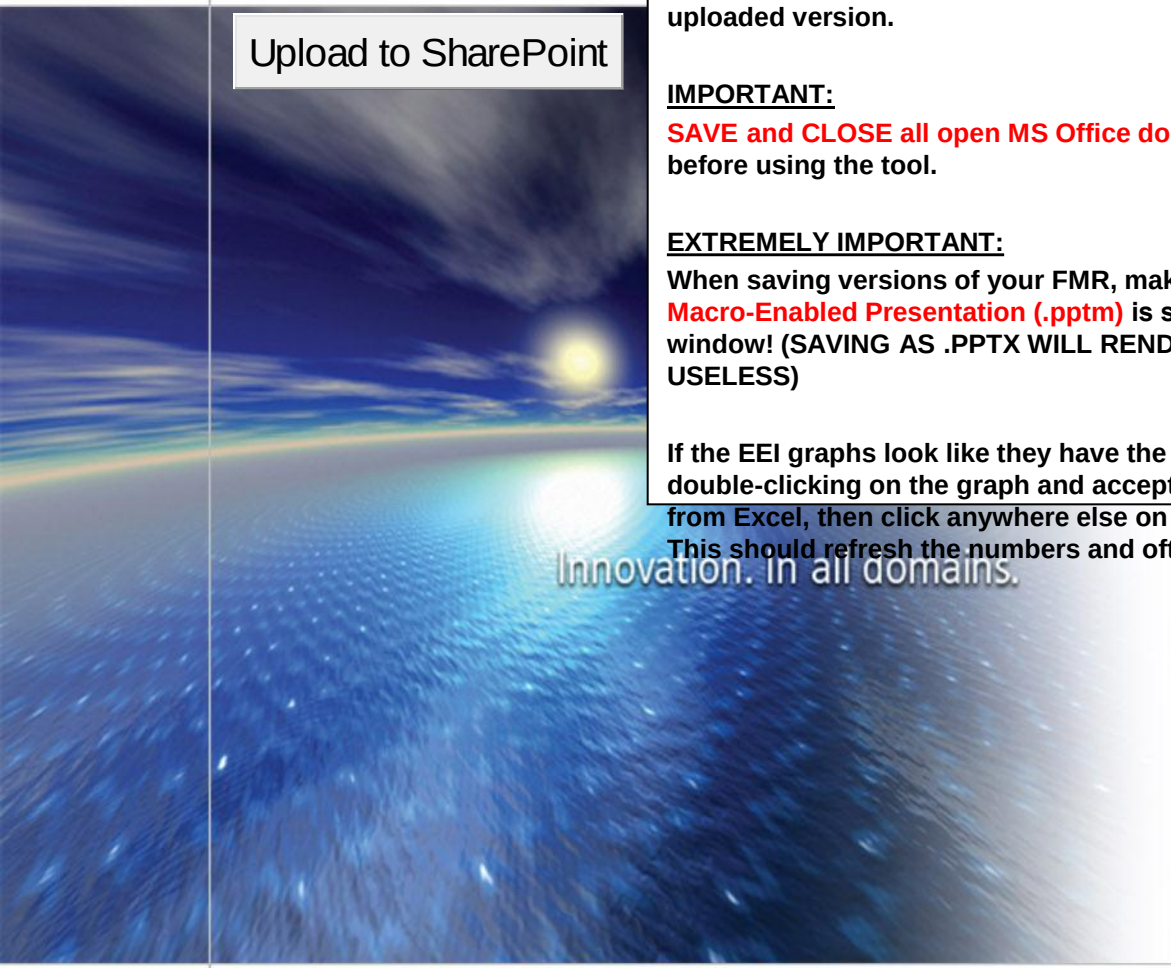
Company Most Private



ics Center epartment anagement Review

Danny Chan

Electronics Center

Digital Products I Department

February 20, 2012

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Execution: Digital Products I Department – Completed Products Scorecard

