

APPENDIX A: CAPACITY ANALYSIS METHODOLOGY

Overview

The Group analyzed individual activity infrastructure by examining the productivity of key resource inputs, e.g. labor (man-hours) and actual space (office, warehouse, etc.). Productivity in this case can be defined as the rate of production of work products per unit of resource. For example the number of contracts produced per contracting personnel, or the number of contracts produced per square foot of contracting workspace. The Group assumes that a low rate of productivity for key resource inputs indicates either inefficient use of resources and/or excess resource capacities.

For the Supply function the Group's capacity methodology uses a standard product and standard resource productivity rates to determine an activity's excess capacity. This is a common commercial industry analytical practice used to account for differences among activities that produce multiple products utilizing multiple resources. This standard-product approach mitigates many of the confounding factors that stem from differences in product mix among Supply and Storage activities. These factors would otherwise distort eventual activity-to-activity comparisons in support of BRAC infrastructure decisions. Additional detail on our standard-product approach and the resource mix that comprises the individual product is provided later in this Appendix.

In the Storage and Distribution functions the Group's methodology is simpler in approach. For storage, actual reported amounts of cubic and square footage of storage space are used to determine capacity. Storage resources are grouped into four (4) like categories representing regular and special covered storage, open storage and liquid storage for petroleum, oil and lubricant (POL) products. For distribution, current available loading bays at strategic distribution depots is compared to loading bays actually utilized by those activities to arrive at an excess determination.

In developing the capacity methodology the Group believed that the most important attribute was that it directly supported optimization modeling. It was also important that the methodology satisfy the Infrastructure Steering Group tasking that by-activity capacity figures are provided to determine an excess capacity total. These two factors were not necessarily mutually supporting which made our methodology development effort more challenging. Early on in capacity planning the Group sought guidance as to definitions of key capacity terminology (i.e. maximum potential capacity, current capacity, current usage, excess capacity and surge). Information provided from the OSD BRAC Office was that capacity terminology was to be defined by the individual JCSG in order to best present (their) functional activity analysis. These definitions have been discussed and approved by

OSD BRAC representatives. Overall *Capacity* for the S&S JCSG is defined in terms of resources. The Group's individual capacity definitions are as follows:

- Current Capacity. Total resources currently available to meet an activity's requirements. For their functions computed as:
 - Supply. Sum of available resources (labor and workspace).
 - Storage. Sum of available cubic footage available for each covered storage category, square footage for open storage, and barrels of POL for wet tank storage.
 - Distribution: Sum of available loading bays at strategic distribution depots.
- Current Usage. Minimum number of resources required to meet an activity's requirements. For each function computed as:
 - Supply. Minimum number of resources (labor and workspace) needed to product the required number of standard products in each supply labor category. (Utilization of standard product and resource productivity rates)
 - Storage: Sum of utilized cubic footage for each covered storage category, square footage utilized for open storage and barrels of POL for wet tank storage.
 - Distribution. Utilized loading bays at strategic distribution depots.
- Excess Capacity. Difference between current capacity and current usage plus surge.
- Maximum Potential Capacity. For purposes of S&S Capacity considered unbounded. For each function the most significant limiting factor on capacity is the number of resources available. In the case of supply, an activity may hire additional resources as required to accommodate increased supply demands. For storage resources can be arbitrarily increased to meet increased storage requirements through buying, leasing or building additional storage facilities. There are no limitations to distribution capacity that may not be remedied by the acquisition or use of additional resources (e.g. buying/leasing more trucks, utilizing additional airports or ports, running more trains, etc.)
- Surge. No DoD surge requirement was available or provided for the Group to factor into the capacity analysis. Despite this fact the Group felt that surge was an important factor in providing a sensitivity analysis as a means of mitigating risk that may arise from increasing requirements on systems with no additional infusion of resources. The Group believes this requirement-based definition of surge was more useful in determining true excess capacity than arbitrarily changing current usage resource levels to unsustainable levels.

Supply

Standard Supply Product. The Group's capacity analysis for the supply function utilizes a standard product and individual resource productivity rates to arrive at capacity determinations. Resource productivity is a measure of the annual output that a single unit of a resource is capable of producing. The standard supply product consists of a proportional mix of the major kinds of transactions that take place in the supply process. A mix of signed contracts, requisitions processed, inventory items managed, individual records managed, etc. are the actual product's components. The Group believes this amalgam is a more realistic representation of the many resources that are used by an activity in performing their Supply function. Resource data consists of FY03 reported information provided by individual activities through the data call. Use of a standard supply product accounts for the many differences among the activities both in the types of product they produce and the mix of resource they possess and utilize to produce those products.

