PROGRAM ACQUISITION COST (PAC) TEMPLATE

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OUTLINE

- PAC Template Origins/Evolution – Where did we start?

- Required Products – Outputs

- Inputs to Outputs – Formulating the plan

- PAC Template Structure – Implementing the plan

- Math Crosschecks – Ensuring it all adds up

- Benefits – Why is the PAC Template so great?

- Lessons Learned

PAC TEMPLATE ORIGINS/EVOLUTION

- In 2006 a demand signal for more government cost estimators brings about the creation of the Navy Information Warfare Center (NIWC) cost analyst group.

- The NIWC group begins to grow with the addition of existing NIWC employees, Private sector, and the Navy Acquisition Development Program (NADP).

- The NIWC group begins to develop a model that will satisfy the reporting requirements of the SPAWAR 1.6 cost model review process and the program offices data calls.

- The software development experience of Jim Cain brings about the formal use of Visual Basic for Applications (VBA) to automate some of the tedious work and simplify complex equations.

REQUIRED PRODUCTS

- **Cost Competency Review Required Products (SPAWAR 1.6)**
  - Estimate Summary Charts – Similar to a Spruill chart with all sources of funding
  - Cost Contributor Charts – A guide to the cost build ups which cover the top 80% of the Cost
  - Estimate Tracker – Prior versions of the programs previously reviewed and approved estimates
  - Estimating Method by Appropriation – The methodology as a percentage of total cost
  - PLCCE Summary Sheets – A table by Appropriation, by WBS, by Year, by Source of the total cost
  - Impact Summary Review – Tables which show the cost impact from the review process
  - Risk Related Products – Several products related to the Monte Carlo Simulation

- **Program/Sponsor Required Products (Mostly PEOC4I / PEO Space Programs)**
  - Spruill Chart, P-Doc/R-Doc input
  - Acquisition Program Baseline, Section C
  - Pivot Table for cost analysis
  - ACAT Status – The evaluation of the ACAT level of the program

INPUTS ---> OUTPUTS

Inputs

- **SME Input**
- **Contract Data**
- **EVM Data**
- **Catalog Pricing**
- **DOD Database Data**
- **FTE Data**
- -
- **Analysis**
- -
- **Application & Phasing**

Model Construct
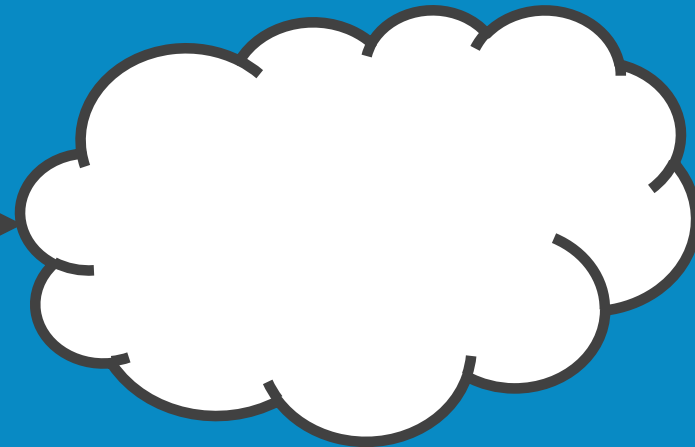
Outputs

- **Spruill Chart**
- **APB Section C**
- **Cost Contributor Chart**
- **Estimate Tracker**
- **ACAT Status**
- **PLCCE Summary Table**
- **Uncertainty Analysis**
- **Pivot Table (Data Calls)**
- **Adjudication Charts**