Status	Days Since Last Status Update	SM	Product Type	Program Name	Product Name
Yellow	97	SM 1	Dig ASIC	Program A	VSS
Red	115	SM 2	Dig Module	Program B	M4
Red	115	SM 3	Dig Module	Program C	GPP ITA
Yellow	115	SM 4	Dig Module	Program D	CEM1
Red	115	SM 5	Dig Module	Program E	RPM
Yellow	97	SM 6	FPGA	Program F	Test Port Interface FPGA
Green	77	SM 7	FPGA	Program G	RIF
Yellow	105	SM 8	FPGA	Program H	Anti Jam
Red	115	SM 9	FPGA	Program I	ACM
Red	115	SM 10	FPGA	Program J	DCM
Red	115	SM 11	FPGA	Program K	RPM
Red	115	SM 12	FPGA	Program L	AWG

These Section Managers are fictitious, but we have a table with the real ones!

These programs are fictitious, but we have a table with the real ones!

To get from **RED** to **YELLOW**: Fill in all of the following fields: SAP Contract #, Project Definition, NWA(s), Actual Start Date, Actual End Date, Actual Metric Value, Actual Labor Hours, Actual % Reuse

To get from **YELLOW** to **GREEN**: Finance must pull the cost data from BW. This Excel file will be sent to the owning SM, who must unmix and untangle the cost data according to the file process. If this file provides an auditable rationale then Finance will approve the product.

To get from **GREEN** to **BLUE**: Wanda Grant must verify that the product's data is either in SBT or marked as impound and David Bloom must verify that the product's data is in either the pending or current version of the Cost Model or marked as a no-go.

Date: February 2012 (January Data)

Analysis & Corrective Actions:

•

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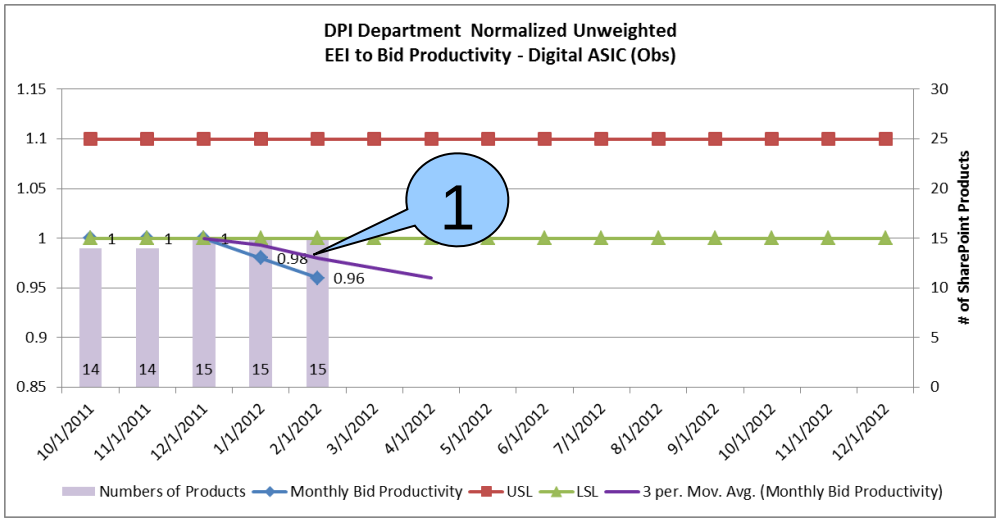
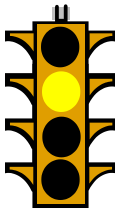
Execution:

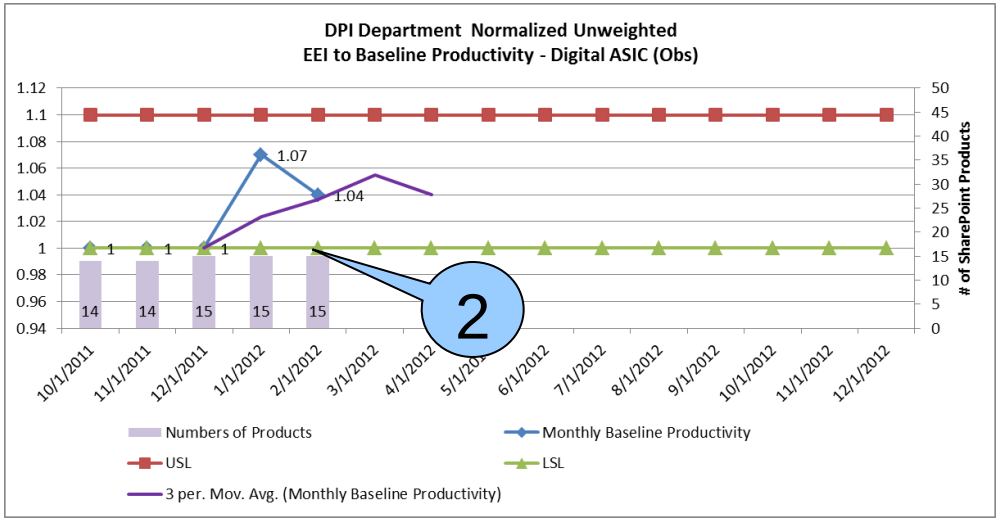
Digital Products I – Engineering Efficiency Index (to Bid/Baseline)

Current Month Status





Current Month Status



Data:
EEC EEI on Active development programs

Source: EEC Productivity Database

Process Owner:
Department Manager

Update Frequency: Monthly

Date: Mar 2012 (Feb data)

Analysis & corrective actions:

1. Add RCCA, explain how you are going to meet your 10% goal
2. Add RCCA

Actual data from SP, insert slide into FMR Package

RED	YELLOW	GREEN	BLUE
<.1.0	>=1.0 to <1.08	>=1.08 to <1.14	>1.13

Nots: weighted takes in consideration people (FTEs);
Baseline refers to current Product Productivity Dataset in Cost Model

