APPENDIX B: SCORING PLAN

Table B1: Military Value Weight of each Metric

Criteria & Metrics	Supply Weight	Storage Weight	Distribution Weight	Common Weight	Total Weight
Criterion 1	**14.00%**	**8.75%**	**12.25%**		**35.00%**
M1	3.92%				
M2	1.68%				
M3	1.26%				
M4	1.26%				
M5	1.68%				
M6	1.47%				
M7	1.05%				
M8	1.26%				
M9	0.42%				
M10		1.31%			
M11		0.44%			
M12		0.44%			
M13		0.92%			
M14		0.92%			
M15		1.23%			
M16		2.10%			
M17		0.70%			
M18		0.70%			
M19			2.76%		
M20			2.76%		
M21			1.68%		
M22			1.68%		
M23			1.68%		
M24			1.68%		
Criterion 2	**7.00%**	**7.00%**	**6.00%**		**20.00%**
M25	0.70%				
M26	0.70%				
M27	1.40%				
M28	2.10%				
M29	2.10%				
M30		1.40%			
M31		1.40%			
M32		4.20%			
M33			2.40%		
M34			1.50%		
M35			2.10%		

Table B1: Military Value Weight of each Metric (cont.)

Criteria & Metrics	Supply Weight	Storage Weight	Distribution Weight	Common Weight	Total Weight
Criterion 3	**8.75%**	**5.25%**	**21.00%**		**35.00%**
M36		0.66%			
M37		0.66%			
M38		0.66%			
M39		0.66%			
M40			1.31%		
M41			1.31%		
M42			1.31%		
M43			1.31%		
M44			2.63%		
M45			2.63%		
M46	3.15%	0.79%	3.15%	≤ 7.09%	
M47	1.05%	0.26%	1.05%	≤ 2.36%	
M48	1.05%	0.26%	1.05%	≤ 2.36%	
M49	1.75%	0.66%	2.63%	≤ 5.03%	
M50	1.75%	0.66%	2.63%	≤ 5.03%	
Criterion 4	**3.50%**	**3.50%**	**3.00%**		**10.00%**
M51	0.88%	0.88%	0.76%	≤ 2.52%	
M52	0.38%	0.38%	0.32%	≤ 1.08%	
M53	0.84%	0.84%	0.72%	≤ 2.40%	
M54	0.84%	0.84%	0.72%	≤ 2.40%	
M55	0.56%	0.56%	0.48%	≤ 1.60%	
Total	**33.25%**	**24.50%**	**42.25%**		**100.00%**

Metric Weights

The metric weights given in Table B1 for metrics one through forty-five are the product of the weights assigned to each Criterion, Characteristic, Attribute, and Metric combination detailed in Appendix A. Calculation of metric weights for Metrics 46 through 55 requires further explanation. These metrics fall within Characteristic Four, the "common" characteristic that is not assigned its own characteristic weight. The weights for the metrics that fall within Characteristic Four are calculated as a composite of the weights assigned to the other three functional characteristics for that particular criterion, attribute, and metric. The Common metrics have four military value weights shown per metric: one each for Supply, Storage, Distribution, and Common. The weight used for these metrics in the military value scoring model is the sum of the component weights that apply to each grouping of Activities. More specifically, the Storage and Distribution functions are not applicable to the grouping of National Inventory Control Points (NICPs), so the weights for the "Common Metrics" are determined by the Supply weight component alone. Similarly, the weights for the Common Metrics for the Defense Distribution Depots (DDDs) are comprised of the Storage and Distribution components listed above for metrics 46 through 55. Finally, the weights for the Common Metrics for Defense Reutilization and Marketing Offices (DRMOs) are based on the Supply and Storage components.