INPUTS → MODEL CONSTRUCT → OUTPUTS

COST MODEL FLOW AND STRUCTURE

Analyst Generated

Generated using VBA Code

General Inputs / Risk Inputs / Normalization

Data / Data Analysis Cost Build Up

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Flat File Data

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Risk Forecast

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Outputs – Estimate Summaries, APB, Spruill, Cost Contributors, Risk Outputs
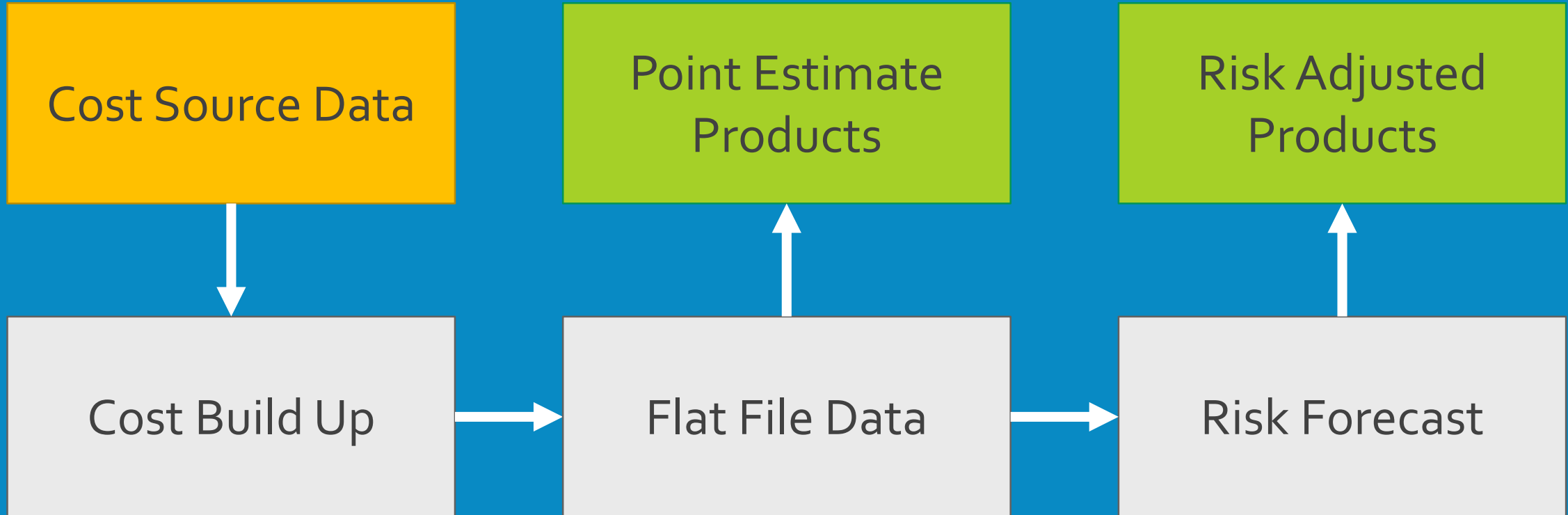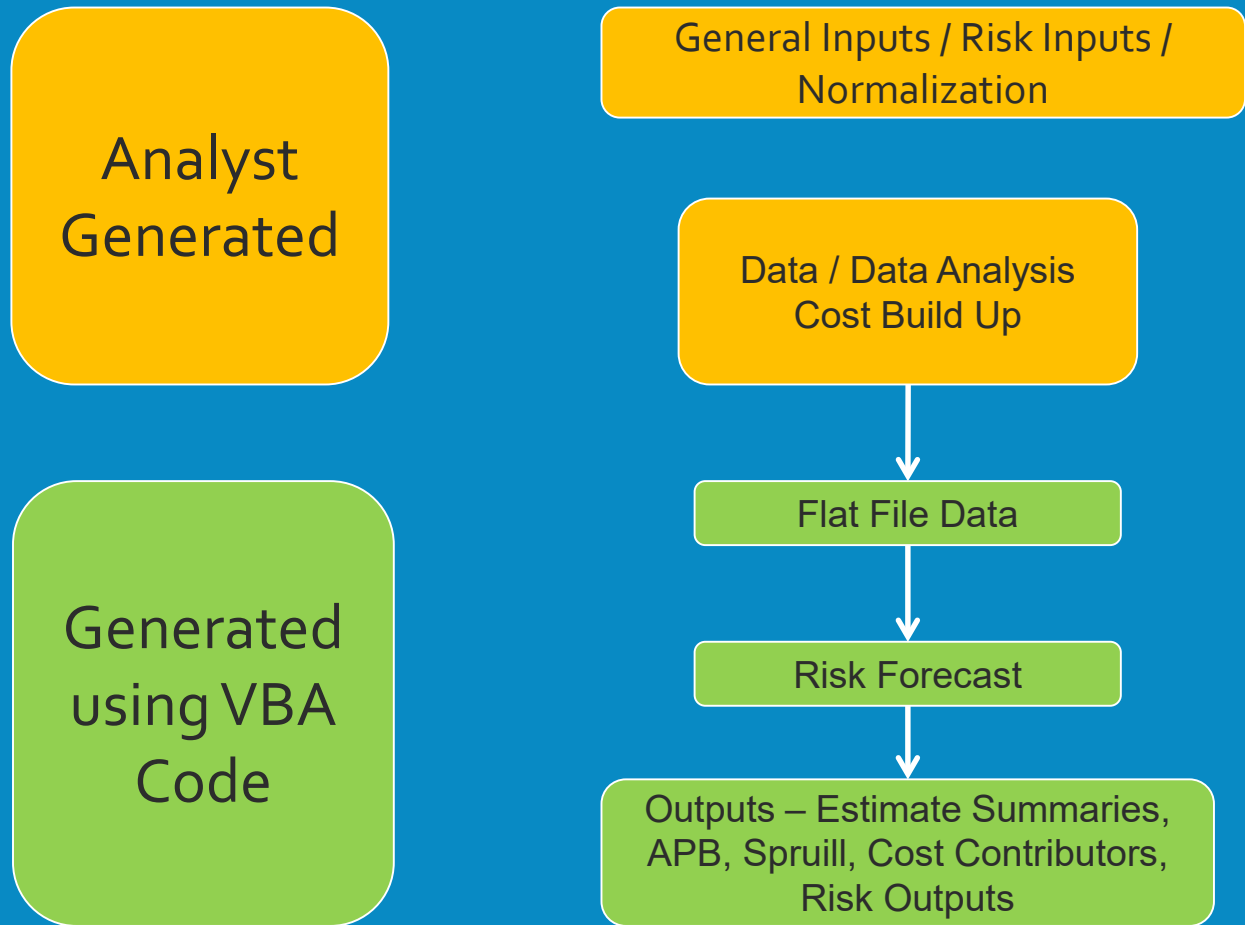
Process Automation Overview