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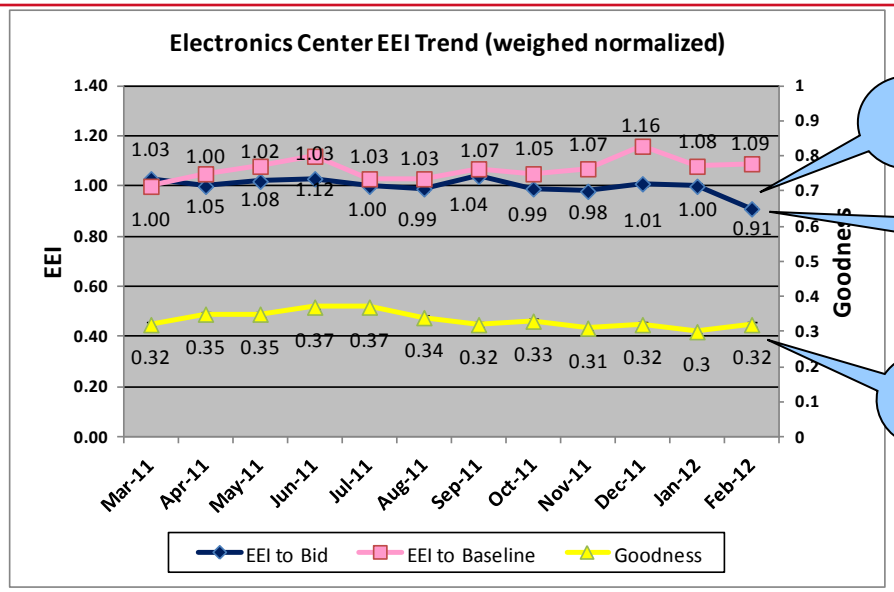
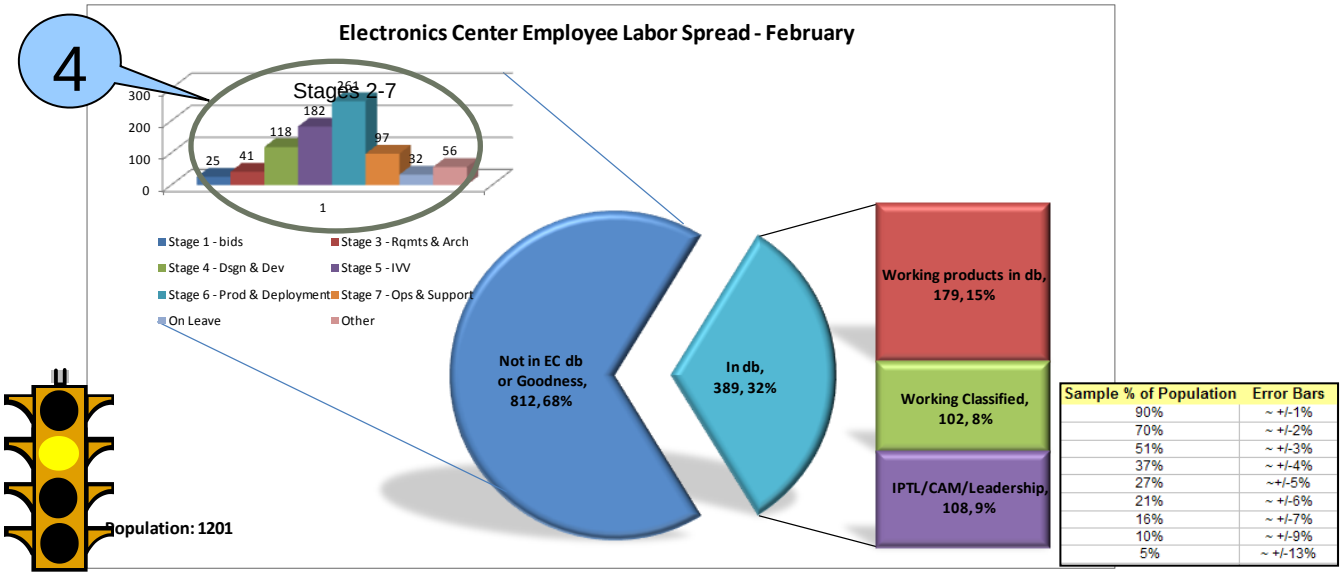
Execution:

Electronics Center – Engineering Efficiency Index (cont.)





Data:
EEC EEI on Active development programs

Source: EEC Productivity Database

Process Owner:
EEC Technical Lead

Update Frequency: Monthly

Date: Mar 2012 (Feb data)

Analysis & corrective actions:

1. Weighted – normalized EEI to Bid: We normalized based December ending #, hence starting Jan reporting with 1.0. Slight decrease this month due to completing 6 products & adding 4
2. Weighted – normalized EEI to Baseline: More involved, 3 things happened – 1) we made an adjustment to our product types productivity baseline #'s in our dataset based upon recent completed products . 2) we added and/or removed products & 3) a few product types KSM changed. This affected our Jan EEI to Baseline # starting Point from 1.00 to 1.08.
3. Slight increase in Goodness due to addition of 4 products
4. Most of our Employees not in db are supporting stage 5 & 6 activities.