S&S JCSG Normalization Method

The primary normalization method is applied to all field data for each military value metric, with the exception of Metric 28 (workspace per employee) and T-Factors 1 and 2 (described in Appendix D). All field responses for each metric were normalized on a scale from 0.00 to 1.00. As a result, the Activity with the most preferred value for each metric received a normalized score of 1.00. Activities who do not accomplish the particular function being measured (indicated by its answer of N/A or zero[5] across all fiscal years for which data was requested) received zero military value points for that metric, and their responses were not included in calculating the mean and standard deviation of the data set. The Activity who accomplishes the function but had the least preferred value received a normalized score of 0.01.[6] All other data responses were normalized between 0.01 and 1.00 using a linear function between the least and most preferred values. To ensure that outliers would not skew the scoring function, the "least preferred value" and "most preferred value" were restricted to values within two standard deviations of the data set mean.

The primary method requires the following steps:

1) Determine the mean average of the data set.
2) Determine the "population standard deviation" (hereafter referred to as the "standard deviation") of the data set.
3) Assign all observed values outside 2 standard deviations of the metric's preferred direction from the mean a score of 1.00.
4) Assign all observed values outside 2 standard deviations of the metric's undesired direction from the mean a score of 0.00.
5) Use the highest value within 2 standard deviations and the lowest value within 2 standard deviations of the mean to create a range of values.
6) From the range created in Step 5, subtract the low value from the high value.
7) Use the value calculated in Step 6 as the denominator for all normalization calculations for the data set.
8) (a) Calculate the numerator by subtracting the low value in the range from each observed value in the data set (except those outside 2 standard deviations from the mean) when the metric assigns the highest score to the highest value in a data set.
   (b) Calculate the numerator by subtracting each observed value in the data set (except those outside 2 standard deviations from the mean) from the high value in the range when the metric assigns the highest score to the lowest value in a data set.
9) Divide the numerator from Step 8 by the denominator from Step 7 for all data.
10) Multiply the result from step 8 by 0.99. Then add 0.01.

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[5] For metrics where lower is considered better, a zero is a meaningful answer for an Activity that accomplishes the particular function and will not be scored the same as an "N/A" response.

[6] This distinguished the Activity with the "least preferred value" from an Activity for which the function being measured does not even apply.

Steps six through ten are shown in equation form below.

If a higher value equals a higher score, then:

$$\text{Normalized Scoring from the Range} = .99 \times \left(\frac{ObservedValue - LowValue}{HighValue - LowValue} \right) + 0.01$$

If a lower value equals a higher score, then:

$$\text{Normalized Scoring from the Range} = .99 \times \left(\frac{HighValue - ObservedValue}{HighValue - LowValue} \right) + 0.01$$

Additional Step Required for Metrics applicable to both Regular and Bulk Fuels Storage or Distribution

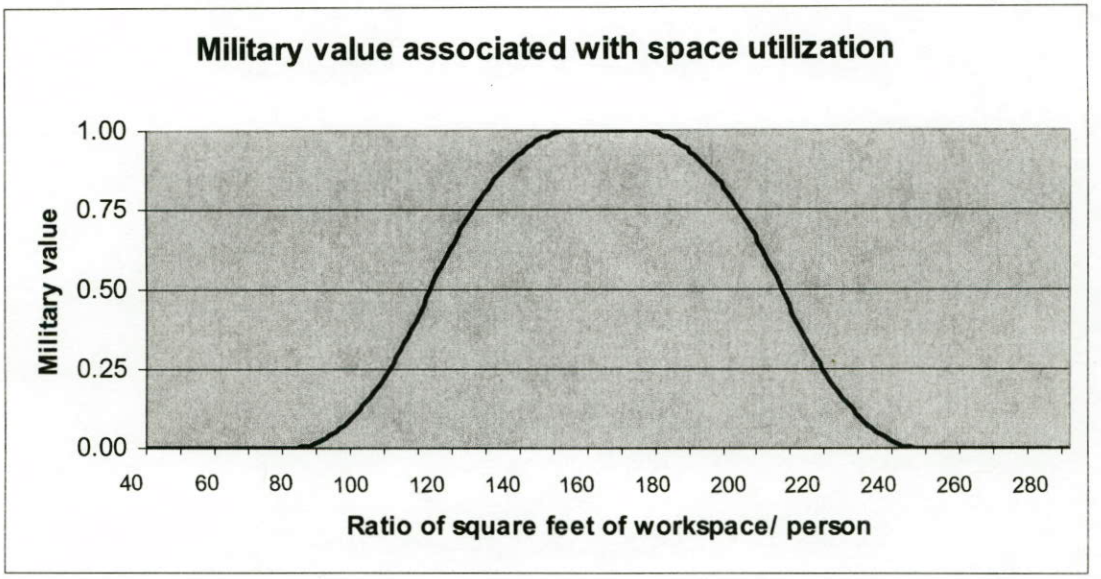
Metrics 15, 20, 27, and 36-39 measure attributes applicable to both regular and bulk fuels storage or distribution. For the same question, an Activity may provide data in one unit of measure for their regular storage or distribution (e.g. Gross Square Feet or line items shipped) and another for their bulk fuels storage or distribution (e.g. Gallons), if applicable. The S&S JCSG has chosen metrics that apply to both "wet" and "dry" storage/distribution at the same time, yet there is no direct relationship between the varying units of measure so that they could legitimately be normalized together. For these metrics, Activities were scored using the primary normalization method for each non-related unit of measure separately. Then, for each metric, the highest normalized score achieved by an Activity became its military value score for that metric.