Analyst Receive data from the program office, contractor, or independently.

The cost data, general inputs, risk inputs, and inflation indices have standard formats.

The standard formatting allows the VBA code to manipulate the inputs into required outputs.

COST MODEL FLOW AND STRUCTURE

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Outputs – Estimate Summaries, APB, Spruill, Cost Contributors, Risk Outputs

General Inputs:

Inputs include base year, estimate start and end year, cost build up column names, and in general any inputs used on multiple sheets

Risk Inputs:

Monte Carlo Assumptions with all related distribution information

GENERAL INPUTS AND RISK INPUTS

General Inputs	
Estimate Sponsor:	Program XYZ
BaseYear:	2014
"To Go" Start Year	2019
Estimate End Year	2025
Sunk Cost Begin Year	2013

Appropriations	
APPN 1	RDTEN
APPN 2	OPN
APPN 3	OMN

Column Names	WBS	Description	Appropriation	Methodology	Performer	Group	System

What Year does the estimate start?
What year will the estimate end?

What are the relevant appropriations?

GENERAL INPUTS

Name	Factor * Assumption	Factor	Assumption	Low	Most Likely	High	Mean	St Dev
Installation - System X	100	100	1.00				1.00	0.19
Installation - Analogy	1.30	1.30	1.00	0.769	1.000	1.077		

RISK INPUTS

COST MODEL FLOW AND STRUCTURE

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Data / Data Analysis Cost Build Up

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Flat File Data

↓

Risk Forecast

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Normalization:

Must have a standardized format

STANDARD INFLATION METHOD

RAW	2013	2014	2015	2016	2017	2018	2019
RDTEN	0.9320	0.9459	0.9563	0.9678	0.9842	1.0000	1.0169
OPN	0.9319	0.9459	0.9563	0.9678	0.9843	1.0000	1.0170
OMN	0.9329	0.9432	0.9530	0.9646	0.9821	1.0000	1.0090

WEIGHTED	2013	2014	2015	2016	2017	2018	2019
RDTEN	0.9442	0.9574	0.9692	0.9857	1.0021	1.0194	1.0383
OPN	0.9513	0.9636	0.9766	0.9922	1.0090	1.0268	1.0463
OMN	0.9371	0.9465	0.9563	0.9690	0.9865	1.0041	1.0135

CY2BY	2013	2014	2015	2016	2017	2018	2019
CY2BY_RDTEN	1.0149	1.0000	0.9891	0.9774	0.9610	0.9459	0.9302
CY2BY_OPN	1.0150	1.0000	0.9891	0.9774	0.9611	0.9459	0.9301
CY2BY_OMN	1.0110	1.0000	0.9897	0.9778	0.9604	0.9432	0.9347

BY2CY	2013	2014	2015	2016	2017	2018	2019
BY2CY_RDTEN	0.9853	1.0000	1.0110	1.0231	1.0405	1.0572	1.0751
BY2CY_OPN	0.9852	1.0000	1.0110	1.0231	1.0405	1.0572	1.0751
BY2CY_OMN	0.9891	1.0000	1.0104	1.0227	1.0413	1.0603	1.0699