Current Month Status

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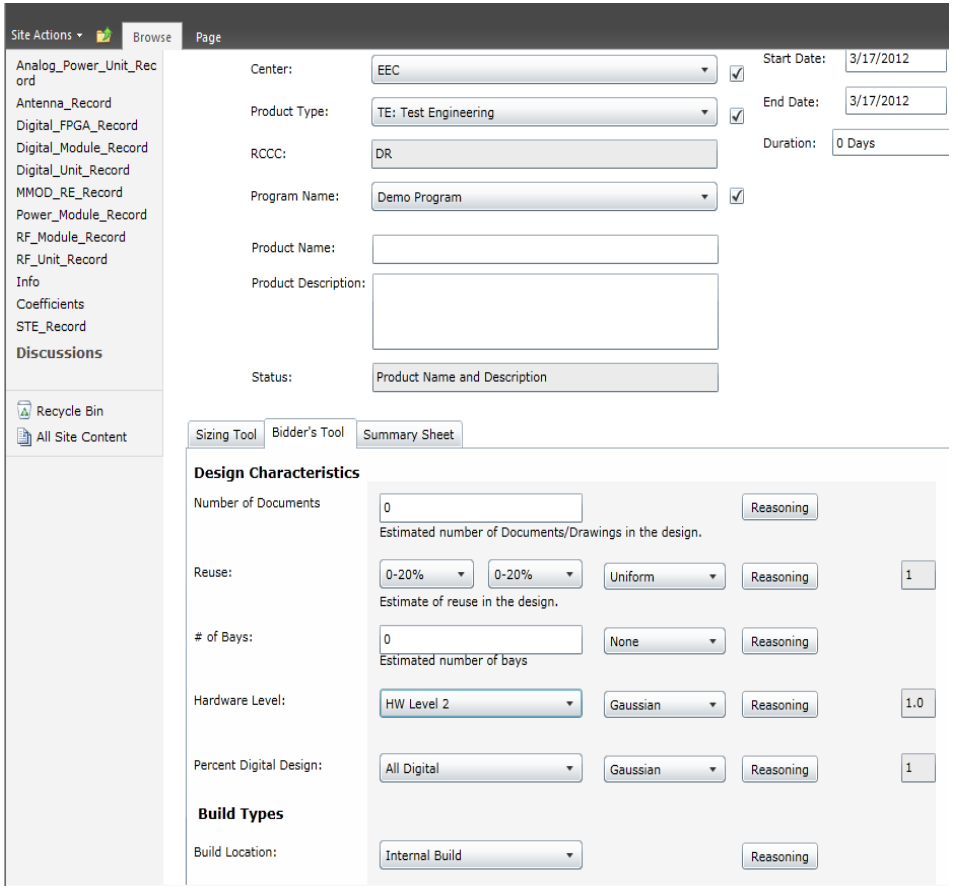
Advanced Topics – Business, IP and Project Management

- Silverlight web parts
  - Run on the client (no corporate IT)
  - Compatible with SBT
- Lightswitch
  - Requires IIS server, which in our environment comes with the Sharepoint environment
  - Is mostly very low code solution space
  - Is designed for the knowledge worker, not IT
- Wiki integration
  - Confluence Wiki integration
- Microsoft Project 2010
  - Requires Sharepoint 2010
  - We have demonstrated integration that provided SM view of all member tasks