- The supply product should be viewed as a single standard unit of throughput. This unit of throughput represents the long run average mix of outputs of the supply process, though it does not necessarily mirror the output of any particular supply operation.
- Many hours of different kinds of work would normally go into processing one of standard supply product (i.e. clerical, data entry, phone calls and faxes, estimating, accounting, financing, billing, report writing, credit checks, procurement advertising, etc.) We capture these in terms of their consumption of two types of standard resources. The metrics are:
 - standard full time equivalent (labor hours) consumed / year in processing each product and,
 - standard square feet of supply workspace (implicitly includes allocations of desk space, phones, aisle space, parking, overhead, utilities, etc.) consumed /year in processing each product.

Supply Resource Productivities. Resource productivity is a measure of the annual output that a single unit of a resource is capable of producing. The Group established common resource productivities to standardize resources for the supply function. To approximate an achievable ideal from our Capacity Data Call inputs, we employed an approach which utilized the top fifty percent of data from the activity population. Using this data we computed the average productivity of that resource in performing the Supply function. By design, the resulting productivity figures represent an "above average" rate of what is achievable in routine actual practice by activities producing a wide range of throughputs with a variety of different work methods and resources.

The group has built standardized resource productivity measures to determine: (1) how much excess capacity exists and (2) how it is distributed among the production resources when they are satisfying specific requirements for standard products. It effectively filters out the problematic differences in actual productivities that are routinely stem from:

- Differences in the resource ages/conditions, imbedded technologies, and skill levels of resources
- Measurement errors
- Randomness in the actual performance of the function at activities
- Differences in the product mix for the function at the different activities

Implicit in this approach is an assumption that low resource productivity is generally symptomatic of activities with excess capacity. (While it is acknowledged that more difficult workloads will have lower productivities, the wide range of activity productivities that make up the sample (fifty percent of the total) will largely negate this effect.) Conversely, it is assumed that high resource productivity is characteristic of activities with relatively little, or no excess capacity. This averaging process produces the following desirable effects:

- Random influences present in the data tend to cancel. So unbiased measurement errors tend to cancel and the impacts of any residual biased measurement errors tend to be minimized.
- Differences in resource efficiencies at the different activities are largely eliminated and high, achievable efficiencies of the best fifty percent of each separate type of resource are reflected in S&S's standard resources.
- Differences in the actual product mixes at individual activities are averaged and tend to reflect the same component product mixes in the standard throughput(s) for each function. Thus more difficult and easier workloads tend to average out.

Resource Utilization Rate. Armed with the standard product and standard resource productivity rates we compute a utilization rate for each activity's resources. This number is the rate needed to produce the activity's portion of the requirement for their grouping. For example, the Inventory Control Point (ICP) located at Tinker AFB, will be required to produce a certain portion of the overall requirement for all ICPs. This determines what percentage of each resource's possible production time is required to produce a unit of throughput.

Excess Resource Determination. The Group can compare the resource utilization rate at the activity to the group's top fifty percent average then

apply any observed difference to number of resources of the activity to determine excess capacity, i.e., the resource excess or shortfall.

Storage

The Group's capacity analysis approach for storage function focuses on resource amounts associated with regular storage (general purpose, shed, transitory shelter), Special Storage (controlled humidity, refrigerated, flammable/HazMat, magazine, dry tank and secure), Open (improved/unimproved) and barrels of POL for wet tank storage.

- Data call respondents' availability totals for each type of storage is considered current capacity and establishes the full available storage available.
- Actual storage space utilized is considered current usage and is as reported through the data call by the individual activity
- Excess capacity determination for the storage function is current capacity minus current usage.

In support of upcoming optimization methodology the Group also developed a standard storage product and storage productivities similar to methodology performed in support of the supply function. This standard storage product and resource productivities are required inputs for optimization.

Distribution

In the S&S capacity analysis, loading bays are looked at for both their availability and their usage as reported in the S&S Capacity Data call.

- Data call respondents' availability of loading bays is considered current capacity and establishes the full distribution available.
- Actual loading bays utilized is considered current usage and is as reported through the data call by the individual activity
- Excess capacity determination for the distribution function is current capacity minus current usage.

In support of upcoming optimization methodology the Group also developed a standard distribution product and distribution productivities similar to methodology performed in support of the supply function. This standard distribution product and resource productivities are required inputs for optimization.