Standardization allows VBA written code to know how to execute crosschecks such as varying the base year of the indices to ensure Then Year costs don't change
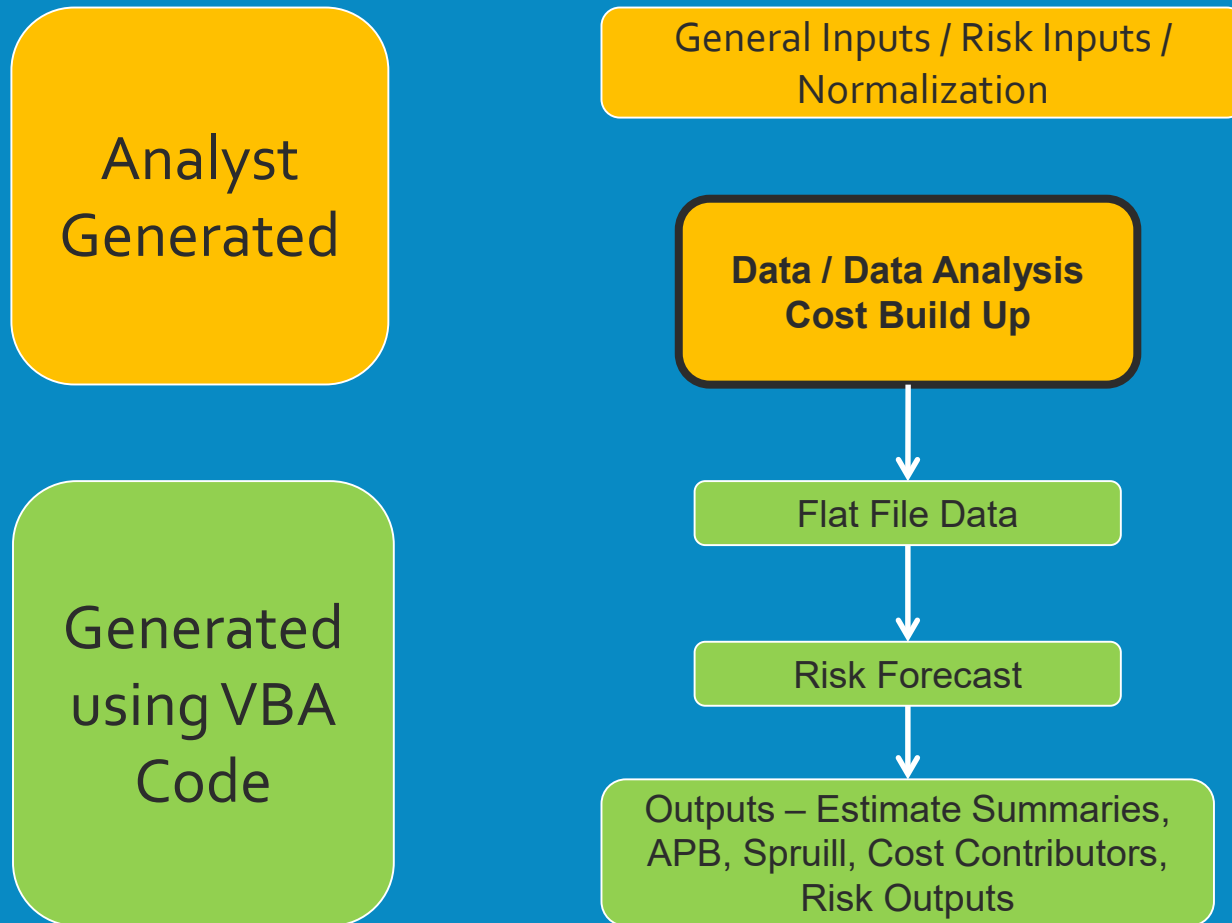
Inflation requires a Raw and Weighted indices whether identical or not

Inflation is not required to be categorized by appropriation or based on component/service indices, however the table format must be followed

Install Type	Platform	Year	Cost $K	Appropriation	BY2014 $K
System X	Ship 100	2017	110	RDTEN	106

=D2*HLOOKUP(C2,INFLATION_MULTIPLIERS,CY2BY_RDTEN,FALSE)

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Data / Data Analysis Cost Build Up

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Flat File Data

↓

Risk Forecast

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Data / Data Analysis:

Is not required to be in a standard format

Cost Build Up:

Cost Build Up tables are in a standard format

However, the Cost Build Up tables can be organized by Phase, Appropriation, WBS, Performer, Contract/CLIN, Etc.

COST BUILD UP

WBS!	Description	APPN	Method	Performer	Variant	Group	Total	2019	2020	2021	2022	2023	2024	2025
1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	$ 14,062	$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ -
2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	$ 3,912	$ -	$ 652	$ 652	$ 652	$ 652	$ 652	$ 652
End of Table						**Total**	**$ 17,974**	**$ 2,344**	**$ 2,996**	**$ 2,996**	**$ 2,996**	**$ 2,996**	**$ 2,996**	**$ 652**

Example data for "2.4.3 – System Y Install"

Analogous Install	Mean	Std Dev.	# Installs
System X	100	19	5

Analogy	Low	Likely	High
System X to Y	1.00	1.30	1.40

Risk Inputs Sheet

Name	Factor * Assumption	Factor	Assumption	Low	Most Likely	High	Mean	St Dev
Installation - System X	100	100	1.00				1.00	0.19
Installation - Analogy	1.30	1.30	1.00	0.769	1.000	1.077		

Analogy Factor	1.30
System X	100
Cost of System Y	130

P&I Plan	2019	2020	2021	2022	2023	2024	2025
Procurement	5	5	5	5	5	5	
Install		5	5	5	5	5	5

This is an example of a system install analysis. The uncertainty variables are fed into the risk inputs sheet, and then fed back to the data analysis to roll up into the cost build up table.

