

Value Proposition for Mission Assurance

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Abstract

The 2016 Mission Assurance Improvement Workshop (MAIW) steering committee sponsored a “micro” topic to attempt to capture the value proposition for mission assurance (MA). A survey was conducted across the community on the perceived value and effort of mission assurance activities conducted across lifecycle phases using the mission assurance activities and phases defined in prior MAIW products. In all, 109 responses to the survey were received.

The value, effort, and efficiency results are presented as normalized heat maps. Population comparisons included the whole population compared to Class A mission population and the Government / Federally Funded Research and Development Center (FFRDC) population compared to the Contractor population. Other cuts of the data resulted in very small sample sizes. Observations based on heat map comparisons may identify areas for further investigation, but the results should not be the basis for action without further investigation and considerate evaluation of the specific situation.



Value Proposition for Mission Assurance

Micro Topic

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Outline—Value of MA Topic

- Steering committee championed a micro topic that would consist of a survey to get at various perspectives of mission assurance value and effort across Industry, Government, and Support Contractors
- The planned output was a heat map showing the relative value-per-effort for common assurance activities across the lifecycle phases

Survey Approach

- What is the role and experience level of each respondent?
- What is the value of MA tasks in each program phase?
 - High, medium, low, none, N/A
 - Used Mission Assurance Guide (*Aerospace Report No. TOR-2007(8546)-6018 Rev B*) for program phases
 - Used mission assurance tasks from Mission Assurance Framework (*Aerospace Report No. TOR-2010(8591)-18*)
- What level of effort is required for each MA task in each program phase?
 - High, medium, low, none, N/A
- Efficiency calculated as ratio of value to effort

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MA Info

es representing the Value and the Effort associated with each task during that phase of a program lifecycle. Values are intended to capture your opinion of that task to success of the mission, if performed properly.

Requirements Analysis and Validation: Please indicate your assessment of the EFFORT and VALUE (two assessments per line). Efforts are intended to represent the labor applied to that task relative to all Mission Assurance activities across the life of the program. If the task applies but no labor was expended, select "None." If the task does not apply, select "N/A."

	EFFORT					VALUE					No answer
	High	Medium	Low	None	N/A	High	Medium	Low	None	N/A	
Concept Studies	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concept Development	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preliminary Design	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Complete Design	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Procurement (HW or SW)	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hardware Fabrication	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Software Code & Unit Test	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Integration & Test	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Operation	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disposal	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Design Assurance: Please indicate your assessment of the EFFORT and VALUE (two assessments per line). Efforts are intended to represent the labor applied to that task relative to all Mission Assurance activities across the life of the program. If the task applies but no labor was expended, select "None." If the task does not apply, select "N/A."

	EFFORT					VALUE					No answer
	High	Medium	Low	None	N/A	High	Medium	Low	None	N/A	
Concept Studies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Concept Development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Preliminary Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Complete Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Procurement (HW or SW)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Hardware Fabrication	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Software Code & Unit Test	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Integration & Test	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Disposal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

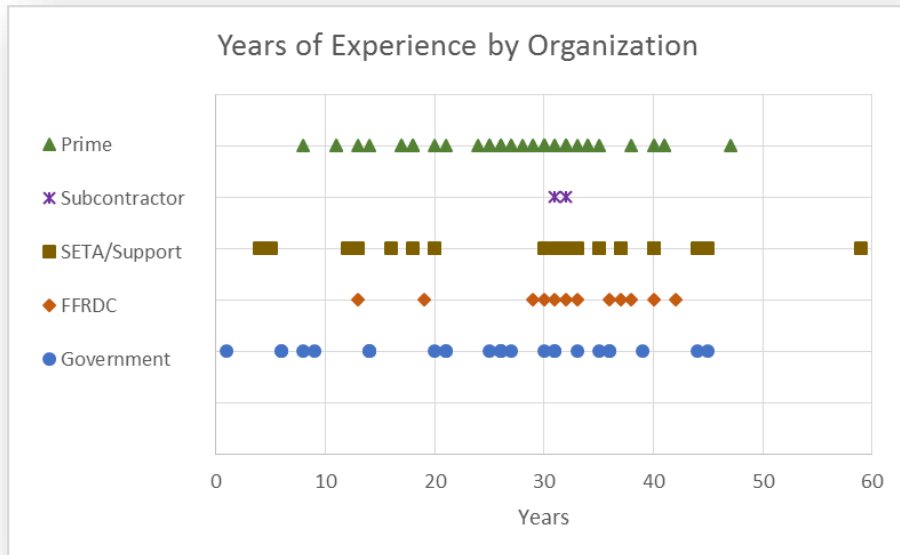


Respondent Profiles—109 Complete Responses

- Government
 - *26 responses from 5 organizations*
 - 15 responses from Missile Defense Agency (MDA)
 - 8 response from NASA
- Systems Engineering and Technical Assistance (SETA)/Support Contractors
 - *23 responses from 13 organizations*
- FFRDCs
 - *12 responses*
- Prime Contractors
 - *45 responses from 8 organizations*
- Subcontractors
 - *2 responses from 2 organizations*
- Other
 - *1 complete response*

Additional Demographics

- Experience
 - From 1 to 59 years



- Mission criticality
 - 67 Class A
 - 23 Class B
 - 5 Class C
 - 3 Class D
 - 11 not identified
- Contract type
 - 47 Cost Plus
 - 36 Fixed Price
 - 26 not identified
- Respondent span of influence
 - 23 enterprise / multi-program / senior executive
 - 16 product / unit / module / assembly
 - 15 space vehicle / major ground system
 - 15 subsystem / assembly of units / integration lead
 - 14 program manager / major product line
 - 14 other
 - 12 piece part / sub-assembly

Value, Effort, and Efficiency Heat Maps

- The following slides include representations of the responses by larger groupings:
 - *All respondents together*
 - *Government and SETA contractors compared to Prime and Subcontractors*
- Value and effort maps show higher responses by color intensity
- Response counts do not allow detailed analysis into smaller groupings
 - *Requested broader Government and Industry involvement during MAIW*
 - *Extended survey to May 31 to gather additional responses*

Activities and Phases Used in Survey

- **Activities**—rows in the heat maps

Program Execution Processes

MA tasks (activities) taken from *Mission Assurance Framework* (Aerospace Report No. TOR-2010(8591)-18)

- *Requirement Analysis and Validation (Req)*
- *Design Assurance (DesAsur)*
- *Parts, Materials, and Processes (PMP)*
- *Environmental Compatibility (Env)*
- *Reliability Engineering (Rel)*
- *System Safety (SysSaf)*
- *Configuration/Change Management (CCM)*
- *Integration, Test, and Evaluation (ITnE)*
- *Risk Management (Risk)*
- *Independent Review (IndRev)*
- *Hardware Quality Assurance (HWQA)*
- *Software Assurance (SWAsur)*
- *Supplier Quality (SupQA)*
- *Failure Review Boards (FRB)*
- *Corrective Action Boards (CAB)*
- *Alert Processes (Alert)*

- **Phases**—columns in the heat maps

Phases taken from *Mission Assurance Guide* (Aerospace Report No. TOR-2007(8546)-6018 Rev B)

- *Concept Studies (ConStd)*
- *Preliminary Design (PrelDes)*
- *Complete Design (CompDes)*
- *Procurement (Procur)*
- *Hardware Fabrication (HWFab)*
- *Software Code and Unit Test (SWCUT)*
- *Integration and Test (InT)*
- *Fielding (Field)*
- *Operations (Oper)*

Whole Population—Value Heat Map and Normalized Heat Map

Raw		Phase									Average
Value	ConStd	PrelDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper		
Req	0.47	0.56	0.64	0.44	0.58	0.46	0.46	0.43	0.41	0.50	
DesAsur	0.35	0.47	0.62	0.40	0.45	0.38	0.46	0.33	0.33	0.42	
PMP	0.30	0.42	0.58	0.43	0.37	0.51	0.30	0.27	0.28	0.39	
Env	0.36	0.45	0.51	0.32	0.48	0.36	0.19	0.30	0.28	0.37	
Rel	0.35	0.46	0.50	0.22	0.30	0.32	0.28	0.25	0.24	0.33	
SysSaf	0.21	0.32	0.37	0.29	0.42	0.22	0.23	0.33	0.30	0.30	
CCM	0.26	0.35	0.56	0.54	0.42	0.46	0.50	0.33	0.29	0.42	
ITnE	0.28	0.35	0.43	0.36	0.73	0.34	0.49	0.43	0.41	0.43	
Risk	0.35	0.46	0.52	0.42	0.46	0.36	0.40	0.41	0.39	0.42	
IndRev	0.32	0.42	0.56	0.33	0.41	0.31	0.42	0.30	0.33	0.38	
HWQA	0.21	0.31	0.40	0.61	0.47	0.42	0.35	0.36	0.31	0.39	
SWAsur	0.16	0.25	0.36	0.14	0.44	0.32	0.54	0.36	0.31	0.33	
SupQA	0.22	0.29	0.38	0.42	0.25	0.56	0.27	0.22	0.21	0.32	
FRB	0.14	0.21	0.35	0.51	0.63	0.39	0.37	0.49	0.50	0.42	
CAB	0.21	0.23	0.32	0.46	0.50	0.41	0.41	0.35	0.33	0.37	
Alert	0.18	0.28	0.35	0.37	0.33	0.42	0.30	0.30	0.28	0.32	
Average	0.28	0.37	0.47	0.40	0.46	0.39	0.38	0.34	0.33	0.38	

Normalized		Phase									Average
Value	ConStd	PrelDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper		
Req	1.21	1.47	1.68	1.15	1.51	1.20	1.20	1.12	1.08	1.30	
DesAsur	0.90	1.22	1.61	1.03	1.18	0.99	1.19	0.85	0.85	1.10	
PMP	0.79	1.10	1.51	1.12	0.95	1.32	0.78	0.71	0.72	1.03	
Env	0.93	1.17	1.33	0.84	1.25	0.95	0.50	0.78	0.73	0.97	
Rel	0.91	1.20	1.31	0.58	0.78	0.84	0.73	0.66	0.62	0.87	
SysSaf	0.55	0.83	0.97	0.75	1.08	0.58	0.61	0.86	0.78	0.78	
CCM	0.67	0.92	1.46	1.40	1.09	1.19	1.31	0.86	0.76	1.08	
ITnE	0.73	0.90	1.11	0.95	1.90	0.89	1.28	1.13	1.07	1.13	
Risk	0.91	1.19	1.37	1.10	1.20	0.94	1.04	1.07	1.02	1.10	
IndRev	0.84	1.08	1.45	0.85	1.06	0.81	1.10	0.79	0.86	0.99	
HWQA	0.55	0.80	1.04	1.59	1.23	1.11	0.91	0.93	0.81	1.01	
SWAsur	0.42	0.66	0.94	0.37	1.14	0.85	1.41	0.94	0.81	0.87	
SupQA	0.56	0.75	0.99	1.10	0.64	1.45	0.71	0.57	0.54	0.83	
FRB	0.36	0.54	0.92	1.32	1.66	1.03	0.96	1.29	1.31	1.09	
CAB	0.54	0.60	0.83	1.20	1.31	1.06	1.06	0.92	0.85	0.95	
Alert	0.46	0.73	0.91	0.97	0.86	1.08	0.78	0.78	0.73	0.82	
Average	0.73	0.97	1.23	1.04	1.19	1.03	1.00	0.90	0.85	1.00	

- For value, effort, and efficiency = value/effort
 - Built initial heat map of average of raw responses
 - Normalized by average (lower right) value in raw heat map (on left)
- In observations on value and effort, reordered by Pareto of activity (while retaining phase order for ease of comparison) and then by Pareto of phase (while retaining activity order for ease of comparison)



Whole Population—Value Observations

By Phase

Value	CompDes	InT	Procur	HWFab	PreDes	SW CUT	Field	Oper	ConStd	Average
Req	1.58	1.52	1.26	1.20	1.38	1.27	1.02	0.94	1.32	1.28
DesAsur	1.55	1.23	1.09	1.09	1.27	1.06	0.73	0.74	1.05	1.10
PMP	1.34	0.86	1.18	1.16	1.17	0.66	0.64	0.70	0.86	0.97
Env	1.19	1.03	0.83	0.68	1.06	0.38	0.68	0.73	1.00	0.86
Rel	1.23	0.69	0.79	0.63	1.17	0.73	0.67	0.64	1.02	0.85
SysSaf	1.04	0.97	0.56	0.69	0.89	0.65	0.86	0.96	0.66	0.81
CCM	1.35	1.13	1.13	1.26	0.95	1.28	0.84	0.81	0.63	1.05
ITnE	1.18	1.69	0.79	0.93	0.91	1.23	1.13	0.98	0.78	1.07
Risk	1.41	1.27	1.11	1.10	1.30	1.10	1.07	1.08	1.08	1.17
IndRev	1.41	1.17	0.84	0.78	1.26	1.12	0.85	0.86	1.05	1.05
HWQA	1.09	1.39	1.16	1.48	0.77	0.86	0.91	0.86	0.53	1.01
SWAsur	1.05	1.26	1.03	0.34	0.77	1.48	0.90	0.90	0.46	0.92
SupQA	1.17	0.80	1.51	1.17	0.93	0.71	0.56	0.61	0.64	0.91
FRB	0.68	1.63	0.89	1.28	0.36	1.01	1.21	1.28	0.31	0.98
CAB	0.91	1.44	1.13	1.33	0.59	1.21	0.91	0.97	0.46	1.00
Alert	1.10	0.99	1.27	1.17	0.82	0.78	0.84	0.82	0.52	0.93
Average	1.22	1.20	1.04	1.03	0.99	0.98	0.87	0.87	0.79	1.00

- Phase with highest value:
 - Complete Design
 - High value across multiple activities
 - Integration and Test was a close second
- Phase with lowest value:
 - Concept Study