Surge

Surge capacity is the maximum potential throughput per year that an activity can produce with its *existing* resources working on a stepped-upped, non-sustainable work schedule. The Group uses the term *surge* to mean using *existing infrastructure resources* to quickly respond to a *short duration sudden increase in demand*. The *surge requirements* define the size of that increase. No DoD surge requirement was provided or available for the Joint Cross Service Groups to factor into the analysis. However, the Group believes there is utility in computing and analyzing the impact of an increase in requirements, system-wide, on current resources. The effect of surge considered in this manner is to force activities to use more of their existing resources – effectively reducing the system-wide excess capacity. This approach effectively provides sensitivity analysis for the capacity report and provides a method of mitigating risk that may arise from an increase in requirements. The Group's analysis considered surge at two levels, plus ten and plus twenty percent (+10% and +20%). Excess capacity was computed in the same manner as with normal capacity just with an increased requirement imposed on the system.

Projected annual S&S requirements

In order to properly analyze capacity of S&S activities estimates of the overall requirements based on the projected force structure through 2025 and the impact of the Integrated Global Force Basing Plan should be factored into calculations. Absent these future requirements data for preparation of this report the Group considered the following possible impacts on current requirements:

- Flat, no-growth- assumes future requirements will be much like the recent actual throughputs (from the Capacity Data Call)
- Surge or quick response driven - assumes future requirements will be like the recent actual throughputs but with an increase in demand. In the S&S Capacity Analysis, surge requirements are met by temporarily enhanced resource usage. (See *Surge Requirements*, above)

Initially, the Group will base its estimates of excess capacity on satisfying projected requirements in the year 2010 utilizing currently available S&S activities and resources. Implicit in this, is an assumption that the requirements leading up to and following after 2010 will be very similar. These requirements will be adjusted based on information provided by the Services as to the impact of future force structure and basing plans on the functions of supply, storage and distribution. Should the reported information lack the level of granularity required to input into capacity

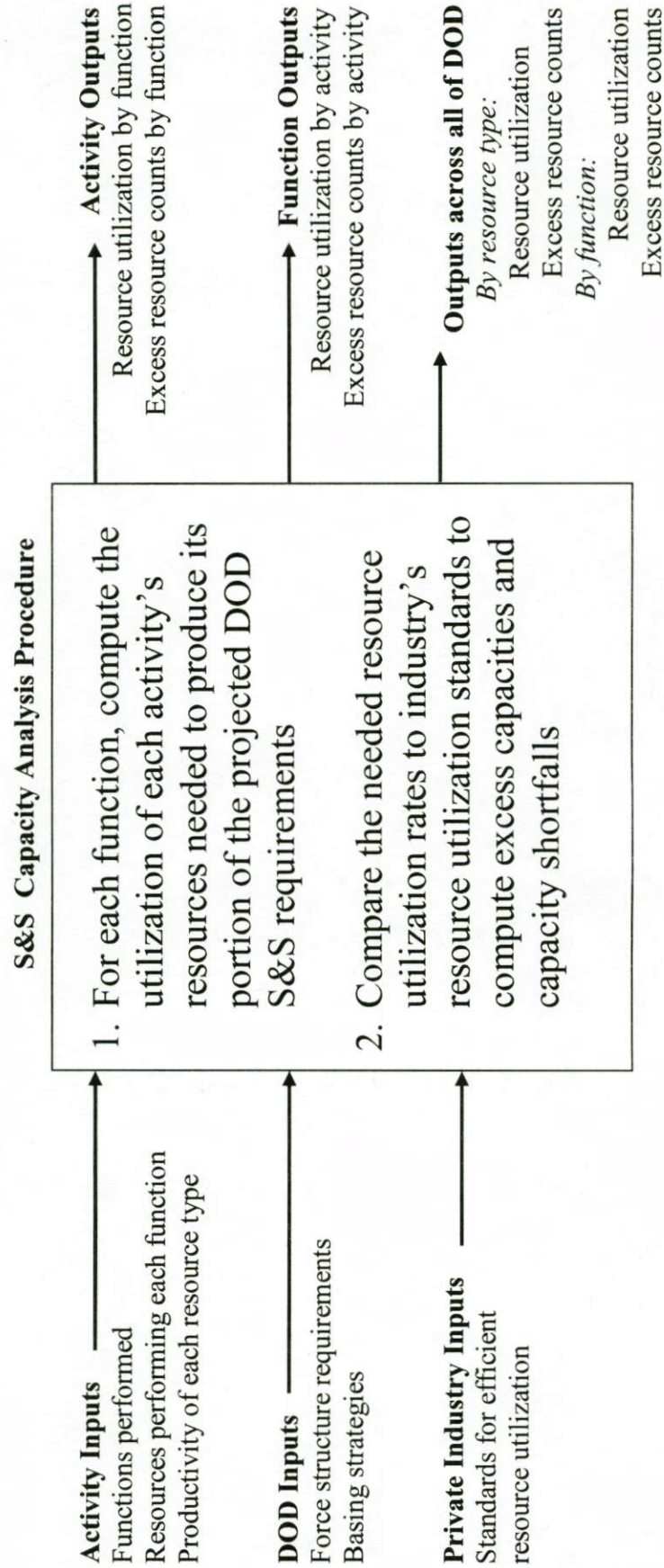
analysis and optimization methodology the Group will use current requirements and extend them into the future considering the four factors mentioned above.