COST MODEL FLOW AND STRUCTURE

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Data / Data Analysis Cost Build Up

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Risk Forecast

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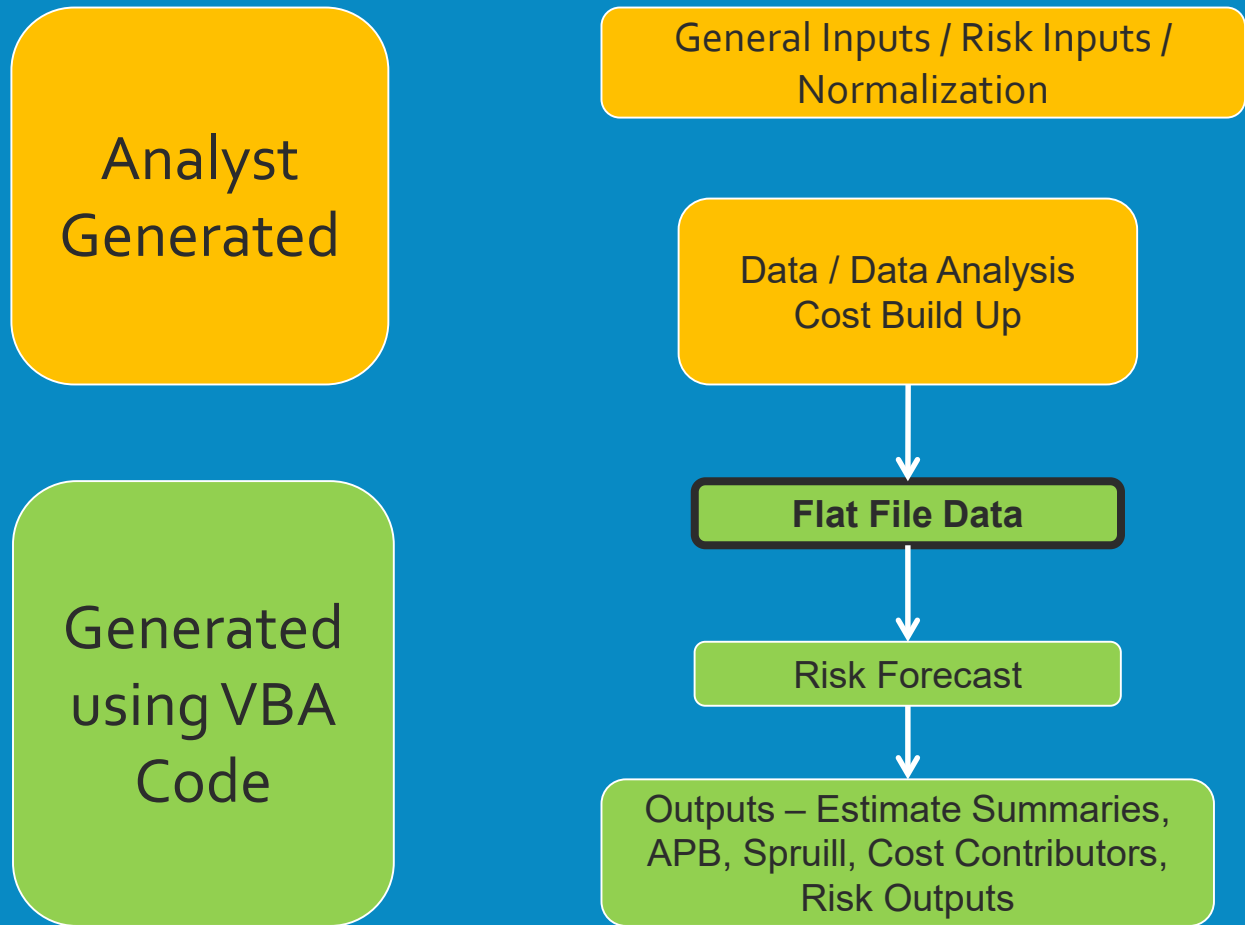
Flat File Data:

The Flat File Data is used to support any point estimate products and build a pivot table. The pivot table is used to perform in depth data drills