By Activity

Value	ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
Req	1.32	1.38	1.58	1.20	1.52	1.26	1.27	1.02	0.94	1.28
Risk	1.08	1.30	1.41	1.10	1.27	1.11	1.10	1.07	1.08	1.17
DesAsur	1.05	1.27	1.55	1.09	1.23	1.09	1.06	0.73	0.74	1.10
ITnE	0.78	0.91	1.18	0.93	1.69	0.79	1.23	1.13	0.98	1.07
CCM	0.63	0.95	1.35	1.26	1.13	1.13	1.28	0.84	0.81	1.05
IndRev	1.05	1.26	1.41	0.78	1.17	0.84	1.12	0.85	0.86	1.05
HWQA	0.53	0.77	1.09	1.48	1.39	1.16	0.86	0.91	0.86	1.01
CAB	0.46	0.59	0.91	1.33	1.44	1.13	1.21	0.91	0.97	1.00
FRB	0.31	0.36	0.68	1.28	1.63	0.89	1.01	1.21	1.28	0.98
PMP	0.86	1.17	1.34	1.16	0.86	1.18	0.66	0.64	0.70	0.97
Alert	0.52	0.82	1.10	1.17	0.99	1.27	0.78	0.84	0.82	0.93
SWAsur	0.46	0.77	1.05	0.34	1.26	1.03	1.48	0.90	0.90	0.92
SupQA	0.64	0.93	1.17	1.17	0.80	1.51	0.71	0.56	0.61	0.91
Env	1.00	1.06	1.19	0.68	1.03	0.83	0.38	0.68	0.73	0.86
Rel	1.02	1.17	1.23	0.63	0.69	0.79	0.73	0.67	0.64	0.85
SysSaf	0.66	0.89	1.04	0.69	0.97	0.56	0.65	0.86	0.96	0.81
Average	0.79	0.99	1.22	1.03	1.20	1.04	0.98	0.87	0.87	1.00

- Activity with highest value:
 - Requirement Analysis and Validation
 - Requirement Analysis and Validation is high through late phases, indicating the persistent value of that activity
- Activity with lowest value:
 - System Safety



Whole Population—Effort Heat Map and Normalized Heat Map

Raw		Phase									
Activity	Effort	ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
	Req	0.57	0.60	0.68	0.52	0.66	0.54	0.55	0.44	0.40	0.55
DesAsur	0.45	0.55	0.67	0.47	0.53	0.47	0.46	0.32	0.32	0.47	
PMP	0.37	0.50	0.58	0.50	0.37	0.51	0.28	0.28	0.30	0.42	
Env	0.43	0.46	0.51	0.29	0.45	0.36	0.16	0.29	0.32	0.37	
Rel	0.44	0.50	0.53	0.27	0.30	0.34	0.32	0.29	0.28	0.37	
SysSaf	0.28	0.39	0.45	0.30	0.42	0.24	0.28	0.37	0.42	0.35	
CCM	0.27	0.41	0.58	0.55	0.49	0.49	0.56	0.36	0.35	0.45	
ITnE	0.34	0.40	0.51	0.40	0.73	0.34	0.53	0.49	0.43	0.46	
Risk	0.47	0.56	0.61	0.47	0.55	0.48	0.48	0.46	0.47	0.51	
IndRev	0.46	0.55	0.61	0.34	0.51	0.36	0.48	0.37	0.37	0.45	
HWQA	0.23	0.33	0.47	0.64	0.60	0.50	0.37	0.40	0.37	0.44	
SWAsur	0.20	0.33	0.46	0.15	0.54	0.45	0.64	0.39	0.39	0.40	
SupQA	0.28	0.40	0.51	0.51	0.35	0.65	0.31	0.24	0.26	0.39	
FRB	0.13	0.16	0.30	0.55	0.71	0.39	0.44	0.52	0.56	0.42	
CAB	0.20	0.26	0.40	0.58	0.62	0.49	0.52	0.40	0.42	0.43	
Alert	0.23	0.36	0.48	0.51	0.43	0.55	0.34	0.36	0.35	0.40	
Average	0.34	0.43	0.53	0.45	0.52	0.45	0.43	0.38	0.38	0.43	

Normalized		Phase									
Activity	Effort	ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
	Req	1.32	1.38	1.58	1.20	1.52	1.26	1.27	1.02	0.94	1.28
DesAsur	1.05	1.27	1.55	1.09	1.23	1.09	1.06	0.73	0.75	1.10	
PMP	0.86	1.17	1.34	1.16	0.86	1.18	0.66	0.64	0.70	0.97	
Env	1.00	1.06	1.19	0.68	1.03	0.83	0.38	0.68	0.73	0.86	
Rel	1.02	1.17	1.23	0.63	0.69	0.79	0.73	0.67	0.64	0.85	
SysSaf	0.66	0.89	1.04	0.69	0.97	0.56	0.65	0.86	0.96	0.81	
CCM	0.63	0.95	1.35	1.27	1.13	1.13	1.28	0.84	0.81	1.05	
ITnE	0.78	0.91	1.18	0.93	1.69	0.79	1.23	1.13	0.99	1.07	
Risk	1.08	1.31	1.41	1.10	1.27	1.11	1.10	1.07	1.08	1.17	
IndRev	1.06	1.26	1.41	0.78	1.17	0.84	1.12	0.85	0.86	1.05	
HWQA	0.53	0.77	1.09	1.48	1.39	1.16	0.86	0.91	0.86	1.01	
SWAsur	0.46	0.77	1.05	0.34	1.26	1.03	1.48	0.90	0.90	0.92	
SupQA	0.64	0.93	1.17	1.17	0.80	1.51	0.71	0.56	0.61	0.91	
FRB	0.31	0.36	0.68	1.28	1.63	0.89	1.01	1.21	1.28	0.98	
CAB	0.46	0.59	0.91	1.33	1.44	1.13	1.21	0.91	0.97	1.00	
Alert	0.52	0.82	1.10	1.17	0.99	1.27	0.78	0.84	0.82	0.93	
Average	0.79	0.99	1.22	1.03	1.20	1.04	0.98	0.87	0.87	1.00	

- For value, effort, and efficiency = value/effort
 - Built initial heat map of average of raw responses
 - Normalized by average (lower right) value in raw heat map (on left)
- In observations on value and effort, reordered by Pareto of activity (while retaining phase order for ease of comparison) and then by Pareto of phase (while retaining activity order for ease of comparison)



Whole Population—Effort Observations

By Phase										
Effort	CompDes	InT	HWFab	Procur	SW CUT	PrelDes	Field	Oper	ConStd	Average
	Req	1.68	1.51	1.15	1.20	1.20	1.47	1.12	1.08	1.22
DesAsur	1.61	1.18	1.03	1.00	1.19	1.22	0.85	0.85	0.90	1.10
PMP	1.51	0.95	1.13	1.32	0.78	1.10	0.71	0.72	0.79	1.03
Env	1.33	1.25	0.84	0.95	0.50	1.17	0.78	0.73	0.93	0.97
Rel	1.31	0.78	0.59	0.84	0.73	1.20	0.66	0.62	0.91	0.87
SysSaf	0.97	1.08	0.75	0.58	0.61	0.83	0.86	0.78	0.55	0.78
CCM	1.46	1.09	1.40	1.19	1.31	0.92	0.86	0.76	0.67	1.08
ITnE	1.11	1.90	0.95	0.89	1.29	0.90	1.13	1.07	0.73	1.13
Risk	1.37	1.20	1.11	0.94	1.05	1.19	1.07	1.02	0.91	1.10
IndRev	1.46	1.06	0.85	0.81	1.10	1.08	0.79	0.86	0.84	0.99
HWQA	1.05	1.24	1.59	1.11	0.91	0.80	0.93	0.81	0.55	1.01
SWAsur	0.94	1.14	0.37	0.85	1.41	0.66	0.94	0.81	0.42	0.87
SupQA	0.99	0.65	1.10	1.45	0.71	0.75	0.57	0.54	0.57	0.83
FRB	0.92	1.66	1.33	1.03	0.96	0.54	1.29	1.31	0.36	1.09
CAB	0.83	1.31	1.20	1.06	1.06	0.60	0.92	0.85	0.54	0.95
Alert	0.91	0.86	0.97	1.08	0.78	0.73	0.78	0.73	0.46	0.82
Average	1.24	1.19	1.05	1.03	1.00	0.97	0.90	0.85	0.74	1.00

By Activity										
Effort	ConStd	PrelDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
	Req	1.22	1.47	1.68	1.15	1.51	1.20	1.20	1.12	1.08
ITnE	0.73	0.90	1.11	0.95	1.90	0.89	1.29	1.13	1.07	1.13
DesAsur	0.90	1.22	1.61	1.03	1.18	1.00	1.19	0.85	0.85	1.10
Risk	0.91	1.19	1.37	1.11	1.20	0.94	1.05	1.07	1.02	1.10
FRB	0.36	0.54	0.92	1.33	1.66	1.03	0.96	1.29	1.31	1.09
CCM	0.67	0.92	1.46	1.40	1.09	1.19	1.31	0.86	0.76	1.08
PMP	0.79	1.10	1.51	1.13	0.95	1.32	0.78	0.71	0.72	1.03
HWQA	0.55	0.80	1.05	1.59	1.24	1.11	0.91	0.93	0.81	1.01
IndRev	0.84	1.08	1.46	0.85	1.06	0.81	1.10	0.79	0.86	0.99
Env	0.93	1.17	1.33	0.84	1.25	0.95	0.50	0.78	0.73	0.97
CAB	0.54	0.60	0.83	1.20	1.31	1.06	1.06	0.92	0.85	0.95
SWAsur	0.42	0.66	0.94	0.37	1.14	0.85	1.41	0.94	0.81	0.87
Rel	0.91	1.20	1.31	0.59	0.78	0.84	0.73	0.66	0.62	0.87
SupQA	0.57	0.75	0.99	1.10	0.65	1.45	0.71	0.57	0.54	0.83
Alert	0.46	0.73	0.91	0.97	0.86	1.08	0.78	0.78	0.73	0.82
SysSaf	0.55	0.83	0.97	0.75	1.08	0.58	0.61	0.86	0.78	0.78
Average	0.74	0.97	1.24	1.05	1.19	1.03	1.00	0.90	0.85	1.00

- Phase with highest effort:
 - *Complete Design*
 - High value across multiple activities
 - *Integration and Test was a close second*
- Phase with lowest effort:
 - *Concept Study*

- Activity with highest effort:
 - *Requirement Analysis and Validation*
 - Requirement Analysis and Validation is high through late phases, indicating the persistent value of that activity
- Activity with lowest effort:
 - *System Safety*

Whole Population—Value/Effort = Efficiency

Heat Map and Normalized Heat Map

Phase

Activity	Value / Effort	Phase									Grand Total
		ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	
Req	1.23	1.06	1.06	1.18	1.14	1.18	1.20	1.03	0.98	1.11	
DesAsur	1.31	1.18	1.09	1.20	1.17	1.24	1.01	0.97	0.99	1.12	
PMP	1.22	1.19	1.00	1.16	1.02	1.01	0.95	1.02	1.10	1.06	
Env	1.21	1.03	1.01	0.91	0.93	0.98	0.85	0.97	1.14	1.00	
Rel	1.26	1.10	1.06	1.21	1.00	1.06	1.13	1.15	1.16	1.11	
SysSaf	1.35	1.22	1.21	1.04	1.01	1.09	1.20	1.13	1.38	1.17	
CCM	1.06	1.16	1.04	1.02	1.17	1.07	1.10	1.10	1.20	1.09	
ITnE	1.21	1.14	1.20	1.10	1.00	1.00	1.08	1.13	1.04	1.08	
Risk	1.34	1.23	1.16	1.12	1.19	1.34	1.19	1.13	1.19	1.20	
IndRev	1.42	1.32	1.09	1.04	1.25	1.17	1.14	1.21	1.13	1.19	
HWQA	1.09	1.09	1.18	1.05	1.27	1.19	1.08	1.11	1.20	1.13	
SWAsur	1.26	1.31	1.27	1.03	1.25	1.37	1.19	1.08	1.25	1.20	
SupQA	1.27	1.39	1.33	1.20	1.39	1.18	1.13	1.11	1.27	1.23	
FRB	0.97	0.76	0.84	1.09	1.11	0.98	1.18	1.06	1.11	1.02	
CAB	0.97	1.11	1.25	1.26	1.24	1.20	1.29	1.12	1.29	1.19	
Alert	1.28	1.28	1.36	1.37	1.30	1.32	1.12	1.20	1.26	1.28	
Grand Total	1.22	1.15	1.11	1.12	1.14	1.14	1.11	1.09	1.15	1.13	

Activity	Value / Effort	Phase									Average
		ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	
Req	1.09	0.94	0.94	1.05	1.00	1.04	1.06	0.91	0.86	0.99	
DesAsur	1.16	1.04	0.96	1.06	1.04	1.10	0.89	0.86	0.88	1.00	
PMP	1.08	1.06	0.89	1.03	0.90	0.90	0.85	0.90	0.97	0.94	
Env	1.07	0.91	0.89	0.81	0.83	0.87	0.75	0.86	1.01	0.89	
Rel	1.11	0.97	0.93	1.07	0.89	0.94	1.00	1.02	1.03	0.98	
SysSaf	1.20	1.08	1.07	0.92	0.89	0.97	1.07	1.00	1.22	1.03	
CCM	0.94	1.02	0.92	0.90	1.03	0.95	0.98	0.97	1.06	0.96	
ITnE	1.07	1.01	1.06	0.97	0.89	0.88	0.95	1.00	0.92	0.95	
Risk	1.19	1.09	1.03	0.99	1.06	1.18	1.06	1.00	1.06	1.07	
IndRev	1.25	1.16	0.97	0.92	1.10	1.03	1.01	1.07	1.00	1.05	
HWQA	0.96	0.97	1.05	0.93	1.12	1.05	0.95	0.98	1.06	1.00	
SWAsur	1.11	1.16	1.12	0.91	1.10	1.21	1.05	0.96	1.11	1.06	
SupQA	1.13	1.23	1.17	1.06	1.23	1.04	1.00	0.98	1.12	1.09	
FRB	0.86	0.67	0.74	0.96	0.98	0.86	1.05	0.93	0.98	0.90	
CAB	0.86	0.98	1.10	1.11	1.10	1.07	1.14	0.99	1.14	1.05	
Alert	1.14	1.13	1.20	1.21	1.15	1.17	0.99	1.07	1.11	1.13	
Average	1.08	1.02	0.98	0.99	1.01	1.01	0.98	0.97	1.02	1.00	