For example, Metric 20 measures "total amount shipped". Data given as total line items shipped were normalized together as one data set using the primary normalization method, as were data given as gallons shipped. An Activity that ships regular line items *and* bulk fuels would receive the higher of their two normalized scores for Metric 20.

Secondary Normalization Methods Used

Secondary normalization methods are used on a case-by-case basis where non-linear functions better serve the scoring of metrics than the primary method. Two T-factors (see Appendix D) are scored using non-linear functions. One other question concerning workspace per employee is scored using a unique non-linear function (see Table B3 for scoring amplification). Figure B1 is provided to see the graphical representation of the non-linear function capturing workspace per employee.

Figure B1: Example Non-Linear Function Graph



Sample Calculation and Other Normalization Methods Considered

Table B2 provides an example of a data set with 21 Activities for a metric where a higher value demands a higher military value score. The example compares the normalization results of the primary method with two alternative normalization methods also considered by the S&S JCSG.

Table B2: Normalization Methods Considered

Activity	Field Response	Normalization Methods			
		Primary	Secondary	Alternative 1	Alternative 2
A	100	0.48	Secondary Normalization Methods are Dependent upon Assigned Non-Linear Functions (e.g. T1 and T2 in Appendix D)	0.01	0.15
B	110	0.53		0.01	0.20
C	120	0.58		0.01	0.25
D	131	0.64		0.01	0.35
E	141	0.69		0.01	0.45
F	**150**	**0.74**		0.02	0.55
G	161	0.80		0.02	0.70
H	171	0.85		0.02	0.80
I	180	0.90		0.02	0.85
J	190	0.95		0.02	0.90
K	200	1.00		0.02	0.95
L	n/a	0.00		0.00	0.00
M	10,000	1.00		1.00	1.00
N	10	0.01		0.00	0.05
O	151	0.74		0.02	0.60
P	139	0.68		0.01	0.40
Q	159	0.79		0.02	0.65
R	169	0.84		0.02	0.75
T	129	0.63		0.01	0.30
U	149	0.73		0.01	0.50
V	12	0.02		0.00	0.10

Applying the ten steps of the primary normalization method to Activity F in the table's example provides:

1) The mean average of the data set is 629.
2) The standard deviation of the data set is 2206.
3) Give all values greater than 5041 a normalized score of 1.00. (5041 = 629 + 2206 + 2206)
4) Give all values less than -3784 a normalized score of 0.00.[7] (-3783 = 629 – 2206 – 2206)
5) The maximum value within 2 standard deviations of the mean is 200 and the minimum scored value within 2 standard deviations is 10. 200 thus becomes the "most preferred value" and 10 becomes the "least preferred value"
6) Subtract 10 from 200.
7) Use the result, 190, as the denominator.
8) Subtract 10 from 150.