FLAT FILE DATA

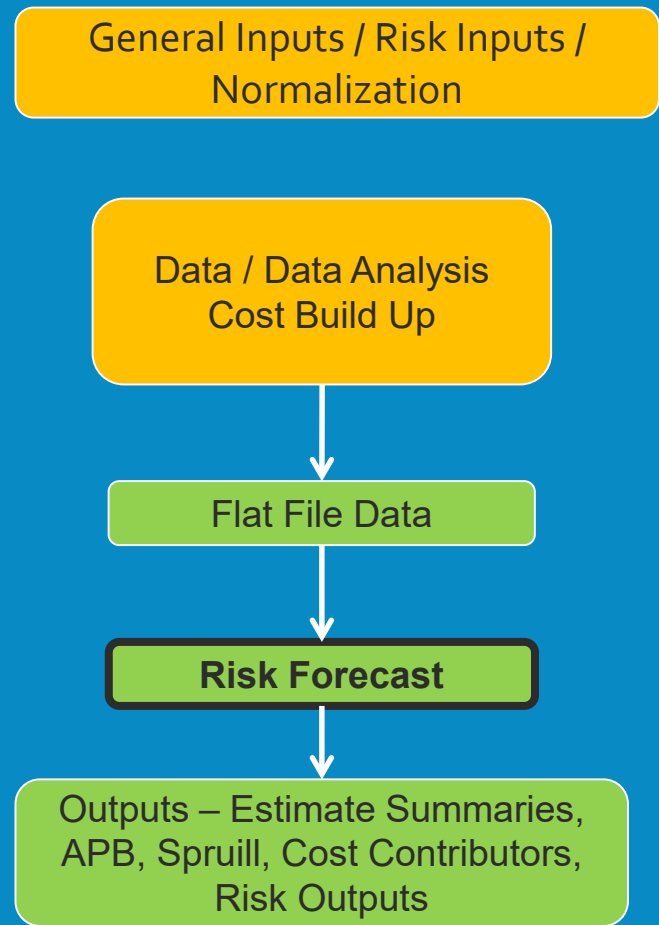| Year	BY $K	TY $K	WBS!	Description	APPN	Method	Performer	Variant	Group	Source Worksheet	WBS Level 3	WBS Level 2
2019	2,344	2,592	1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	1.1.1 - Hardware	1.1 - Prime Mission Product
2020	2,344	2,644	1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	1.1.1 - Hardware	1.1 - Prime Mission Product
2021	2,344	2,696	1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	1.1.1 - Hardware	1.1 - Prime Mission Product
2022	2,344	2,750	1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	1.1.1 - Hardware	1.1 - Prime Mission Product
2023	2,344	2,805	1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	1.1.1 - Hardware	1.1 - Prime Mission Product
2024	2,344	2,861	1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	1.1.1 - Hardware	1.1 - Prime Mission Product
2025	-	-	1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	1.1.1 - Hardware	1.1 - Prime Mission Product
2019	-	-	2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	2.4.3 - System Installatio	2.4 - Platform/Site Activation/Installation
2020	652	735	2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	2.4.3 - System Installatio	2.4 - Platform/Site Activation/Installation
2021	652	750	2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	2.4.3 - System Installatio	2.4 - Platform/Site Activation/Installation
2022	652	765	2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	2.4.3 - System Installatio	2.4 - Platform/Site Activation/Installation
2023	652	780	2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	2.4.3 - System Installatio	2.4 - Platform/Site Activation/Installation
2024	652	796	2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	2.4.3 - System Installatio	2.4 - Platform/Site Activation/Installation
2025	652	812	2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	Procure & Install	2.4.3 - System Installatio	2.4 - Platform/Site Activation/Installation

Flat File Data is transposed

2 Cost build up lines * **7** estimate years = **14** Flat File Data lines

WBS!	Description	APPN	Method	Performer	Variant	Group	Total	2019	2020	2021	2022	2023	2024	2025
1.1.1	System Y Procurement	OPN	Analogy	KTR	V-2	PB Systems	$ 14,062	$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ -
2.4.3	System Y Install	OPN	Analogy	KTR	V-2	PB Systems	$ 3,912	$ -	$ 652	$ 652	$ 652	$ 652	$ 652	$ 652
End of Table						**Total**	$ 17,974	$ 2,344	$ 2,996	$ 2,996	$ 2,996	$ 2,996	$ 2,996	$ 652

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Risk Forecast

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Risk Forecast:

A summarized version of the Flat File Data

The risk summary is determined by output requirements

RISK/FORECAST OUTPUT

WBS	BY or TY	APPN	FY	Point Estimate	Mean	StdDev	0%	50%	100%
	TY	OPN	To Go Total	20,989	23,561	1,061	20,916	23,511	26,864
	BY	OPN	To Go Total	17,974	20,026	894	17,795	19,983	22,811
	TY	OPN	2019	2,592	2,592		2,592	2,592	2,592
	TY	OPN	2020	3,379	3,324	168	2,905	3,316	3,848
	TY	OPN	2021	3,447	3,391	172	2,963	3,382	3,925
	TY	OPN	2022	3,516	3,458	175	3,022	3,450	4,003
	TY	OPN	2023	3,586	3,528	178	3,083	3,519	4,083
	TY	OPN	2024	3,658	3,598	182	3,144	3,590	4,165
	TY	OPN	2025	812	3,670	186	3,207	3,661	4,248
2.1.1	TY	OPN	2019	2,592	2,592		2,592	2,592	2,592
2.1.1	TY	OPN	2020	2,644	2,644		2,644	2,644	2,644
2.1.1	TY	OPN	2021	2,696	2,696		2,696	2,696	2,696
2.1.1	TY	OPN	2022	2,750	2,750		2,750	2,750	2,750
2.1.1	TY	OPN	2023	2,805	2,805		2,805	2,805	2,805
2.1.1	TY	OPN	2024	2,861	2,861		2,861	2,861	2,861
2.1.1	TY	OPN	2025	-	2,919		2,919	2,919	2,919
2.3.4	TY	OPN	2019	-					
2.3.4	TY	OPN	2020	735	681	168	261	673	1,204
2.3.4	TY	OPN	2021	750	694	172	266	686	1,228
2.3.4	TY	OPN	2022	765	708	175	272	700	1,253
2.3.4	TY	OPN	2023	780	722	178	277	714	1,278
2.3.4	TY	OPN	2024	796	737	182	283	728	1,303
2.3.4	TY	OPN	2025	812	751	186	288	743	1,329

→ **Total by Appropriation**

→ **Total by Appropriation, by year**

→ **Total by Appropriation, by year, by WBS**

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Output Deliverables:

The output tables and graphs are generated by VBA code based on the Flat File Data and Risk Forecast tabs

OUTPUTS

Spruill

APB Sec. C

Total Ownership Cost

Estimate Tracker
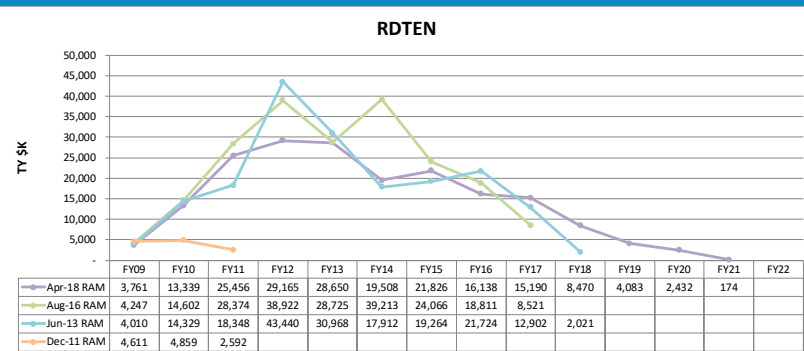
S-Curve Chart
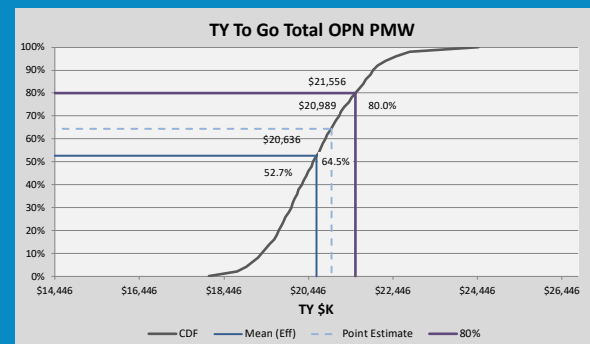
MATHEMATICAL CROSSCHECKS