- For value, effort, and value/effort
 - Built initial heat map of average of raw responses
 - Normalized by average (lower right)
- In observations, reordered by Pareto of activity and phase



Whole Population—Value/Effort = Efficiency Observations

- Phase with highest efficiency:
 - *Concept Study*
- Phase with lowest efficiency:
 - *Fielding*
- Activity with highest efficiency:
 - *Alert Processes*
- Activity with lowest efficiency:
 - *Environmental Compatibility*
- These are different than phases and activities identified in looking at value and effort separately
 - *Beware that small effort scores can inflate efficiency*
 - *High efficiency may indicate areas for in-depth review—high value for effort*
 - Alerts across most phases
 - *Low efficiency may indicate activity is not applicable to phase or ineffective processes or signal perception disconnects*

By Efficiency											
Activity	Value / Effort	ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	Average
	Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.99	1.07	1.13
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09	
Risk	1.19	1.09	1.06	1.06	1.18	0.99	1.03	1.06	1.00	1.07	
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.05	0.96	1.06	
IndRev	1.25	1.16	1.00	1.10	1.03	0.92	0.97	1.01	1.07	1.05	
CAB	0.86	0.98	1.14	1.10	1.07	1.11	1.10	1.14	0.99	1.05	
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03	
DesAsur	1.16	1.04	0.88	1.04	1.10	1.06	0.96	0.89	0.86	1.00	
HWQA	0.96	0.97	1.06	1.12	1.05	0.93	1.05	0.95	0.98	1.00	
Req	1.09	0.94	0.86	1.00	1.04	1.05	0.94	1.06	0.91	0.99	
Rel	1.11	0.97	1.03	0.89	0.94	1.07	0.93	1.00	1.02	0.98	
CCM	0.94	1.02	1.06	1.03	0.95	0.90	0.92	0.98	0.97	0.96	
ITnE	1.07	1.01	0.92	0.89	0.88	0.97	1.06	0.95	1.00	0.95	
PMP	1.08	1.06	0.97	0.90	0.90	1.03	0.89	0.85	0.90	0.94	
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90	
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.75	0.86	0.89	
Average	1.08	1.02	1.02	1.01	1.01	0.99	0.98	0.98	0.97	1.00	



Whole Population—Efficiency Corresponding Value and Effort

By Efficiency

Activity	Value	By Efficiency									
		ConStd	PreDes	Oper	InT	Procur	HWFeb	CompDes	SW CUT	Field	Average
Alert	0.52	0.82	0.82	0.99	1.27	1.17	1.10	0.78	0.84	0.93	
SupQA	0.64	0.93	0.61	0.80	1.51	1.17	1.17	0.71	0.56	0.91	
Risk	1.08	1.30	1.08	1.27	1.11	1.10	1.41	1.10	1.07	1.17	
SWAsur	0.46	0.77	0.90	1.26	1.03	0.34	1.05	1.48	0.90	0.92	
IndRev	1.05	1.26	0.86	1.17	0.84	0.78	1.41	1.12	0.85	1.05	
CAB	0.46	0.59	0.97	1.44	1.13	1.33	0.91	1.21	0.91	1.00	
SysSaf	0.66	0.89	0.96	0.97	0.56	0.69	1.04	0.65	0.86	0.81	
DesAsur	1.05	1.27	0.74	1.23	1.09	1.09	1.55	1.06	0.73	1.10	
HWQA	0.53	0.77	0.86	1.39	1.16	1.48	1.09	0.86	0.91	1.01	
Req	1.32	1.38	0.94	1.52	1.26	1.20	1.58	1.27	1.02	1.28	
Rel	1.02	1.17	0.64	0.69	0.79	0.68	1.23	0.73	0.67	0.85	
CCM	0.63	0.95	0.81	1.13	1.13	1.26	1.35	1.28	0.84	1.05	
ITnE	0.78	0.91	0.98	1.69	0.79	0.93	1.18	1.23	1.13	1.07	
PMP	0.86	1.17	0.70	0.86	1.18	1.16	1.34	0.66	0.64	0.97	
FRB	0.31	0.36	1.28	1.63	0.89	1.28	0.68	1.01	1.21	0.98	
Env	1.00	1.06	0.73	1.03	0.83	0.68	1.19	0.38	0.68	0.86	
Average	0.79	0.99	0.87	1.20	1.04	1.03	1.22	0.98	0.87	1.00	

By Efficiency

Activity	Effort	By Efficiency									
		ConStd	PreDes	Oper	InT	Procur	HWFeb	CompDes	SW CUT	Field	Average
Alert	0.46	0.73	0.73	0.86	1.08	0.97	0.91	0.78	0.78	0.82	
SupQA	0.57	0.75	0.54	0.65	1.45	1.10	0.99	0.71	0.57	0.83	
Risk	0.91	1.19	1.02	1.20	0.94	1.11	1.37	1.05	1.07	1.10	
SWAsur	0.42	0.66	0.81	1.14	0.85	0.37	0.94	1.41	0.94	0.87	
IndRev	0.84	1.08	0.86	1.06	0.81	0.85	1.46	1.10	0.79	0.99	
CAB	0.54	0.60	0.85	1.31	1.06	1.20	0.83	1.06	0.92	0.95	
SysSaf	0.55	0.83	0.78	1.08	0.58	0.75	0.97	0.61	0.86	0.78	
DesAsur	0.90	1.22	0.85	1.18	1.00	1.03	1.61	1.19	0.85	1.10	
HWQA	0.55	0.80	0.81	1.24	1.11	1.59	1.05	0.91	0.93	1.01	
Req	1.22	1.47	1.08	1.51	1.20	1.15	1.68	1.20	1.12	1.30	
Rel	0.91	1.20	0.62	0.78	0.84	0.59	1.31	0.73	0.66	0.87	
CCM	0.67	0.92	0.76	1.09	1.19	1.40	1.46	1.31	0.86	1.08	
ITnE	0.73	0.90	1.07	1.90	0.89	0.95	1.11	1.29	1.13	1.13	
PMP	0.79	1.10	0.72	0.95	1.32	1.13	1.51	0.78	0.71	1.03	
FRB	0.36	0.54	1.11	1.66	1.03	1.13	0.92	0.96	1.29	1.09	
Env	0.93	1.17	0.73	1.25	0.95	0.84	1.33	0.50	0.78	0.97	
Average	0.74	0.97	0.85	1.19	1.03	1.05	1.24	1.00	0.90	1.00	

- Phases with highest value and effort have efficiency at or above 1
 - Complete Design and Integration and Test have high value and effort

Activity	Value / Effort	By Efficiency									
		ConStd	PreDes	Oper	InT	Procur	HWFeb	CompDes	SW CUT	Field	Average
Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.99	1.07	1.13	
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09	
Risk	1.19	1.09	1.08	1.06	1.18	0.91	1.03	1.06	1.00	1.07	
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.05	0.96	1.06	
IndRev	1.25	1.16	1.09	1.10	1.03	0.92	0.97	1.01	1.07	1.05	
CAB	0.86	0.98	1.11	1.10	1.07	1.11	1.10	1.14	0.99	1.05	
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03	
DesAsur	1.16	1.04	0.88	1.04	1.10	1.01	0.96	0.89	0.86	1.00	
HWQA	0.96	0.97	1.08	1.12	1.05	0.91	1.05	0.95	0.98	1.00	
Req	1.09	0.94	0.85	1.00	1.04	1.05	0.94	1.06	0.91	0.99	
Rel	1.11	0.97	1.03	0.89	0.94	1.01	0.93	1.00	1.02	0.98	
CCM	0.94	1.02	1.08	1.03	0.95	0.90	0.92	0.98	0.97	0.96	
ITnE	1.07	1.01	0.91	0.89	0.88	0.97	1.06	0.95	1.00	0.95	
PMP	1.08	1.06	0.97	0.90	0.90	1.01	0.89	0.85	0.90	0.94	
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90	
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.75	0.86	0.89	
Average	1.08	1.02	1.02	1.01	1.01	0.99	0.98	0.98	0.97	1.00	



Whole Population—Efficiency Corresponding Value and Effort

By Efficiency

Activity	Value	By Efficiency										Average
		ConStd	PreDes	Oper	InT	Procur	HWFeb	CompDes	SW CUT	Field		
Alert	0.52	0.82	0.82	0.99	1.27	1.17	1.10	0.78	0.84	0.93		
SupQA	0.64	0.93	0.61	0.80	1.51	1.17	1.17	0.71	0.56	0.91		
Risk	1.08	1.30	1.08	1.27	1.11	1.10	1.41	1.10	1.07	1.17		
SWAsur	0.46	0.77	0.90	1.26	1.03	0.34	1.05	1.48	0.90	0.92		
IndRev	1.05	1.26	0.66	1.17	0.84	0.78	1.41	1.12	0.85	1.05		
CAB	0.46	0.59	0.97	1.44	1.13	1.33	0.91	1.21	0.91	1.00		
SysSaf	0.66	0.89	0.96	0.97	0.56	0.69	1.04	0.65	0.86	0.81		
DesAsur	1.05	1.27	0.74	1.23	1.09	1.09	1.55	1.06	0.73	1.10		
HWQA	0.53	0.77	0.86	1.39	1.16	1.48	1.09	0.86	0.91	1.01		
Req	1.32	1.38	0.94	1.52	1.26	1.20	1.58	1.27	1.02	1.28		
Rel	1.02	1.17	0.64	0.69	0.79	0.68	1.23	0.73	0.67	0.85		
CCM	0.63	0.95	0.81	1.13	1.13	1.26	1.35	1.28	0.84	1.05		
ITnE	0.78	0.91	0.98	1.69	0.79	0.93	1.18	1.23	1.13	1.07		
PMP	0.86	1.17	0.70	0.86	1.18	1.16	1.34	0.66	0.64	0.97		
FRB	0.31	0.36	1.28	1.63	0.89	1.28	0.68	1.01	1.21	0.98		
Env	1.00	1.06	0.73	1.03	0.83	0.68	1.19	0.38	0.68	0.86		
Average	0.79	0.99	0.87	1.20	1.04	1.03	1.22	0.98	0.87	1.00		

By Efficiency

Activity	Effort	By Efficiency										Average
		ConStd	PreDes	Oper	InT	Procur	HWFeb	CompDes	SW CUT	Field		
Alert	0.46	0.73	0.73	0.86	1.08	0.97	0.91	0.78	0.78	0.82		
SupQA	0.57	0.75	0.54	0.65	1.45	1.10	0.99	0.71	0.57	0.83		
Risk	0.91	1.19	1.02	1.20	0.94	1.11	1.37	1.05	1.07	1.10		
SWAsur	0.42	0.66	0.81	1.14	0.85	0.37	0.94	1.41	0.94	0.87		
IndRev	0.84	1.08	0.86	1.06	0.81	0.85	1.46	1.10	0.79	0.99		
CAB	0.54	0.60	0.85	1.31	1.06	1.20	0.83	1.06	0.92	0.95		
SysSaf	0.55	0.83	0.78	1.08	0.58	0.75	0.97	0.61	0.86	0.78		
DesAsur	0.90	1.22	0.85	1.18	1.00	1.03	1.61	1.19	0.85	1.10		
HWQA	0.55	0.80	0.81	1.24	1.11	1.59	1.05	0.91	0.93	1.01		
Req	1.22	1.47	1.08	1.51	1.20	1.15	1.68	1.20	1.12	1.30		
Rel	0.91	1.20	0.62	0.78	0.84	0.59	1.31	0.73	0.66	0.87		
CCM	0.67	0.92	0.76	1.09	1.19	1.40	1.46	1.31	0.86	1.08		
ITnE	0.73	0.90	1.07	1.90	0.89	0.95	1.11	1.29	1.13	1.13		
PMP	0.79	1.10	0.72	0.95	1.32	1.13	1.51	0.78	0.71	1.03		
FRB	0.36	0.54	1.11	1.66	1.03	1.13	0.92	0.96	1.29	1.09		
Env	0.93	1.17	0.73	1.25	0.95	0.84	1.33	0.50	0.78	0.97		
Average	0.74	0.97	0.85	1.19	1.03	1.05	1.24	1.00	0.90	1.00		

- Phases with highest value and effort have efficiency at or above 1
 - Complete Design and Integration and Test have high value and effort
- Activity with highest value and effort has efficiency near 1
 - Requirements Analysis has high value and effort on multiple phases

Activity	Value / Effort	By Efficiency										Average
		ConStd	PreDes	Oper	InT	Procur	HWFeb	CompDes	SW CUT	Field		
Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.99	1.07	1.13		
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09		
Risk	1.19	1.09	1.08	1.06	1.18	0.91	1.03	1.06	1.00	1.07		
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.05	0.96	1.06		
IndRev	1.25	1.16	1.09	1.10	1.03	0.92	0.97	1.01	1.07	1.05		
CAB	0.86	0.98	1.11	1.10	1.07	1.11	1.10	1.14	0.99	1.05		
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03		
DesAsur	1.16	1.04	0.88	1.04	1.10	1.01	0.96	0.89	0.86	1.00		
HWQA	0.96	0.97	1.08	1.12	1.05	0.91	1.03	0.93	0.96	1.00		
Req	1.09	0.94	0.85	1.00	1.04	1.05	0.94	1.06	0.91	0.99		
Rel	1.11	0.97	1.01	0.89	0.94	1.01	0.93	1.00	1.02	0.98		
CCM	0.94	1.02	1.01	1.03	0.95	0.90	0.92	0.98	0.97	0.96		
ITnE	1.07	1.01	0.91	0.89	0.88	0.97	1.06	0.95	1.00	0.95		
PMP	1.08	1.06	0.97	0.90	0.90	1.01	0.89	0.85	0.90	0.94		
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90		
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.75	0.86	0.89		
Average	1.08	1.02	1.01	1.01	1.01	0.91	0.98	0.98	0.97	1.00		