[7] This step does not affect the given data set.

9) Divide the result, 140, by 190.
10) Multiply the result, 0.74, by 0.99. Then add 0.01. Activity F's normalized score is .74.

$$(0.99 \times 0.74) + .01 = .74$$

Note that the example data set produces two normalized scores of 1.0. Activity M received a normalized score of 1.0 from Step three (outlier value). Activity K also received a normalized score of 1.0 as the highest value within 2 standard deviations of the mean, according to steps six through ten.

Alternative Methods of Normalization Considered by the S&S JCSG

Alternative Method 1 is a simplified version of the primary method and simply considers all values in a data set for normalization. To calculate Alternative Method 1, simply follow Step 5 through Step 9 of the primary method (but create the range of values using the true maximum and minimum values in the data set rather than values within two standard deviations).

- Pros
  - Simple to compute
  - Most commonly used
- Cons
  - Allows outliers to skew data
  - Minimizes the "scatter" of values

Alternative Method 2 ranks all values in a data set. Assigns a normalized score based only on the rank of the value in the data set.

- Pros
  - Provides "perfect scatter" of observed values in the data set
  - Negates the skewing effect of outliers
- Cons
  - Loses the "richness" of the data set; stripped of numeric values
  - Rarely used

Table B3: Scoring Workspace per Employee

Square Feet per Employee	Score	Square Feet per Employee	Score	Square Feet per Employee	Score	Square Feet per Employee	Score
<=81	0.00	121	0.65	161	1.00	201	0.67
82	0.01	122	0.67	162	1.00	202	0.65
83	0.01	123	0.69	163	1.00	203	0.62
84	0.01	124	0.71	164	1.00	204	0.60
85	0.02	125	0.73	165	1.00	205	0.58
86	0.02	126	0.75	166	1.00	206	0.55
87	0.03	127	0.77	167	1.00	207	0.53
88	0.04	128	0.78	168	1.00	208	0.50
89	0.04	129	0.80	169	1.00	209	0.47
90	0.05	130	0.82	170	1.00	210	0.45
91	0.06	131	0.83	171	1.00	211	0.42
92	0.07	132	0.85	172	1.00	212	0.40
93	0.08	133	0.86	173	1.00	213	0.37
94	0.09	134	0.88	174	0.99	214	0.35
95	0.11	135	0.89	175	0.99	215	0.33
96	0.12	136	0.90	176	0.99	216	0.31
97	0.13	137	0.91	177	0.98	217	0.29
98	0.15	138	0.92	178	0.98	218	0.27
99	0.16	139	0.93	179	0.97	219	0.25
100	0.18	140	0.94	180	0.97	220	0.23
101	0.19	141	0.95	181	0.96	221	0.21
102	0.21	142	0.96	182	0.95	222	0.19
103	0.23	143	0.97	183	0.94	223	0.18
104	0.25	144	0.97	184	0.93	224	0.16
105	0.27	145	0.98	185	0.92	225	0.15
106	0.29	146	0.98	186	0.91	226	0.13
107	0.31	147	0.99	187	0.90	227	0.12
108	0.33	148	0.99	188	0.89	228	0.11
109	0.35	149	0.99	189	0.88	229	0.09
110	0.37	150	1.00	190	0.86	230	0.08
111	0.40	151	1.00	191	0.85	231	0.07
112	0.42	152	1.00	192	0.83	232	0.06
113	0.45	153	1.00	193	0.82	233	0.05
114	0.47	154	1.00	194	0.80	234	0.04
115	0.50	155	1.00	195	0.78	235	0.04
116	0.53	156	1.00	196	0.77	236	0.03
117	0.55	157	1.00	197	0.75	237	0.02
118	0.58	158	1.00	198	0.73	238	0.02
119	0.60	159	1.00	199	0.71	239	0.01
120	0.62	160	1.00	200	0.69	>=240	0.00