Current Calculation	$	Check	Target	Notes
Baseline Test Point Estimate (PE)	TY $K	$2,004,437	$ 2,004,437	Checks whether the Point Estimate (PE) baselined cost has changed
Pivot TY vs PLCCE Summary TY	TY $K	$2,004,437	$ 2,004,437	Verifies that Then Year (TY) Pivot Data Output matches TY Summary Worksheet Output
Withhold Test		Embedded	Not Embedded	
	TY $K	$1,665,934	$ 1,665,934	Verifies that embedding or not embedding withholds does not change the TY Grand Totals
Then Yr Test Years		2019	2000	
Estimate Summaries RAM (Sunk TY)	TY $K	$ 338,504	$ 338,504	Compare Sunk $ on (TY) RAM table to (TY) PE table
Spruill RAM (To Go Total)	TY $K	$ 620,066	$ 620,066	Compare (Grand Total - Prior) to Uncertainty Output (TY) To Go Total
APB RAM (Grand Total)	TY $K	$ 891,509	$ 891,509	Compare APB (TY) Total Life Cycle Cost + SCN with PLCCE Summary (TY) Grand Total
HeadCounts (To Go Total)	FTE	543.82	543.82	
ACAT Status (Includes Sunk)	$K	1,644,174	1,644,174	Compare ACAT Status with Uncertainty Output & Cost Database
Cost DB vs. Cost Build Up tabs	BY$K	$1,731,846	$ 1,731,846	Compares the total on each build up tab, headcount table, sunk cost table with Cost DB

Crosschecks:

The crosschecks in the model ensure all the output sheets are aligned arithmetically

BENEFITS

- Rapid generation of cost models and rapid data call response
- Analyst/Sponsor/Management can open a cost model from any program and be familiar with the construct
- New ideas/functionality/formats from any analyst can be easily implemented into another cost model
- New Analysts learn to use templates quickly
- Analysts have more time to spend on analytical work

LESSONS LEARNED

- The PAC template was a ground up initiative
  - The PAC template was created incrementally and as a joint effort by the cost estimators creating cost models.

- The PAC template is primarily an organizational tool. It does not constrain the analyst to conform to an estimating methodology or any specific format.

- Templates require a level of effort to maintain. There will always be new scenarios and new ideas. We continue to Improve….
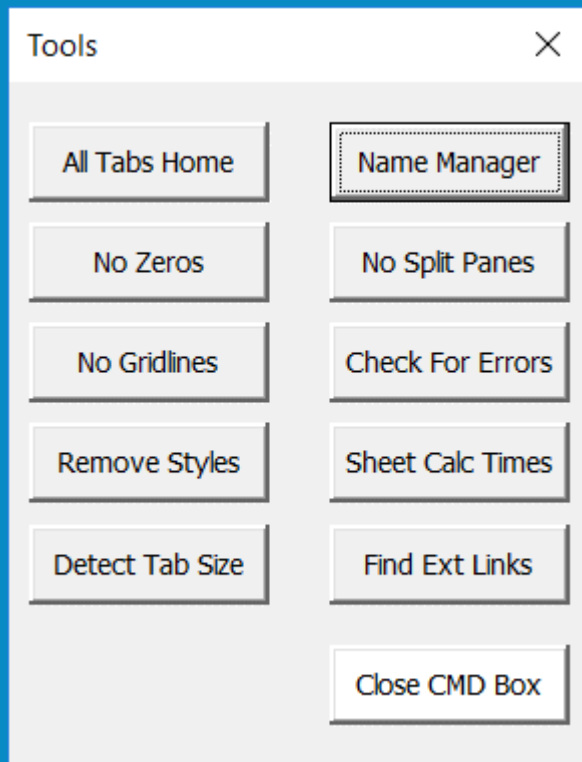
COST MODEL VIEW

Results	Variables and Inputs	Cost Build Up	WBS Exhibits
Crosschecks	Input Variables	SunkCostTables	Travel Costs Source Data
PLCCE Summary TY	WithHolds	HeadcountTables	**Crystall Ball**
PLCCE Summary BY	Risk Inputs	Hardware Development	CB Skew Template
APB	WBS Crosswalks	Travel Build Up	Correlation
Spruill RAM	**Background Information**	**Support Data**	Crystal Ball Run Settings
Cost Contributors	Cover Sheet	Uncertainty Output	**Templates**
Estimate Summaries Charts	Navigation Home	Pivot Table TY	PLCCE Summary_T
Estimate Summaries	WBS Navigation	Pivot Table BY	Cost DB (BY)_T
Crystal Ball Charts	TOC	Cost DB (BY)	Uncertainty Output_T
ACAT Status	General Information	Cost DB Transposed (BY-TY)	CostBuildUp_T
Method By APPN	Ground Rules	Pivot Table FTE	Exhibit_T
Total Ownership Cost	Program Schedule	FTE DB Transposed	Blank_T
LBLR Impact Summary	Contracts	FTE Charts	
ULBLR Impact Summary	**Reference Material**	**Labor Rates**	
Estimate Tracker	Inflation Indices	Labor Rates	
Fielding Plan	Changes	Labor Gov_Mil	
Fielding Plan	Acronyms		
	POC		
	RGB Color Chart		
	Analagous Distribution		

Command Window

ToolBox

EXAMPLE- VBA CODE PROVIDED

- A toolbox is provided via USB drive
  - The code is open source and includes the following:

BACKUP

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