Whole Population—Low Efficiency Corresponding Value and Effort

By Efficiency

Activity	Value	ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	Average
	Alert	0.52	0.82	0.82	0.99	1.27	1.17	1.10	0.78	0.84	0.93
SupQA	0.64	0.93	0.61	0.80	1.51	1.17	1.17	0.71	0.56	0.91	
Risk	1.08	1.30	1.08	1.27	1.11	1.10	1.41	1.10	1.07	1.17	
SWAsur	0.46	0.77	0.90	1.26	1.03	0.34	1.05	1.48	0.90	0.92	
IndRev	1.05	1.26	0.86	1.17	0.84	0.78	1.41	1.12	0.85	1.05	
CAB	0.46	0.59	0.97	1.44	1.13	1.33	0.91	1.21	0.91	1.00	
SysSaf	0.66	0.89	0.96	0.97	0.56	0.69	1.04	0.65	0.86	0.81	
DesAsur	1.05	1.27	0.74	1.23	1.09	1.09	1.55	1.06	0.73	1.10	
HWQA	0.53	0.77	0.86	1.39	1.16	1.48	1.09	0.86	0.91	1.01	
Req	1.32	1.38	0.94	1.52	1.26	1.20	1.58	1.27	1.02	1.28	
Rel	1.02	1.17	0.64	0.69	0.79	0.63	1.23	0.73	0.67	0.85	
CCM	0.63	0.95	0.81	1.13	1.13	1.26	1.35	1.28	0.84	1.05	
ITnE	0.78	0.91	0.98	1.69	0.79	0.93	1.18	1.23	1.13	1.07	
PMP	0.86	1.17	0.70	0.86	1.18	1.16	1.34	0.66	0.64	0.97	
FRB	0.31	0.36	1.28	1.63	0.89	1.28	0.68	1.01	1.21	0.98	
Env	1.00	1.06	0.73	1.03	0.83	0.68	1.19	0.38	0.68	0.86	
Average	0.79	0.99	0.87	1.20	1.04	1.03	1.22	0.98	0.87	1.00	

By Efficiency

Activity	Effort	ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	Average
	Alert	0.46	0.73	0.73	0.86	1.08	0.97	0.91	0.78	0.78	0.82
SupQA	0.57	0.75	0.54	0.65	1.45	1.10	0.99	0.71	0.57	0.83	
Risk	0.91	1.19	1.02	1.20	0.94	1.11	1.37	1.05	1.07	1.10	
SWAsur	0.42	0.66	0.81	1.14	0.85	0.37	0.94	1.41	0.94	0.87	
IndRev	0.84	1.08	0.86	1.06	0.81	0.85	1.46	1.10	0.79	0.99	
CAB	0.54	0.60	0.85	1.31	1.06	1.20	0.83	1.06	0.92	0.95	
SysSaf	0.55	0.83	0.78	1.08	0.58	0.75	0.97	0.61	0.86	0.78	
DesAsur	0.90	1.22	0.85	1.18	1.00	1.03	1.61	1.19	0.85	1.10	
HWQA	0.55	0.80	0.81	1.24	1.11	1.59	1.05	0.91	0.93	1.01	
Req	1.22	1.47	1.08	1.51	1.20	1.15	1.68	1.20	1.12	1.30	
Rel	0.91	1.20	0.62	0.78	0.84	0.59	1.31	0.73	0.66	0.87	
CCM	0.67	0.92	0.76	1.09	1.19	1.40	1.46	1.31	0.86	1.08	
ITnE	0.73	0.90	1.07	1.90	0.89	0.95	1.11	1.29	1.13	1.13	
PMP	0.79	1.10	0.72	0.95	1.32	1.13	1.51	0.78	0.71	1.03	
FRB	0.36	0.54	1.31	1.66	1.03	1.33	0.92	0.96	1.29	1.09	
Env	0.93	1.17	0.73	1.25	0.95	0.84	1.33	0.50	0.78	0.97	
Average	0.74	0.97	0.85	1.19	1.03	1.05	1.24	1.00	0.90	1.00	

- Phase with lowest efficiency is Fielding
 - May be driven by multiple activities with low value and effort due applicability in a few phases

Activity	Value / Effort	ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	Average
	Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.91	1.07	1.13
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09	
Risk	1.19	1.09	1.06	1.06	1.18	0.99	1.03	1.00	1.00	1.07	
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.09	0.96	1.06	
IndRev	1.25	1.16	1.00	1.10	1.03	0.92	0.97	1.01	1.07	1.05	
CAB	0.86	0.98	1.14	1.10	1.07	1.11	1.10	1.11	0.99	1.05	
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03	
DesAsur	1.16	1.04	0.88	1.04	1.10	1.06	0.96	0.89	0.86	1.00	
HWQA	0.96	0.97	1.06	1.12	1.05	0.93	1.05	0.99	0.98	1.00	
Req	1.09	0.94	0.86	1.00	1.04	1.05	0.94	1.06	0.91	0.99	
Rel	1.11	0.97	1.03	0.89	0.94	1.07	0.93	1.00	1.02	0.98	
CCM	0.94	1.02	1.06	1.03	0.95	0.90	0.92	0.98	0.97	0.96	
ITnE	1.07	1.01	0.92	0.89	0.88	0.97	1.06	0.95	1.00	0.95	
PMP	1.08	1.06	0.97	0.90	0.90	1.03	0.89	0.89	0.90	0.94	
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90	
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.79	0.86	0.89	
Average	1.08	1.02	1.02	1.01	1.01	0.99	0.98	0.98	0.97	1.00	



Whole Population—Low Efficiency Corresponding Value and Effort

By Efficiency

Activity	Value	By Efficiency									Average
		ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	
Alert	0.52	0.82	0.82	0.99	1.27	1.17	1.10	0.78	0.84	0.93	
SupQA	0.64	0.93	0.61	0.80	1.51	1.17	1.17	0.71	0.56	0.91	
Risk	1.08	1.30	1.08	1.27	1.11	1.10	1.41	1.10	1.07	1.17	
SWAsur	0.46	0.77	0.90	1.26	1.03	0.34	1.05	1.48	0.90	0.92	
IndRev	1.05	1.26	0.86	1.17	0.84	0.78	1.41	1.12	0.85	1.05	
CAB	0.46	0.59	0.97	1.44	1.13	1.33	0.91	1.21	0.91	1.00	
SysSaf	0.66	0.89	0.96	0.97	0.56	0.69	1.04	0.65	0.86	0.81	
DesAsur	1.05	1.27	0.74	1.23	1.09	1.09	1.55	1.06	0.73	1.10	
HWQA	0.53	0.77	0.86	1.39	1.16	1.48	1.09	0.86	0.91	1.01	
Req	1.32	1.38	0.94	1.52	1.26	1.20	1.58	1.27	1.02	1.28	
Rel	1.02	1.17	0.64	0.69	0.79	0.63	1.23	0.73	0.67	0.85	
CCM	0.63	0.95	0.81	1.13	1.13	1.26	1.35	1.28	0.84	1.05	
ITnE	0.78	0.91	0.98	1.69	0.79	0.93	1.18	1.23	1.13	1.07	
PMP	0.86	1.17	0.70	0.86	1.18	1.16	1.34	0.66	0.64	0.97	
FRB	0.31	0.36	1.28	1.63	0.89	1.28	0.68	1.01	1.21	0.98	
Env	1.00	1.06	0.73	1.03	0.83	0.68	1.19	0.38	0.68	0.86	
Average	0.79	0.99	0.87	1.20	1.04	1.03	1.22	0.98	0.87	1.00	

By Efficiency

Activity	Effort	By Efficiency									Average
		ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	
Alert	0.46	0.73	0.73	0.86	1.08	0.97	0.91	0.73	0.78	0.82	
SupQA	0.57	0.75	0.54	0.65	1.45	1.10	0.99	0.71	0.57	0.83	
Risk	0.91	1.19	1.02	1.20	0.94	1.11	1.37	1.05	1.07	1.10	
SWAsur	0.42	0.66	0.81	1.14	0.85	0.37	0.94	1.41	0.94	0.87	
IndRev	0.84	1.08	0.86	1.06	0.81	0.85	1.46	1.10	0.79	0.99	
CAB	0.54	0.60	0.85	1.31	1.06	1.20	0.83	1.06	0.92	0.95	
SysSaf	0.55	0.83	0.78	1.08	0.58	0.75	0.97	0.61	0.86	0.78	
DesAsur	0.90	1.22	0.85	1.18	1.00	1.03	1.61	1.19	0.85	1.10	
HWQA	0.55	0.80	0.81	1.24	1.11	1.59	1.05	0.91	0.93	1.01	
Req	1.22	1.47	1.08	1.51	1.20	1.15	1.68	1.20	1.12	1.30	
Rel	0.91	1.20	0.62	0.78	0.84	0.59	1.31	0.73	0.66	0.87	
CCM	0.67	0.92	0.76	1.09	1.19	1.40	1.46	1.31	0.86	1.08	
ITnE	0.73	0.90	1.07	1.90	0.89	0.95	1.11	1.23	1.13	1.13	
PMP	0.79	1.10	0.72	0.95	1.32	1.13	1.51	0.78	0.71	1.03	
FRB	0.36	0.54	1.31	1.66	1.03	1.33	0.92	0.96	1.29	1.09	
Env	0.93	1.17	0.73	1.25	0.95	0.84	1.33	0.50	0.78	0.97	
Average	0.74	0.97	0.85	1.19	1.03	1.05	1.24	1.00	0.90	1.00	

- Phase with lowest efficiency is Fielding
 - May be driven by multiple activities with low value and effort due applicability in a few phases
- Activities with lowest efficiency are Environment and FRB
 - Effort perceived higher than value across multiple phases
 - May not be applicable to all phases
 - Potential area for further investigation

Activity	Value / Effort	By Efficiency									Average
		ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	
Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.91	1.07	1.13	
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09	
Risk	1.19	1.09	1.06	1.06	1.18	0.99	1.03	1.00	1.00	1.07	
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.09	0.96	1.06	
IndRev	1.25	1.16	1.00	1.10	1.03	0.92	0.97	1.01	1.07	1.05	
CAB	0.86	0.98	1.14	1.10	1.07	1.11	1.10	1.11	0.99	1.05	
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03	
DesAsur	1.16	1.04	0.88	1.04	1.10	1.06	0.96	0.83	0.86	1.00	
HWQA	0.96	0.97	1.06	1.12	1.05	0.93	1.05	0.91	0.98	1.00	
Req	1.09	0.94	0.86	1.00	1.04	1.05	0.94	1.06	0.91	0.99	
Rel	1.11	0.97	1.03	0.89	0.94	1.07	0.93	1.00	1.02	0.98	
CCM	0.94	1.02	1.06	1.03	0.95	0.90	0.92	0.98	0.97	0.96	
ITnE	1.07	1.01	0.92	0.89	0.88	0.97	1.06	0.95	1.00	0.95	
PMP	1.08	1.06	0.97	0.90	0.90	1.03	0.89	0.83	0.90	0.94	
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90	
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.73	0.86	0.89	
Average	1.08	1.02	1.02	1.01	1.01	0.99	0.98	0.98	0.97	1.00	



Comparing Whole Population with Class A Population

Whole Population Compared to Class A Value—By Phase

Whole Population Value by Phase

By Phase											
Value	CompDes		InT	Procur	HWFab	PreIDes	SW CUT	Field	Oper	ConStd	Average
	Value	Value									
Req	1.58	1.52	1.26	1.20	1.38	1.27	1.02	0.94	1.32	1.28	
DesAsur	1.55	1.23	1.09	1.09	1.27	1.06	0.73	0.74	1.05	1.10	
PMP	1.34	0.86	1.18	1.16	1.17	0.66	0.64	0.70	0.86	0.97	
Env	1.19	1.03	0.83	0.68	1.06	0.38	0.68	0.73	1.00	0.86	
Rel	1.23	0.69	0.79	0.63	1.17	0.73	0.67	0.64	1.02	0.85	
SysSaf	1.04	0.97	0.56	0.69	0.89	0.65	0.86	0.96	0.66	0.81	
CCM	1.35	1.13	1.13	1.26	0.95	1.28	0.84	0.81	0.63	1.05	
ITnE	1.18	1.69	0.79	0.93	0.91	1.23	1.13	0.98	0.78	1.07	
Risk	1.41	1.27	1.11	1.10	1.30	1.10	1.07	1.08	1.08	1.17	
IndRev	1.41	1.17	0.84	0.78	1.26	1.12	0.85	0.86	1.05	1.05	
HWQA	1.09	1.39	1.16	1.48	0.77	0.86	0.91	0.86	0.53	1.01	
SWAsur	1.05	1.26	1.03	0.34	0.77	1.48	0.90	0.90	0.46	0.92	
SupQA	1.17	0.80	1.51	1.17	0.93	0.71	0.56	0.61	0.64	0.91	
FRB	0.68	1.63	0.89	1.28	0.36	1.01	1.21	1.28	0.31	0.98	
CAB	0.91	1.44	1.13	1.33	0.59	1.21	0.91	0.97	0.46	1.00	
Alert	1.10	0.99	1.27	1.17	0.82	0.78	0.84	0.82	0.52	0.93	
Average	1.22	1.20	1.04	1.03	0.99	0.98	0.87	0.87	0.79	1.00	

Class A Population Value by Phase

By Phase											
Value	CompDes		InT	HWFab	Procur	SW CUT	PreIDes	Field	Oper	ConStd	Average
	Value	Value									
Req	1.54	1.42	1.20	1.30	1.26	1.40	0.98	0.93	1.28	1.26	
DesAsur	1.55	1.23	1.12	1.11	1.10	1.33	0.70	0.71	1.04	1.10	
PMP	1.35	0.89	1.23	1.23	0.72	1.16	0.73	0.76	0.89	1.01	
Env	1.25	1.07	0.71	0.88	0.44	1.13	0.71	0.67	0.96	0.89	
Rel	1.30	0.76	0.69	0.82	0.83	1.17	0.75	0.71	0.96	0.90	
SysSaf	1.00	0.97	0.77	0.64	0.69	0.77	0.88	0.99	0.54	0.80	
CCM	1.25	1.13	1.27	1.15	1.22	0.84	0.90	0.85	0.58	1.02	
ITnE	1.11	1.60	0.95	0.75	1.27	0.90	1.10	0.97	0.75	1.05	
Risk	1.51	1.26	1.15	1.16	1.11	1.36	0.95	1.02	1.16	1.19	
IndRev	1.47	1.18	0.82	0.86	1.15	1.38	0.86	0.83	1.14	1.09	
HWQA	1.03	1.24	1.42	1.10	0.99	0.77	0.85	0.78	0.52	0.97	
SWAsur	1.00	1.15	0.33	1.00	1.38	0.72	0.84	0.83	0.39	0.86	
SupQA	1.15	0.87	1.19	1.38	0.74	0.82	0.59	0.63	0.56	0.89	
FRB	0.71	1.63	1.38	0.95	1.08	0.39	1.15	1.30	0.31	1.00	
CAB	0.90	1.45	1.31	1.09	1.15	0.59	0.92	1.01	0.44	0.99	
Alert	1.09	1.05	1.20	1.21	0.77	0.79	0.92	0.92	0.51	0.94	
Average	1.21	1.18	1.06	1.05	1.00	0.98	0.87	0.87	0.77	1.00	