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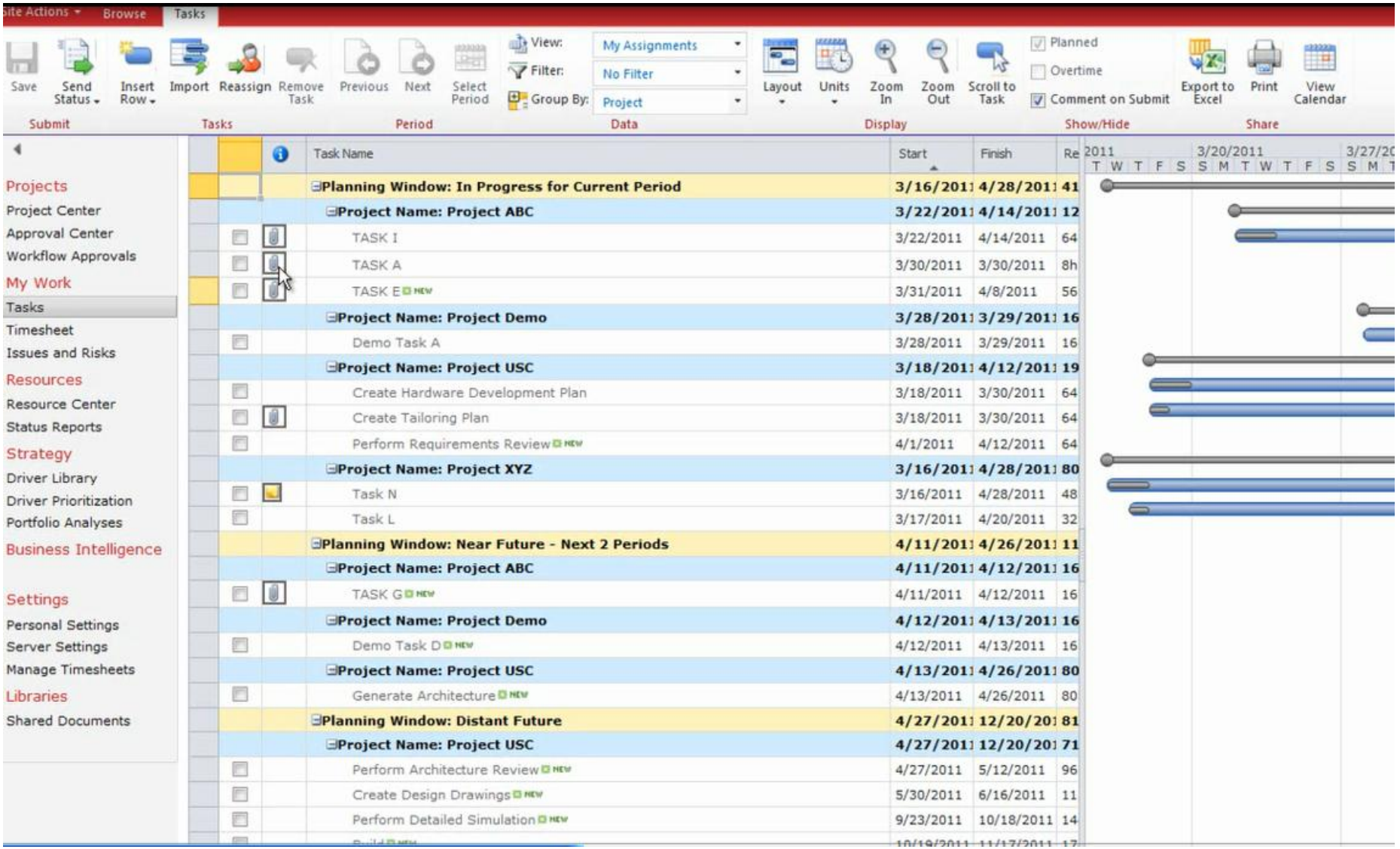
Microsoft Project Server Requires Sharepoint