Supply and Storage Capacity Analysis Methodology

The methodology followed by the Group for the supply function is graphically represented by the following three figures:

Figure A1

Schematic of the Supply and Storage Capacity Analysis



Notes:

1. There are three S&S functions: Supply, Store, and Distribute
2. Resources - there are 13 classes of labor, 1 type of workspace, 12 types of item storage, 1 type of POL storage, and 5 types of transportation terminals

Figure A2

S&S Capacity Analysis Procedure — Step 1

For each function, compute the utilization rates of each activity's resources needed to produce its portion of the projected DOD S&S requirements

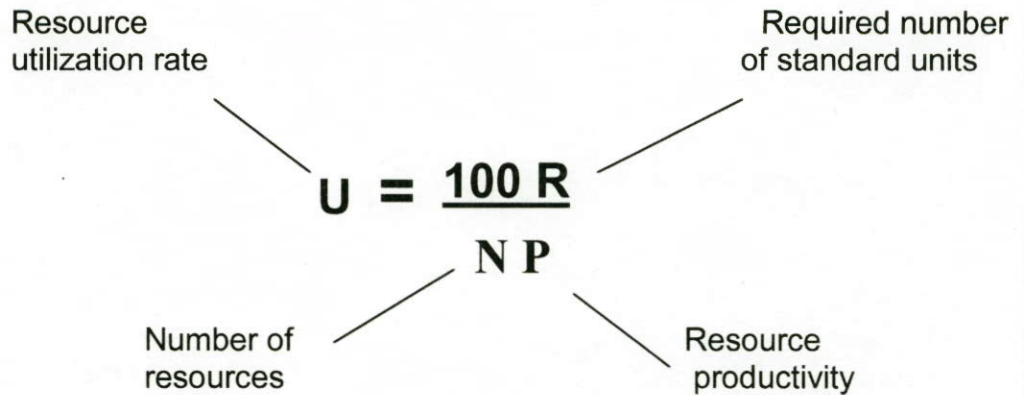
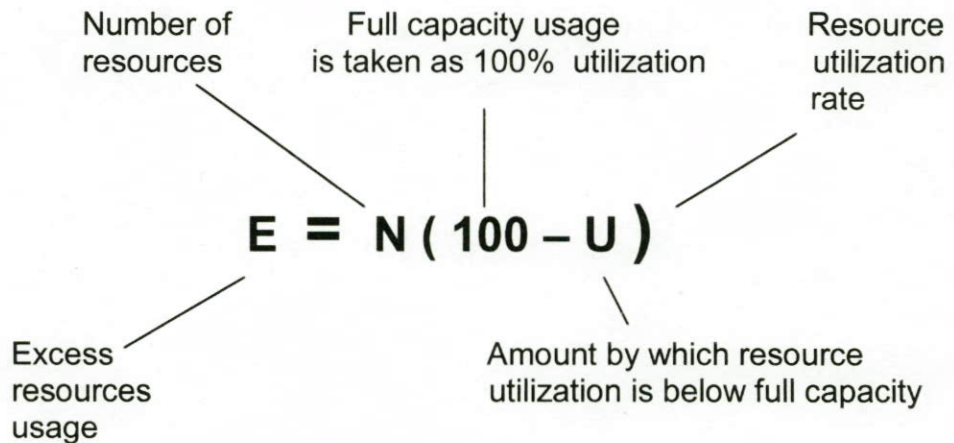


Figure A3

S&S Capacity Analysis Procedure — Step 2

Convert the estimated resource utilization rates to excess resources and resource shortfalls



Note: Utilization values greater than 100% imply extra resources are needed to produce the required number of standard products. Excess values that are less than zero give the sizes of any resource shortfalls.