- Similar ordering
 - *Procurement and Hardware Fabrication phases swapped*



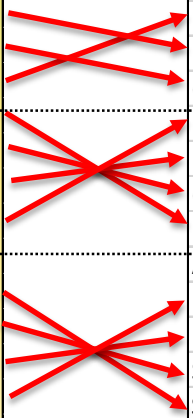
Whole Population Compared to Class A Value—By Activity

Whole Population Value by Activity

Value	ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
Req	1.32	1.38	1.58	1.20	1.52	1.26	1.27	1.02	0.94	1.28
Risk	1.08	1.30	1.41	1.10	1.27	1.11	1.10	1.07	1.08	1.17
DesAsur	1.05	1.27	1.55	1.09	1.23	1.09	1.06	0.73	0.74	1.10
ITnE	0.78	0.91	1.18	0.93	1.69	0.79	1.23	1.13	0.98	1.07
CCM	0.63	0.95	1.35	1.26	1.13	1.13	1.28	0.84	0.81	1.05
IndRev	1.05	1.26	1.41	0.78	1.17	0.84	1.12	0.85	0.86	1.05
HWQA	0.53	0.77	1.09	1.48	1.39	1.16	0.86	0.91	0.86	1.01
CAB	0.46	0.59	0.91	1.33	1.44	1.13	1.21	0.91	0.97	1.00
FRB	0.31	0.36	0.68	1.28	1.63	0.89	1.01	1.21	1.28	0.98
PMP	0.86	1.17	1.34	1.16	0.86	1.18	0.66	0.64	0.70	0.97
Alert	0.52	0.82	1.10	1.17	0.99	1.27	0.78	0.84	0.82	0.93
SWAsur	0.46	0.77	1.05	0.34	1.26	1.03	1.48	0.90	0.90	0.92
SupQA	0.64	0.93	1.17	1.17	0.80	1.51	0.71	0.56	0.61	0.91
Env	1.00	1.06	1.19	0.68	1.03	0.83	0.38	0.68	0.73	0.86
Rel	1.02	1.17	1.23	0.63	0.69	0.79	0.73	0.67	0.64	0.85
SysSaf	0.66	0.89	1.04	0.69	0.97	0.56	0.65	0.86	0.96	0.81
Average	0.79	0.99	1.22	1.03	1.20	1.04	0.98	0.87	0.87	1.00

Class A Population Value by Activity

Value	ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
Req	1.28	1.40	1.54	1.20	1.42	1.30	1.26	0.98	0.93	1.26
Risk	1.16	1.36	1.51	1.15	1.26	1.16	1.11	0.95	1.02	1.19
DesAsur	1.04	1.33	1.55	1.12	1.23	1.11	1.10	0.70	0.71	1.10
IndRev	1.14	1.38	1.47	0.82	1.18	0.86	1.15	0.86	0.83	1.09
ITnE	0.75	0.90	1.11	0.95	1.60	0.75	1.27	1.10	0.97	1.05
CCM	0.58	0.84	1.25	1.27	1.13	1.15	1.22	0.90	0.85	1.02
PMP	0.89	1.16	1.35	1.23	0.89	1.23	0.72	0.73	0.76	1.01
FRB	0.31	0.39	0.71	1.38	1.63	0.95	1.08	1.15	1.30	1.00
CAB	0.44	0.59	0.90	1.31	1.45	1.09	1.15	0.92	1.01	0.99
HWQA	0.52	0.77	1.03	1.42	1.24	1.10	0.99	0.85	0.78	0.97
Alert	0.51	0.79	1.09	1.20	1.05	1.21	0.77	0.92	0.92	0.94
Rel	0.96	1.17	1.30	0.69	0.76	0.82	0.83	0.75	0.71	0.90
Env	0.96	1.13	1.25	0.71	1.07	0.88	0.44	0.71	0.67	0.89
SupQA	0.56	0.82	1.15	1.19	0.87	1.38	0.74	0.59	0.63	0.89
SWAsur	0.39	0.72	1.00	0.33	1.15	1.00	1.38	0.84	0.83	0.86
SysSaf	0.54	0.77	1.00	0.77	0.97	0.64	0.69	0.88	0.99	0.80
Average	0.77	0.98	1.21	1.06	1.18	1.05	1.00	0.87	0.87	1.00



- Similar ordering
 - Requirement Analysis and Validation, Risk Management, and Design Assurance identified as highest value activities in both populations
 - Some swaps but generally grouped similarly



Whole Population Compared to Class A Effort—By Phase

Whole Population Effort

By Phase										
Effort										
	CompDes	InT	HWFab	Procur	SW CUT	PreIDes	Field	Oper	ConStd	Average
Req	1.68	1.51	1.15	1.20	1.20	1.47	1.12	1.08	1.22	1.30
DesAsur	1.61	1.18	1.03	1.00	1.19	1.22	0.85	0.85	0.90	1.10
PMP	1.51	0.95	1.13	1.32	0.78	1.10	0.71	0.72	0.79	1.03
Env	1.33	1.25	0.84	0.95	0.50	1.17	0.78	0.73	0.93	0.97
Rel	1.31	0.78	0.59	0.84	0.73	1.20	0.66	0.62	0.91	0.87
SysSaf	0.97	1.08	0.75	0.58	0.61	0.83	0.86	0.78	0.55	0.78
CCM	1.46	1.09	1.40	1.19	1.31	0.92	0.86	0.76	0.67	1.08
ITnE	1.11	1.90	0.95	0.89	1.29	0.90	1.13	1.07	0.73	1.13
Risk	1.37	1.20	1.11	0.94	1.05	1.19	1.07	1.02	0.91	1.10
IndRev	1.46	1.06	0.85	0.81	1.10	1.08	0.79	0.86	0.84	0.99
HWQA	1.05	1.24	1.59	1.11	0.91	0.80	0.93	0.81	0.55	1.01
SWAsur	0.94	1.14	0.37	0.85	1.41	0.66	0.94	0.81	0.42	0.87
SupQA	0.99	0.65	1.10	1.45	0.71	0.75	0.57	0.54	0.57	0.83
FRB	0.92	1.66	1.33	1.03	0.96	0.54	1.29	1.31	0.36	1.09
CAB	0.83	1.31	1.20	1.06	1.06	0.60	0.92	0.85	0.54	0.95
Alert	0.91	0.86	0.97	1.08	0.78	0.73	0.78	0.73	0.46	0.82
Average	1.24	1.19	1.05	1.03	1.00	0.97	0.90	0.85	0.74	1.00

Class A Population Effort

By Phase										
Effort										
	CompDes	InT	HWFab	Procur	SW CUT	PreIDes	Field	Oper	ConStd	Average
Req	1.70	1.49	1.17	1.20	1.21	1.53	1.07	1.07	1.22	1.30
DesAsur	1.64	1.18	1.08	1.04	1.24	1.27	0.89	0.84	0.93	1.13
PMP	1.58	1.02	1.25	1.46	0.84	1.24	0.76	0.76	0.91	1.11
Env	1.37	1.29	0.88	0.98	0.53	1.21	0.83	0.75	0.91	0.99
Rel	1.38	0.88	0.68	0.92	0.87	1.27	0.68	0.65	0.93	0.94
SysSaf	0.98	1.08	0.79	0.61	0.66	0.79	0.82	0.83	0.53	0.79
CCM	1.35	1.05	1.44	1.18	1.26	0.89	0.82	0.72	0.61	1.04
ITnE	1.08	1.82	0.98	0.97	1.34	0.89	1.14	1.02	0.74	1.12
Risk	1.39	1.18	1.14	0.98	1.02	1.23	0.96	0.96	0.93	1.09
IndRev	1.41	0.91	0.76	0.78	0.95	1.09	0.75	0.72	0.94	0.94
HWQA	1.04	1.13	1.56	1.13	0.95	0.83	0.84	0.72	0.61	0.99
SWAsur	0.89	1.14	0.41	0.86	1.34	0.61	0.86	0.77	0.35	0.83
SupQA	0.96	0.64	1.05	1.34	0.75	0.66	0.62	0.55	0.47	0.79
FRB	0.88	1.64	1.41	1.04	0.97	0.54	1.25	1.24	0.35	1.08
CAB	0.86	1.36	1.27	1.07	1.08	0.62	0.89	0.84	0.56	0.97
Alert	0.86	0.87	0.98	1.07	0.81	0.67	0.79	0.73	0.47	0.81
Average	1.23	1.17	1.08	1.05	1.01	0.99	0.87	0.83	0.74	1.00

- Whole population and Class A population have same ordering of phases with respect to effort



Whole Population Compared to Class A Effort—By Activity

Whole Population Effort

By Activity										
Effort	ConStd	PreIDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
Req	1.22	1.47	1.68	1.15	1.51	1.20	1.20	1.12	1.08	1.30
ITnE	0.73	0.90	1.11	0.95	1.90	0.89	1.29	1.13	1.07	1.13
DesAsur	0.90	1.22	1.61	1.03	1.18	1.00	1.19	0.85	0.85	1.10
Risk	0.91	1.19	1.37	1.11	1.20	0.94	1.05	1.07	1.02	1.10
FRB	0.36	0.54	0.92	1.33	1.66	1.03	0.96	1.29	1.31	1.09
CCM	0.67	0.92	1.46	1.40	1.09	1.19	1.31	0.86	0.76	1.08
PMP	0.79	1.10	1.51	1.13	0.95	1.32	0.78	0.71	0.72	1.03
HWQA	0.55	0.80	1.05	1.59	1.24	1.11	0.91	0.93	0.81	1.01
IndRev	0.84	1.08	1.46	0.85	1.06	0.81	1.10	0.79	0.86	0.99
Env	0.93	1.17	1.33	0.84	1.25	0.95	0.50	0.78	0.73	0.97
CAB	0.54	0.60	0.83	1.20	1.31	1.06	1.06	0.92	0.85	0.95
SWAsur	0.42	0.66	0.94	0.37	1.14	0.85	1.41	0.94	0.81	0.87
Rel	0.91	1.20	1.31	0.59	0.78	0.84	0.73	0.66	0.62	0.87
SupQA	0.57	0.75	0.99	1.10	0.65	1.45	0.71	0.57	0.54	0.83
Alert	0.46	0.73	0.91	0.97	0.86	1.08	0.78	0.78	0.73	0.82
SysSaf	0.55	0.83	0.97	0.75	1.08	0.58	0.61	0.86	0.78	0.78
Average	0.74	0.97	1.24	1.05	1.19	1.03	1.00	0.90	0.85	1.00

Class A Population Effort

By Activity										
Effort	ConStd	PreIDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
Req	1.22	1.53	1.70	1.17	1.49	1.20	1.21	1.07	1.07	1.30
DesAsur	0.93	1.27	1.64	1.08	1.18	1.04	1.24	0.89	0.84	1.13
ITnE	0.74	0.89	1.08	0.98	1.82	0.97	1.34	1.14	1.02	1.12
PMP	0.91	1.24	1.58	1.25	1.02	1.46	0.84	0.76	0.76	1.11
Risk	0.93	1.23	1.39	1.14	1.18	0.98	1.02	0.96	0.96	1.09
FRB	0.35	0.54	0.88	1.41	1.64	1.04	0.97	1.25	1.24	1.08
CCM	0.61	0.89	1.35	1.44	1.05	1.18	1.26	0.82	0.72	1.04
Env	0.91	1.21	1.37	0.88	1.29	0.98	0.53	0.83	0.75	0.99
HWQA	0.61	0.83	1.04	1.56	1.13	1.13	0.95	0.84	0.72	0.99
CAB	0.56	0.62	0.86	1.27	1.36	1.07	1.08	0.89	0.84	0.97
IndRev	0.94	1.09	1.41	0.76	0.91	0.78	0.95	0.75	0.72	0.94
Rel	0.93	1.27	1.38	0.68	0.88	0.92	0.87	0.68	0.65	0.94
SupQA	0.47	0.66	0.96	1.05	0.64	1.34	0.75	0.62	0.55	0.79
SysSaf	0.53	0.79	0.98	0.79	1.08	0.61	0.66	0.82	0.83	0.79
SWAsur	0.35	0.61	0.89	0.41	1.14	0.86	1.34	0.86	0.77	0.83
Alert	0.47	0.67	0.86	0.98	0.87	1.07	0.81	0.79	0.73	0.81
Average	0.74	0.99	1.23	1.08	1.17	1.05	1.01	0.87	0.83	1.00

- Similar ordering
 - Requirement Analysis and Validation identified as highest effort in both populations
 - Some swaps but generally grouped similarly



Whole Population Compared to Class A Efficiency—By Phase

Whole Population Efficiency

By Efficiency											
Activity	Value / Effort	ConStd	PreIDes	Oper	InT	Procur	HW Fab	CompDes	SW CUT	Field	Average
	Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.99	1.07	1.13
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09	
Risk	1.19	1.09	1.06	1.06	1.18	0.99	1.03	1.06	1.00	1.07	
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.05	0.96	1.06	
IndRev	1.25	1.16	1.00	1.10	1.03	0.92	0.97	1.01	1.07	1.05	
CAB	0.86	0.98	1.14	1.10	1.07	1.11	1.10	1.14	0.99	1.05	
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03	
DesAsur	1.16	1.04	0.88	1.04	1.10	1.06	0.96	0.89	0.86	1.00	
HWQA	0.96	0.97	1.06	1.12	1.05	0.93	1.05	0.95	0.98	1.00	
Req	1.09	0.94	0.86	1.00	1.04	1.05	0.94	1.06	0.91	0.99	
Rel	1.11	0.97	1.03	0.89	0.94	1.07	0.93	1.00	1.02	0.98	
CCM	0.94	1.02	1.06	1.03	0.95	0.90	0.92	0.98	0.97	0.96	
ITnE	1.07	1.01	0.92	0.89	0.88	0.97	1.06	0.95	1.00	0.95	
PMP	1.08	1.06	0.97	0.90	0.90	1.03	0.89	0.85	0.90	0.94	
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90	
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.75	0.86	0.89	
Average	1.08	1.02	1.02	1.01	1.01	0.99	0.98	0.98	0.97	1.00	