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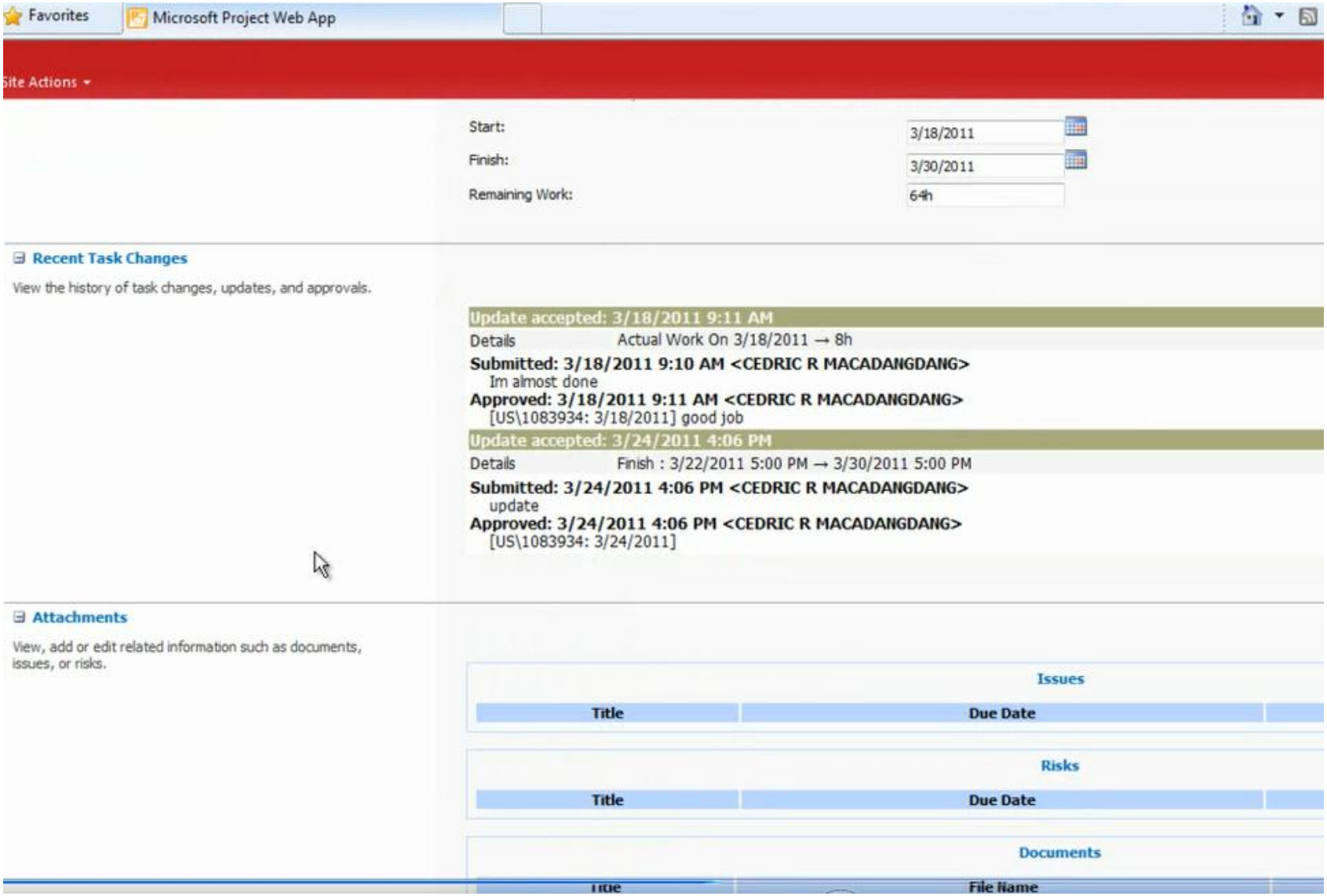
Enablers and Tracking of Each Task



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Corp IT Plans (Communications Campaign, Integration plans)

Lotus Notes & Sametime
(Email, calendar, chat, meetings)

Confluence Wiki
(Corp IT may possibly terminate existing wikis and enable Rspace wiki)

Enterprise Content Management
(Currently investigating technologies, applications, and options for consolidating our content management capabilities)

eRoom
(Team room / Collaboration)

Newsgator
(Enterprise RSS)

RTube
(Youtube for the enterprise)

RTN broadcast

Mission: provide a place to go to connect, collaborate, and innovate

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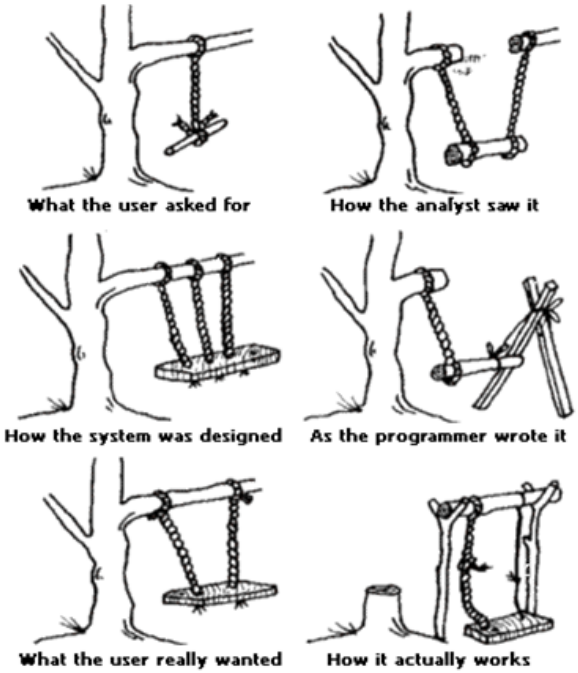
Wrap-up

What Would the Requirements Look Like?