Class A Population Efficiency

Activity	Value / Effort	Oper	ConStd	InT	PreIDes	Procur	SW CUT	Field	CompDes	HW Fab	Average
	IndRev	1.16	1.21	1.30	1.26	1.10	1.21	1.14	1.04	1.07	1.16
Alert	1.25	1.09	1.21	1.18	1.13	0.95	1.16	1.26	1.22	1.16	
SupQA	1.14	1.19	1.35	1.24	1.03	0.99	0.97	1.19	1.12	1.12	
Risk	1.06	1.25	1.07	1.11	1.19	1.09	0.99	1.09	1.01	1.09	
SWAsur	1.07	1.09	1.02	1.19	1.17	1.03	0.98	1.13	0.81	1.04	
SysSaf	1.19	1.02	0.90	0.98	1.05	1.04	1.08	1.02	0.98	1.02	
CAB	1.19	0.79	1.06	0.95	1.01	1.06	1.03	1.05	1.03	1.02	
DesAsur	0.84	1.11	1.04	1.05	1.07	0.89	0.78	0.95	1.03	0.98	
CCM	1.19	0.96	1.07	0.94	0.97	0.97	1.10	0.93	0.88	0.98	
HWQA	1.08	0.86	1.10	0.93	0.98	1.04	1.01	1.00	0.91	0.98	
Req	0.87	1.04	0.95	0.92	1.08	1.05	0.91	0.90	1.03	0.97	
Rel	1.09	1.03	0.87	0.92	0.89	0.95	1.11	0.94	1.01	0.96	
ITnE	0.95	1.02	0.88	1.01	0.78	0.94	0.97	1.03	0.97	0.94	
FRB	1.05	0.88	0.99	0.72	0.91	1.10	0.92	0.80	0.98	0.93	
PMP	0.99	0.97	0.87	0.94	0.84	0.86	0.96	0.85	0.99	0.91	
Env	0.89	1.05	0.83	0.93	0.90	0.82	0.85	0.92	0.81	0.89	
Average	1.05	1.03	1.01	1.00	1.00	1.00	0.99	0.98	0.98	1.00	

- Order of efficiency ranking by phase varied
 - Efficiency ≥ 1.0 mostly includes same phases for both populations
 - Efficiency < 1.0 mostly includes same phases for both populations



Whole Population Compared to Class A Efficiency—By Activity

Whole Population Efficiency

By Efficiency										
Value / Effort	ConStd	PreIDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	Average
Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.99	1.07	1.13
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09
Risk	1.19	1.09	1.06	1.06	1.18	0.99	1.03	1.06	1.00	1.07
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.05	0.96	1.06
IndRev	1.25	1.16	1.00	1.10	1.03	0.92	0.97	1.01	1.07	1.05
CAB	0.86	0.98	1.14	1.10	1.07	1.11	1.10	1.14	0.99	1.05
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03
DesAsur	1.16	1.04	0.88	1.04	1.10	1.06	0.96	0.89	0.86	1.00
HWQA	0.96	0.97	1.06	1.12	1.05	0.93	1.05	0.95	0.98	1.00
Req	1.09	0.94	0.86	1.00	1.04	1.05	0.94	1.06	0.91	0.99
Rel	1.11	0.97	1.03	0.89	0.94	1.07	0.93	1.00	1.02	0.98
CCM	0.94	1.02	1.06	1.03	0.95	0.90	0.92	0.98	0.97	0.96
ITnE	1.07	1.01	0.92	0.89	0.88	0.97	1.06	0.95	1.00	0.95
PMP	1.08	1.06	0.97	0.90	0.90	1.03	0.89	0.85	0.90	0.94
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.75	0.86	0.89
Average	1.08	1.02	1.02	1.01	1.01	0.99	0.98	0.98	0.97	1.00

Class A Population Efficiency

Value / Effort	Oper	ConStd	InT	PreIDes	Procur	SW CUT	Field	CompDes	HWFab	Average
IndRev	1.16	1.21	1.30	1.26	1.10	1.21	1.14	1.04	1.07	1.16
Alert	1.25	1.09	1.21	1.18	1.13	0.95	1.16	1.26	1.22	1.16
SupQA	1.14	1.19	1.35	1.24	1.03	0.99	0.97	1.19	1.12	1.12
Risk	1.06	1.25	1.07	1.11	1.19	1.09	0.99	1.09	1.01	1.09
SWAsur	1.07	1.09	1.02	1.19	1.17	1.03	0.98	1.13	0.81	1.04
SysSaf	1.19	1.02	0.90	0.98	1.05	1.04	1.08	1.02	0.98	1.02
CAB	1.19	0.79	1.06	0.95	1.01	1.06	1.03	1.05	1.03	1.02
DesAsur	0.84	1.11	1.04	1.05	1.07	0.89	0.78	0.95	1.03	0.98
CCM	1.19	0.96	1.07	0.94	0.97	0.97	1.10	0.93	0.88	0.98
HWQA	1.08	0.86	1.10	0.93	0.98	1.04	1.01	1.00	0.91	0.98
Req	0.87	1.04	0.95	0.92	1.08	1.05	0.91	0.90	1.03	0.97
Rel	1.09	1.03	0.87	0.92	0.89	0.95	1.11	0.94	1.01	0.96
ITnE	0.95	1.02	0.88	1.01	0.78	0.94	0.97	1.03	0.97	0.94
FRB	1.05	0.88	0.99	0.72	0.91	1.10	0.92	0.80	0.98	0.93
PMP	0.99	0.97	0.87	0.94	0.84	0.86	0.96	0.85	0.99	0.91
Env	0.89	1.05	0.83	0.93	0.90	0.82	0.85	0.92	0.81	0.89
Average	1.05	1.03	1.01	1.00	1.00	1.00	0.99	0.98	0.98	1.00

- Order of efficiency ranking by activity
 - Independent Review and Configuration/Change Management show higher efficiency in Class A population compared to whole population
 - However, Independent Review and Configuration/Change Management did not stand out in value or effort heat maps



Whole Population Compared to Class A Efficiency—By Efficiency

Whole Population Efficiency

Activity	Value / Effort	ConStd	PreDes	Oper	InT	Procur	HWFab	CompDes	SW CUT	Field	Average
	Alert	1.14	1.13	1.11	1.15	1.17	1.21	1.20	0.99	1.07	1.13
SupQA	1.13	1.23	1.12	1.23	1.04	1.06	1.17	1.00	0.98	1.09	
Risk	1.19	1.09	1.06	1.06	1.18	0.99	1.03	1.06	1.00	1.07	
SWAsur	1.11	1.16	1.11	1.10	1.21	0.91	1.12	1.05	0.96	1.06	
IndRev	1.25	1.16	1.00	1.10	1.03	0.92	0.97	1.01	1.07	1.05	
CAB	0.86	0.98	1.14	1.10	1.07	1.11	1.10	1.14	0.99	1.05	
SysSaf	1.20	1.08	1.22	0.89	0.97	0.92	1.07	1.07	1.00	1.03	
DesAsur	1.16	1.04	0.88	1.04	1.10	1.06	0.96	0.89	0.86	1.00	
HWQA	0.96	0.97	1.06	1.12	1.05	0.93	1.05	0.95	0.98	1.00	
Req	1.09	0.94	0.86	1.00	1.04	1.05	0.94	1.06	0.91	0.99	
Rel	1.11	0.97	1.03	0.89	0.94	1.07	0.93	1.00	1.02	0.98	
CCM	0.94	1.02	1.06	1.03	0.95	0.90	0.92	0.98	0.97	0.96	
ITnE	1.07	1.01	0.92	0.89	0.88	0.97	1.06	0.95	1.00	0.95	
PMP	1.08	1.06	0.97	0.90	0.90	1.03	0.89	0.85	0.90	0.94	
FRB	0.86	0.67	0.98	0.98	0.86	0.96	0.74	1.05	0.93	0.90	
Env	1.07	0.91	1.01	0.83	0.87	0.81	0.89	0.75	0.86	0.89	
Average	1.08	1.02	1.02	1.01	1.01	0.99	0.98	0.98	0.97	1.00	

Class A Population Efficiency

Activity	Value / Effort	Oper	ConStd	InT	PreDes	Procur	SW CUT	Field	CompDes	HWFab	Average
	IndRev	1.16	1.21	1.30	1.26	1.10	1.21	1.14	1.04	1.07	1.16
Alert	1.25	1.09	1.21	1.18	1.13	0.95	1.16	1.26	1.22	1.16	
SupQA	1.14	1.19	1.35	1.24	1.03	0.99	0.97	1.19	1.12	1.12	
Risk	1.06	1.25	1.07	1.11	1.19	1.09	0.99	1.09	1.01	1.09	
SWAsur	1.07	1.09	1.02	1.19	1.17	1.03	0.98	1.13	0.81	1.04	
SysSaf	1.19	1.02	0.90	0.98	1.05	1.04	1.08	1.02	0.98	1.02	
CAB	1.19	0.79	1.06	0.95	1.01	1.06	1.03	1.05	1.03	1.02	
DesAsur	0.84	1.11	1.04	1.05	1.07	0.89	0.78	0.95	1.03	0.98	
CCM	1.19	0.96	1.07	0.94	0.97	0.97	1.10	0.93	0.88	0.98	
HWQA	1.08	0.86	1.10	0.93	0.98	1.04	1.01	1.00	0.91	0.98	
Req	0.87	1.04	0.95	0.92	1.08	1.05	0.91	0.90	1.03	0.97	
Rel	1.09	1.03	0.87	0.92	0.89	0.95	1.11	0.94	1.01	0.96	
ITnE	0.95	1.02	0.88	1.01	0.78	0.94	0.97	1.03	0.97	0.94	
FRB	1.05	0.88	0.99	0.72	0.91	1.10	0.92	0.80	0.98	0.93	
PMP	0.99	0.97	0.87	0.94	0.84	0.86	0.96	0.85	0.99	0.91	
Env	0.89	1.05	0.83	0.93	0.90	0.82	0.85	0.92	0.81	0.89	
Average	1.05	1.03	1.01	1.00	1.00	1.00	0.99	0.98	0.98	1.00	

- Efficiency ordered by phase and activity for each population



Comparing Government and FFRDC with Contractor Population

Government/FFRDC Compared to Contractor Value—By Phase

Government/FFRDC Population Value by Phase

Activity	Value	CompDes	Procur	InT	PreDes	SW CUT	HWFab	ConStd	Oper	Field	Average
	Req	1.59	1.32	1.41	1.41	1.32	0.88	1.45	0.75	0.97	1.23
DesAsur	1.54	1.23	1.15	1.37	0.88	0.88	1.28	0.53	0.57	1.06	
PMP	1.40	1.36	0.88	1.24	0.88	1.15	0.92	0.66	0.72	1.06	
Env	1.08	0.77	0.83	1.17	0.44	0.61	0.98	0.61	0.50	0.81	
Rel	1.37	0.98	0.88	1.37	0.88	0.88	1.08	0.88	0.88	1.05	
SysSaf	1.08	0.93	0.88	0.98	0.94	0.98	0.83	0.94	0.83	0.93	
CCM	1.15	0.97	0.93	0.97	1.10	1.01	0.79	0.63	0.64	0.92	
ITnE	1.27	1.10	1.54	0.94	1.38	1.32	0.83	0.76	0.88	1.12	
Risk	1.22	1.05	1.15	1.19	1.27	1.06	1.01	0.83	0.69	1.05	
IndRev	1.32	1.10	0.94	1.37	1.26	0.83	1.08	0.44	0.44	1.02	
HWQA	1.15	1.15	1.17	0.93	1.10	1.15	0.53	0.72	0.55	0.94	
SWAsur	1.27	1.17	1.17	1.08	1.43	0.50	0.44	1.16	0.88	1.02	
SupQA	1.32	1.42	0.88	1.03	0.99	1.08	0.69	0.66	0.61	0.97	
FRB	0.88	0.98	1.76	0.63	1.03	1.22	0.44	1.13	1.05	1.04	
CAB	0.88	1.17	1.38	0.55	1.17	1.37	0.33	0.88	0.99	0.98	
Alert	1.01	1.06	0.84	0.79	0.69	0.88	0.44	0.63	0.64	0.78	
Average	1.23	1.12	1.11	1.08	1.06	1.00	0.84	0.76	0.74	1.00	

Contractor Population Value by Phase

Activity	Value	CompDes	InT	HWFab	Procur	PreDes	SW CUT	Oper	Field	ConStd	Average
	Req	1.59	1.56	1.30	1.24	1.38	1.26	1.01	1.03	1.29	1.30
DesAsur	1.57	1.25	1.15	1.07	1.24	1.10	0.84	0.80	0.97	1.11	
PMP	1.32	0.86	1.16	1.11	1.13	0.61	0.73	0.62	0.81	0.94	
Env	1.22	1.08	0.70	0.82	1.05	0.37	0.74	0.69	1.00	0.87	
Rel	1.18	0.66	0.58	0.74	1.10	0.67	0.58	0.59	0.99	0.80	
SysSaf	1.02	0.98	0.59	0.46	0.85	0.57	0.98	0.85	0.61	0.77	
CCM	1.42	1.19	1.35	1.18	0.93	1.34	0.88	0.88	0.55	1.08	
ITnE	1.15	1.76	0.78	0.68	0.92	1.18	1.06	1.19	0.78	1.06	
Risk	1.47	1.31	1.10	1.12	1.34	1.08	1.17	1.18	1.10	1.21	
IndRev	1.44	1.22	0.75	0.75	1.26	1.08	0.97	0.95	1.07	1.06	
HWQA	1.10	1.46	1.60	1.16	0.72	0.77	0.92	1.00	0.52	1.04	
SWAsur	1.00	1.28	0.29	0.97	0.68	1.51	0.84	0.89	0.48	0.89	
SupQA	1.11	0.75	1.19	1.55	0.91	0.59	0.60	0.51	0.59	0.88	
FRB	0.66	1.61	1.30	0.91	0.31	0.98	1.33	1.25	0.29	0.98	
CAB	0.94	1.47	1.33	1.11	0.60	1.21	1.01	0.91	0.49	1.01	
Alert	1.12	1.03	1.26	1.34	0.81	0.78	0.85	0.88	0.51	0.96	
Average	1.22	1.22	1.04	1.01	0.97	0.96	0.91	0.89	0.77	1.00	

- Complete Design and Integration and Test show high value for Government/FFRDC and Contractor
 - Government/FFRDC has higher value for Procurement than Contractor population
 - Contractor population has higher value for Hardware Fabrication than Government/FFRDC
- Concept Studies, Operations, and Fielding show lower value for Government/FFRDC and Contractor



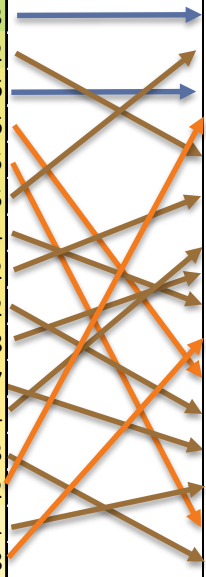
Government/FFRDC Compared to Contractor Value—By Activity

Government/FFRDC Value by Activity

Value	ConStd	PrelDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
Req	1.45	1.41	1.59	0.88	1.41	1.32	1.32	0.97	0.75	1.23
ITnE	0.83	0.94	1.27	1.32	1.54	1.10	1.38	0.88	0.76	1.12
DesAsur	1.28	1.37	1.54	0.88	1.15	1.23	0.88	0.57	0.53	1.06
PMP	0.92	1.24	1.40	1.15	0.88	1.36	0.88	0.72	0.66	1.06
Rel	1.08	1.37	1.37	0.88	0.88	0.98	0.88	0.88	0.88	1.05
Risk	1.01	1.19	1.22	1.06	1.15	1.05	1.27	0.69	0.83	1.05
FRB	0.44	0.63	0.88	1.22	1.76	0.98	1.03	1.05	1.13	1.04
IndRev	1.08	1.37	1.32	0.83	0.94	1.10	1.26	0.44	0.44	1.02
SWAsur	0.44	1.08	1.27	0.50	1.17	1.17	1.43	0.88	1.16	1.02
CAB	0.33	0.55	0.88	1.37	1.38	1.17	1.17	0.99	0.88	0.98
SupQA	0.69	1.03	1.32	1.08	0.88	1.42	0.99	0.61	0.66	0.97
HWQA	0.53	0.93	1.15	1.15	1.17	1.15	1.10	0.55	0.72	0.94
SysSaf	0.83	0.98	1.08	0.98	0.88	0.93	0.94	0.83	0.94	0.93
CCM	0.79	0.97	1.15	1.01	0.93	0.97	1.10	0.64	0.63	0.92
Env	0.98	1.17	1.08	0.61	0.83	0.77	0.44	0.50	0.61	0.81
Alert	0.44	0.79	1.01	0.88	0.84	1.06	0.69	0.64	0.63	0.78
Average	0.84	1.08	1.23	1.00	1.11	1.12	1.06	0.74	0.76	1.00

Contractor Population Value by Activity

Value	ConStd	PrelDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
Req	1.29	1.38	1.59	1.30	1.56	1.24	1.26	1.03	1.01	1.30
Risk	1.10	1.34	1.47	1.10	1.31	1.12	1.08	1.18	1.17	1.21
DesAsur	0.97	1.24	1.57	1.15	1.25	1.07	1.10	0.80	0.84	1.11
CCM	0.55	0.93	1.42	1.35	1.19	1.18	1.34	0.88	0.88	1.08
ITnE	0.78	0.92	1.15	0.78	1.76	0.68	1.18	1.19	1.06	1.06
IndRev	1.07	1.26	1.44	0.75	1.22	0.75	1.08	0.95	0.97	1.06
HWQA	0.52	0.72	1.10	1.60	1.46	1.16	0.77	1.00	0.92	1.04
CAB	0.49	0.60	0.94	1.33	1.47	1.11	1.21	0.91	1.01	1.01
FRB	0.29	0.31	0.66	1.30	1.61	0.91	0.98	1.25	1.33	0.98
Alert	0.51	0.81	1.12	1.26	1.03	1.34	0.78	0.88	0.85	0.96
PMP	0.81	1.13	1.32	1.16	0.86	1.11	0.61	0.62	0.73	0.94
SWAsur	0.48	0.68	1.00	0.29	1.28	0.97	1.51	0.89	0.84	0.89
SupQA	0.59	0.91	1.11	1.19	0.75	1.55	0.59	0.51	0.60	0.88
Env	1.00	1.05	1.22	0.70	1.08	0.82	0.37	0.69	0.74	0.87
Rel	0.99	1.10	1.18	0.58	0.66	0.74	0.67	0.59	0.58	0.80
SysSaf	0.61	0.85	1.02	0.59	0.98	0.46	0.57	0.85	0.98	0.77
Average	0.77	0.97	1.22	1.04	1.22	1.01	0.96	0.89	0.91	1.00



- Requirement Analysis and Validation and Design Assurance show high value for Government/FFRDC and Contractor populations
- Perceived value of remaining activities differs between Government/FFRDC and Contractor populations
 - *Parts, Materials, and Processes, Configuration/Change Management, Reliability Engineering, and Alert Processes are activities with largest differences in perceived value*



Government/FFRDC Compared to Contractor Effort—By Phase

Government/FFRDC Population Effort

Activity	Effort	Phases									Average
		CompDes	InT	PreIDes	HWFab	Procur	SW CUT	Field	ConStd	Oper	
Req		1.65	1.35	1.44	1.15	1.24	1.11	0.86	1.08	0.92	1.21
DesAsur		1.55	0.98	1.44	0.92	1.09	0.90	0.63	1.03	0.63	1.03
PMP		1.75	1.03	1.13	1.20	1.19	0.86	0.88	0.77	0.88	1.11
Env		1.55	1.35	1.38	0.81	0.96	0.39	0.86	0.97	0.74	1.06
Rel		1.44	1.16	1.13	0.96	1.16	0.95	0.69	0.93	0.69	1.05
SysSaf		1.16	1.10	1.03	0.97	0.84	0.74	1.11	0.77	0.72	0.95
CCM		1.32	1.09	0.97	1.29	1.03	0.96	0.84	0.84	0.66	1.01
ITnE		1.03	1.81	0.84	1.26	1.11	1.29	1.11	0.74	0.69	1.12
Risk		1.24	1.03	1.29	1.13	0.86	1.03	0.90	0.98	0.74	1.04
IndRev		1.48	0.59	1.03	0.81	0.81	0.81	0.72	0.97	0.52	0.90
HWQA		1.20	1.03	1.09	1.26	1.03	0.88	0.77	0.64	0.52	0.97
SWAsur		0.92	1.16	0.80	0.72	0.97	1.20	1.11	0.52	0.96	0.95
SupQA		1.29	0.90	0.84	0.84	1.10	0.88	0.86	0.44	0.62	0.88
FRB		1.03	1.66	0.72	1.23	0.90	0.97	1.03	0.41	1.03	1.05
CAB		0.86	1.26	0.52	1.16	1.03	1.16	0.74	0.31	0.44	0.88
Alert		0.86	0.86	0.77	0.77	0.92	0.71	0.71	0.45	0.59	0.75
Average		1.30	1.15	1.06	1.05	1.02	0.95	0.86	0.78	0.72	1.00

Contractor Population Effort

Activity	Effort	Phases									Average
		CompDes	InT	HWFab	Procur	SW CUT	PreIDes	Field	Oper	ConStd	
Req		1.70	1.55	1.17	1.19	1.21	1.48	1.22	1.11	1.28	1.33
DesAsur		1.64	1.24	1.08	0.98	1.25	1.14	0.94	0.92	0.87	1.13
PMP		1.44	0.91	1.09	1.35	0.78	1.08	0.66	0.70	0.76	1.00
Env		1.30	1.21	0.85	0.93	0.53	1.13	0.77	0.72	0.90	0.94
Rel		1.27	0.69	0.50	0.76	0.65	1.21	0.65	0.61	0.92	0.82
SysSaf		0.93	1.10	0.66	0.51	0.59	0.78	0.77	0.80	0.48	0.74
CCM		1.53	1.11	1.45	1.23	1.39	0.89	0.84	0.79	0.62	1.10
ITnE		1.16	1.95	0.82	0.84	1.31	0.93	1.15	1.17	0.75	1.14
Risk		1.41	1.25	1.11	0.97	1.06	1.15	1.10	1.10	0.90	1.12
IndRev		1.45	1.15	0.88	0.82	1.16	1.12	0.83	0.92	0.81	1.02
HWQA		1.01	1.28	1.69	1.11	0.87	0.71	0.94	0.89	0.51	1.02
SWAsur		0.92	1.12	0.24	0.78	1.47	0.61	0.87	0.80	0.39	0.83
SupQA		0.93	0.57	1.18	1.54	0.67	0.73	0.45	0.51	0.55	0.81
FRB		0.91	1.68	1.37	1.08	0.97	0.51	1.38	1.39	0.35	1.11
CAB		0.83	1.32	1.20	1.08	1.01	0.63	0.98	0.92	0.60	0.97
Alert		0.90	0.87	1.03	1.12	0.76	0.71	0.77	0.77	0.44	0.83
Average		1.23	1.20	1.05	1.03	1.01	0.95	0.90	0.89	0.72	1.00

- Government/FFRDC population and Contractor population have similar ordering of phases with respect to effort
 - Preliminary Design is largest variation in relative ordering between populations



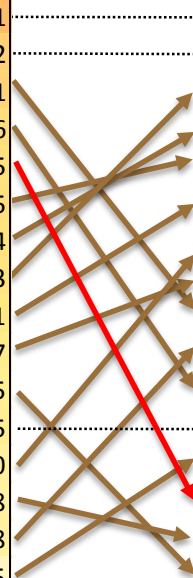
Government/FFRDC Compared to Contractor Effort—By Activity

Government/FFRDC Population Effort

Activity	Effort	ConStd	PreIDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
	Req	1.08	1.44	1.65	1.15	1.35	1.24	1.11	0.86	0.92	1.21
ITnE	0.74	0.84	1.03	1.26	1.81	1.11	1.29	1.11	0.69	1.12	
PMP	0.77	1.13	1.75	1.20	1.03	1.19	0.86	0.88	0.88	1.11	
Env	0.97	1.38	1.55	0.81	1.35	0.96	0.39	0.86	0.74	1.06	
Rel	0.93	1.13	1.44	0.96	1.16	1.16	0.95	0.69	0.69	1.05	
FRB	0.41	0.72	1.03	1.23	1.66	0.90	0.97	1.03	1.03	1.05	
Risk	0.98	1.29	1.24	1.13	1.03	0.86	1.03	0.90	0.74	1.04	
DesAsur	1.03	1.44	1.55	0.92	0.98	1.09	0.90	0.63	0.63	1.03	
CCM	0.84	0.97	1.32	1.29	1.09	1.03	0.96	0.84	0.66	1.01	
HWQA	0.64	1.09	1.20	1.26	1.03	1.03	0.88	0.77	0.52	0.97	
SysSaf	0.77	1.03	1.16	0.97	1.10	0.84	0.74	1.11	0.72	0.95	
SWAsur	0.52	0.80	0.92	0.72	1.16	0.97	1.20	1.11	0.96	0.95	
IndRev	0.97	1.03	1.48	0.81	0.59	0.81	0.81	0.72	0.52	0.90	
SupQA	0.44	0.84	1.29	0.84	0.90	1.10	0.88	0.86	0.62	0.88	
CAB	0.31	0.52	0.86	1.16	1.26	1.03	1.16	0.74	0.44	0.88	
Alert	0.45	0.77	0.86	0.77	0.86	0.92	0.71	0.71	0.59	0.75	
Average	0.78	1.06	1.30	1.05	1.15	1.02	0.95	0.86	0.72	1.00	

Contractor Population Effort

Activity	Effort	ConStd	PreIDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
	Req	1.28	1.48	1.70	1.17	1.55	1.19	1.21	1.22	1.11	1.33
ITnE	0.75	0.93	1.16	0.82	1.95	0.84	1.31	1.15	1.17	1.14	
DesAsur	0.87	1.14	1.64	1.08	1.24	0.98	1.25	0.94	0.92	1.13	
Risk	0.90	1.15	1.41	1.11	1.25	0.97	1.06	1.10	1.10	1.12	
FRB	0.35	0.51	0.91	1.37	1.68	1.08	0.97	1.38	1.39	1.11	
CCM	0.62	0.89	1.53	1.45	1.11	1.23	1.39	0.84	0.79	1.10	
IndRev	0.81	1.12	1.45	0.88	1.15	0.82	1.16	0.83	0.92	1.02	
HWQA	0.51	0.71	1.01	1.69	1.28	1.11	0.87	0.94	0.89	1.02	
PMP	0.76	1.08	1.44	1.09	0.91	1.35	0.78	0.66	0.70	1.00	
CAB	0.60	0.63	0.83	1.20	1.32	1.08	1.01	0.98	0.92	0.97	
Env	0.90	1.13	1.30	0.85	1.21	0.93	0.53	0.77	0.72	0.94	
SWAsur	0.39	0.61	0.92	0.24	1.12	0.78	1.47	0.87	0.80	0.83	
Alert	0.44	0.71	0.90	1.03	0.87	1.12	0.76	0.77	0.77	0.83	
Rel	0.92	1.21	1.27	0.50	0.69	0.76	0.65	0.65	0.61	0.82	
SupQA	0.55	0.73	0.93	1.18	0.57	1.54	0.67	0.45	0.51	0.81	
SysSaf	0.48	0.78	0.93	0.66	1.10	0.51	0.59	0.77	0.80	0.74	
Average	0.72	0.95	1.23	1.05	1.20	1.03	1.01	0.90	0.89	1.00	



- Requirement Analysis and Validation and Integration, Test, and Evaluation show high effort for both Government/FFRDC and Contractor populations
- Perceived effort of remaining activities differs between Government/FFRDC and Contractor populations
 - Reliability Engineering is activity with largest difference in perceived effort