- Wouldn't it be amazing if we had a computing environment that is …
  - Web Based
    - Standard permissions
    - Open to everyone that needs it
  - Extensible
    - Collect cost data for any type of product
    - Data visible to corporate applications
    - 3rd Normal Form
  - Collaborative
    - 80 pairs of boots on the ground
    - No lockouts like eRoom
  - Self-Serve
    - Minimum IT involvement
    - Does not require full time administration
  - Agile
    - Data collection needs are always changing
  - Report productivity close to real time
    - Tell a story with charts
    - Tightly integrated with Microsoft Office



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Backup and alternative slides

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David Bloom Bio

Biography:

After graduating from the University of California at Davis in 1983, Mr. Bloom has worked for the Naval Weapons Center, Lockheed Martin, Lawrence Livermore National Labs and since 2008, for Raytheon Space and Airborne Systems (SAS) where he is a Sr. Engineering Manager.

Mr. Bloom is currently the Cost Estimation Subject Matter Expert (SME) for the Electronics Center of SAS. He has developed parametric models for all Electronics Center products and helped transform the culture of the organization in the use of parametric bidding methodologies.

In addition to Mr. Bloom's focus for the Electronics Center in developing parametric cost models for the design and development cycle activity of electronics sub-products, he is also leading the effort to reduce the cost of FPGA and ASIC development by modernizing the Digital Verification methods and establishing reproducible re-use methods.

Mr. Bloom has patents and software copyrights along with a number of publications ranging from electromagnetic boundary value problems to cost estimation. In 2006, he won the International R&D 100 Award for innovating a cost effective Gigapixel Camera for persistent surveillance applications.

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Wanda Grant Bio

Current Position: Electronics Center Chief Process Engineer.

Master in Electrical Engineering from LMU, concentration in Computer Design

Worked for Hughes / Raytheon for 34 years in various roles from test engineer, design engineer to systems engineer

Raytheon

Mason Wexler Bio

Mason Wexler has worked for Raytheon for over 23 years in the Information Technology and Engineering organizations and is currently a member of the SAS IT Information Security department. He started working with the IBM Company in 1979 as a numerical control programmer writing algorithms to control machines used to manufacture of printed circuit boards, and also worked as a member of the IBM DB2 database development team. He joined Hughes Aircraft Company in 1984 where he has performed systems administration, systems architecture, and programming assignments. Mason participated in the design and implementation of the Raytheon Active Directory and is currently the SAS Domain Administrator for the us.ray.com Windows Domain. Mason was the project manager for the SAS Server Virtualization project, and most recently was part of the design effort for the SAS Distributed System Architecture (DSA) which developed the design for the next generation SAS desktop environment. Mason graduated in 1979 from the State University of New York College at Potsdam with a major in Computer Science.

Mason Wexler, a Senior Principle Software Engineer, joined Raytheon 23 years ago. Mason was the SAS project manager for the Server Virtualization project, representing SAS IT Engineering Services Architecture and Alignment. He was part of SAS Distributed System Architecture (DSA) that designed the SAS desktop environment. Mason helped design and implement the Raytheon Active Directory and was a SAS Domain Administrator for the us.ray.com Windows Domain. Mason joined Hughes Aircraft Company in 1984 where he performed systems administration, systems architecture, and programming assignments. He started his career at the IBM Company in 1979 as a numerical control programmer and worked as a member of the IBM DB2 database development team. Mason graduated in 1979 from the State University of New York College at Potsdam with a major in Computer Science.