Government/FFRDC Compared to Contractor Efficiency—By Phase

Government/FFRDC Population Efficiency

Activity	Value / Effort	SW CUT	Procur	ConStd	Oper	PreDes	InT	CompDes	HWFab	Field	Average
	Req	1.20	1.07	1.34	0.82	0.98	1.04	0.96	0.77	1.13	1.02
DesAsur	0.98	1.13	1.24	0.84	0.95	1.17	1.00	0.96	0.91	1.02	
PMP	1.02	1.15	1.19	0.75	1.09	0.85	0.80	0.95	0.81	0.95	
Env	1.14	0.80	1.00	0.82	0.85	0.61	0.70	0.75	0.59	0.76	
Rel	0.93	0.84	1.16	1.28	1.20	0.76	0.95	0.92	1.28	1.00	
SysSaf	1.27	1.11	1.08	1.31	0.95	0.80	0.93	1.01	0.75	0.98	
CCM	1.15	0.94	0.95	0.95	0.99	0.85	0.87	0.79	0.76	0.91	
ITnE	1.07	1.00	1.12	1.10	1.12	0.85	1.23	1.05	0.80	1.00	
Risk	1.23	1.22	1.03	1.12	0.92	1.11	0.99	0.93	0.76	1.01	
IndRev	1.55	1.36	1.11	0.85	1.33	1.60	0.89	1.02	0.61	1.14	
HWQA	1.25	1.11	0.82	1.39	0.85	1.14	0.95	0.91	0.71	0.98	
SWAsur	1.19	1.21	0.85	1.21	1.34	1.01	1.39	0.69	0.80	1.08	
SupQA	1.12	1.29	1.55	1.07	1.23	0.98	1.02	1.28	0.70	1.10	
FRB	1.06	1.08	1.07	1.10	0.87	1.06	0.85	1.00	1.01	0.99	
CAB	1.01	1.14	1.07	1.99	1.07	1.09	1.02	1.18	1.35	1.12	
Alert	0.97	1.15	0.98	1.07	1.02	0.97	1.18	1.14	0.90	1.05	
Average	1.12	1.10	1.07	1.06	1.02	0.97	0.95	0.95	0.86	1.00	

Contractor Population Efficiency

Activity	Value / Effort	ConStd	PreDes	InT	Oper	CompDes	HWFab	Procur	Field	SW CUT	Average
	Req	1.01	0.93	1.01	0.91	0.94	1.11	1.05	0.84	1.04	0.98
DesAsur	1.11	1.09	1.01	0.91	0.96	1.06	1.09	0.86	0.88	0.99	
PMP	1.07	1.05	0.95	1.05	0.91	1.06	0.82	0.93	0.79	0.94	
Env	1.11	0.93	0.89	1.02	0.94	0.82	0.89	0.90	0.70	0.92	
Rel	1.08	0.91	0.95	0.96	0.93	1.16	0.97	0.91	1.03	0.98	
SysSaf	1.26	1.09	0.89	1.23	1.10	0.89	0.90	1.11	0.97	1.04	
CCM	0.88	1.04	1.07	1.11	0.92	0.92	0.96	1.04	0.96	0.98	
ITnE	1.04	0.99	0.90	0.90	1.00	0.95	0.81	1.03	0.90	0.93	
Risk	1.22	1.17	1.05	1.06	1.05	0.99	1.15	1.07	1.02	1.08	
IndRev	1.31	1.13	1.06	1.06	0.99	0.86	0.92	1.15	0.93	1.04	
HWQA	1.02	1.02	1.14	1.03	1.08	0.95	1.04	1.07	0.88	1.02	
SWAsur	1.21	1.11	1.15	1.05	1.09	1.21	1.24	1.03	1.03	1.07	
SupQA	1.07	1.25	1.31	1.18	1.19	1.01	1.00	1.14	0.88	1.08	
FRB	0.82	0.61	0.96	0.95	0.73	0.95	0.84	0.91	1.01	0.88	
CAB	0.82	0.95	1.12	1.10	1.14	1.11	1.02	0.93	1.20	1.04	
Alert	1.15	1.14	1.19	1.10	1.24	1.22	1.20	1.14	1.02	1.15	
Average	1.07	1.02	1.02	1.02	0.99	0.99	0.99	0.99	0.95	1.00	

- Order of efficiency ranking by phase varied
 - Efficiency ≥ 1.0 mostly includes same phases for both populations
 - Efficiency < 1.0 mostly includes same phases for both populations
- Exceptions are Software Code and Unit Test, Procurement, and Integration and Test



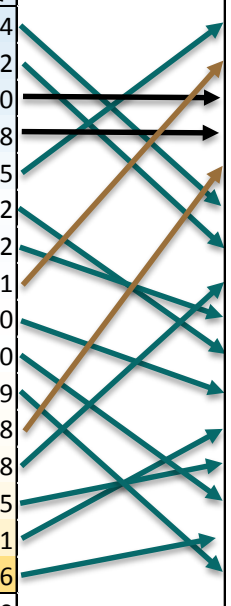
Government/FFRDC Compared to Contractor Efficiency—By Activity

Government/FFRDC Population Efficiency

Activity	Value / Effort	ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
	IndRev	1.11	1.33	0.89	1.02	1.60	1.36	1.55	0.61	0.85	1.14
CAB	1.07	1.07	1.02	1.18	1.09	1.14	1.01	1.35	1.99	1.12	
SupQA	1.55	1.23	1.02	1.28	0.98	1.29	1.12	0.70	1.07	1.10	
SWAsur	0.85	1.34	1.39	0.69	1.01	1.21	1.19	0.80	1.21	1.08	
Alert	0.98	1.02	1.18	1.14	0.97	1.15	0.97	0.90	1.07	1.05	
Req	1.34	0.98	0.96	0.77	1.04	1.07	1.20	1.13	0.82	1.02	
DesAsur	1.24	0.95	1.00	0.96	1.17	1.13	0.98	0.91	0.84	1.02	
Risk	1.03	0.92	0.99	0.93	1.11	1.22	1.23	0.76	1.12	1.01	
Rel	1.16	1.20	0.95	0.92	0.76	0.84	0.93	1.28	1.28	1.00	
ITnE	1.12	1.12	1.23	1.05	0.85	1.00	1.07	0.80	1.10	1.00	
FRB	1.07	0.87	0.85	1.00	1.06	1.08	1.06	1.01	1.10	0.99	
SysSaf	1.08	0.95	0.93	1.01	0.80	1.11	1.27	0.75	1.31	0.98	
HWQA	0.82	0.85	0.95	0.91	1.14	1.11	1.25	0.71	1.39	0.98	
PMP	1.19	1.09	0.80	0.95	0.85	1.15	1.02	0.81	0.75	0.95	
CCM	0.95	0.99	0.87	0.79	0.85	0.94	1.15	0.76	0.95	0.91	
Env	1.00	0.85	0.70	0.75	0.61	0.80	1.14	0.59	0.82	0.76	
Average	1.07	1.02	0.95	0.95	0.97	1.10	1.12	0.86	1.06	1.00	

Contractor Population Efficiency

Activity	Value / Effort	ConStd	PreDes	CompDes	HWFab	InT	Procur	SW CUT	Field	Oper	Average
	Alert	1.15	1.14	1.24	1.22	1.19	1.20	1.02	1.14	1.10	1.15
Risk	1.22	1.17	1.05	0.99	1.05	1.15	1.02	1.07	1.06	1.08	
SupQA	1.07	1.25	1.19	1.01	1.31	1.00	0.88	1.14	1.18	1.08	
SWAsur	1.21	1.11	1.09	1.21	1.15	1.24	1.03	1.03	1.05	1.07	
SysSaf	1.26	1.09	1.10	0.89	0.89	0.90	0.97	1.11	1.23	1.04	
IndRev	1.31	1.13	0.99	0.86	1.06	0.92	0.93	1.15	1.06	1.04	
CAB	0.82	0.95	1.14	1.11	1.12	1.02	1.20	0.93	1.10	1.04	
HWQA	1.02	1.02	1.08	0.95	1.14	1.04	0.88	1.07	1.03	1.02	
DesAsur	1.11	1.09	0.96	1.06	1.01	1.09	0.88	0.86	0.91	0.99	
Req	1.01	0.93	0.94	1.11	1.01	1.05	1.04	0.84	0.91	0.98	
Rel	1.08	0.91	0.93	1.16	0.95	0.97	1.03	0.91	0.96	0.98	
CCM	0.88	1.04	0.92	0.92	1.07	0.96	0.96	1.04	1.11	0.98	
PMP	1.07	1.05	0.91	1.06	0.95	0.82	0.79	0.93	1.05	0.94	
ITnE	1.04	0.99	1.00	0.95	0.90	0.81	0.90	1.03	0.90	0.93	
Env	1.11	0.93	0.94	0.82	0.89	0.89	0.70	0.90	1.02	0.92	
FRB	0.82	0.61	0.73	0.95	0.96	0.84	1.01	0.91	0.95	0.88	
Average	1.07	1.02	0.99	0.99	1.02	0.99	0.95	0.99	1.02	1.00	



- Order of efficiency ranked by activity
- Perceived efficiency of activities differs between Government/FFRDC and Contractor populations



Government/FFRDC Compared to Contractor Efficiency—By Efficiency

Government/FFRDC Population Efficiency

Activity	Value / Effort	SW CUT	Procur	ConStd	Oper	PreDes	InT	CompDes	HWFab	Field	Average
	IndRev	1.55	1.36	1.11	0.85	1.33	1.60	0.89	1.02	0.61	1.14
CAB	1.01	1.14	1.07	1.99	1.07	1.09	1.02	1.18	1.35	1.12	
SupQA	1.12	1.29	1.55	1.07	1.23	0.98	1.02	1.28	0.70	1.10	
SWAsur	1.19	1.21	0.85	1.21	1.34	1.01	1.39	0.69	0.80	1.08	
Alert	0.97	1.15	0.98	1.07	1.02	0.97	1.18	1.14	0.90	1.05	
Req	1.20	1.07	1.34	0.82	0.98	1.04	0.96	0.77	1.13	1.02	
DesAsur	0.98	1.13	1.24	0.84	0.95	1.17	1.00	0.96	0.91	1.02	
Risk	1.23	1.22	1.03	1.12	0.92	1.11	0.99	0.93	0.76	1.01	
Rel	0.93	0.84	1.16	1.28	1.20	0.76	0.95	0.92	1.28	1.00	
ITnE	1.07	1.00	1.12	1.10	1.12	0.85	1.23	1.05	0.80	1.00	
FRB	1.06	1.08	1.07	1.10	0.87	1.06	0.85	1.00	1.01	0.99	
SysSaf	1.27	1.11	1.08	1.31	0.95	0.80	0.93	1.01	0.75	0.98	
HWQA	1.25	1.11	0.82	1.39	0.85	1.14	0.95	0.91	0.71	0.98	
PMP	1.02	1.15	1.19	0.75	1.09	0.85	0.80	0.95	0.81	0.95	
CCM	1.15	0.94	0.95	0.95	0.99	0.85	0.87	0.79	0.76	0.91	
Env	1.14	0.80	1.00	0.82	0.85	0.61	0.70	0.75	0.59	0.76	
Average	1.12	1.10	1.07	1.06	1.02	0.97	0.95	0.95	0.86	1.00	

Contractor Population Efficiency

Activity	Value / Effort	ConStd	PreDes	InT	Oper	CompDes	HWFab	Procur	Field	SW CUT	Average
	Alert	1.15	1.14	1.19	1.10	1.24	1.22	1.20	1.14	1.02	1.15
Risk	1.22	1.17	1.05	1.06	1.05	0.99	1.15	1.07	1.02	1.08	
SupQA	1.07	1.25	1.31	1.18	1.19	1.01	1.00	1.14	0.88	1.08	
SWAsur	1.21	1.11	1.15	1.05	1.09	1.21	1.24	1.03	1.03	1.07	
SysSaf	1.26	1.09	0.89	1.23	1.10	0.89	0.90	1.11	0.97	1.04	
IndRev	1.31	1.13	1.06	1.06	0.99	0.86	0.92	1.15	0.93	1.04	
CAB	0.82	0.95	1.12	1.10	1.14	1.11	1.02	0.93	1.20	1.04	
HWQA	1.02	1.02	1.14	1.03	1.08	0.95	1.04	1.07	0.88	1.02	
DesAsur	1.11	1.09	1.01	0.91	0.96	1.06	1.09	0.86	0.88	0.99	
Req	1.01	0.93	1.01	0.91	0.94	1.11	1.05	0.84	1.04	0.98	
Rel	1.08	0.91	0.95	0.96	0.93	1.16	0.97	0.91	1.03	0.98	
CCM	0.88	1.04	1.07	1.11	0.92	0.92	0.96	1.04	0.96	0.98	
PMP	1.07	1.05	0.95	1.05	0.91	1.06	0.82	0.93	0.79	0.94	
ITnE	1.04	0.99	0.90	0.90	1.00	0.95	0.81	1.03	0.90	0.93	
Env	1.11	0.93	0.89	1.02	0.94	0.82	0.89	0.90	0.70	0.92	
FRB	0.82	0.61	0.96	0.95	0.73	0.95	0.84	0.91	1.01	0.88	
Average	1.07	1.02	1.02	1.02	0.99	0.99	0.99	0.99	0.95	1.00	

- Efficiency ordered by phase and activity for each population



Summary

- 2016 MAIW sponsored a micro topic to attempt to capture the value proposition for mission assurance
 - *A survey was conducted across the community on the perceived value and effort of mission assurance activities conducted across lifecycle phases*
 - 109 were responses received with extension of deadline to complete survey
 - *Value, effort, and efficiency results were presented as normalized heat maps*
 - *Population comparisons included:*
 - Whole population versus Class A mission population
 - Government/FFRDC population versus Contractor population
 - Other cuts of the data resulted in very small samples
- Observations based on heat map comparisons may identify areas for further investigation

Value Proposition for Mission Assurance

Approved Electronically by:

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SYSTEMS ENGINEERING DIVISION
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Cognizant Program Manager Approval:

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Value Proposition for Mission Assurance

Aerospace Corporate Officer Approval:

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Value Proposition for Mission Assurance

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