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DCMC RESOURCE ESTIMATORS

JULY 1995

FOR

DEFENSE LOGISTICS AGENCY

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INSIGHT THROUGH ANALYSIS

DORO

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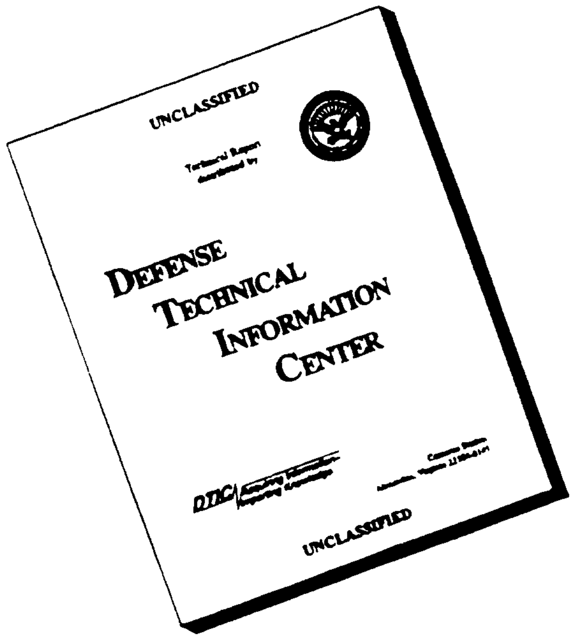

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July 1995

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FOREWORD

The Defense Logistics Agency (DLA) Defense Contract Management Command (DCMC) senior management asked the DLA Operations Research Office to develop models to support its newly implemented Resource Utilization Council (RUC) process. The models will help the RUC review staffing needs at each of the Defense Plant Representative Offices (DPROs) and Defense Contract Management Area Offices (DCMAOs). The models quantify the relationship between workload indicators and staffing. We wish to thank all the personnel at the three DCMC Districts who helped to identify possible workload indicators and collect the necessary data, the functional area experts at both the districts and DCMC Business Office who helped with the development by critiquing the models, and the Industrial Analysis Support Office who provided outyear data on contractor business activity. Finally, we would like to credit the DCMC Business Office who initiated and sponsored the effort.

HAROLD BANKIRER
Colonel, USA
Chief, DLA Operations Research Office

EXECUTIVE SUMMARY

The Defense Logistics Agency (DLA) Defense Contract Management Command (DCMC) manages more than 25,000 contractors having almost 375,000 contracts with a value of nearly $850 billion. To do this it has 33 Defense Contract Management Area Offices (DCMAOs) and 51 Defense Plant Representative offices (DPROs). Currently the staffing of these offices (not including the three district headquarters, DCMC International and DCMC Headquarters at Fort Belvoir) totals about 13,900.

In order to equitably and consistently estimate the staffing needed at each office, DCMC has instituted a Resource Utilization Council (RUC) to determine the appropriate staffing levels at the Contract Administrative Offices (CAO). The RUC process does this using analytical models, field input, and human judgment. The RUC process will ensure that the DCMC Field Organizations are properly sized for accomplishing their mission in the most efficient manner. This is a must in today's government reinvention and DoD downsizing environment.

DCMC requested that the DLA Operations Research Office (DORO) develop models for use in it's RUC process. These models quantify the relationship between workload measures and staffing. The workload measures are indicators that are external to DCMC such as contractor employees for DPROs or number of contractors for DCMAOs. As a result of DLA senior management requests, DCMC asked that the models not assume that current staffing levels are appropriate, and the models result in "should-be" staffing. In this regard, the models result in workload per employee rates that are as high as they have been during the past 20 years. Within the context of this historical comparison the models are "should-be" in nature.

After an extensive literature search, and many discussions with HQ DLA experts, we determined that adapting the model the Air Force Manpower Engineering Team (MET) developed for Air Force Plant Representative Office (AFPROs) would be the best approach for DPROs. The search revealed no other methodologies that could be used or adapted to determine "should-be" type staffing other than the one used in the AF MET Model.

We could not adjust the MET AFPRO model for DCMAOs. However we did borrow its general structure to develop a new model. We did this because there are no prior DCMAO models other than previous DORO models. Those models are no longer appropriate because of DCMC's move to teaming.

Besides estimating current year requirements the models will also be used to project seven year staffing requirements. This projection is made by using independent outyear information compiled by the Industrial Analysis Support Office (IASO).

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SECTION 1

INTRODUCTION

The Defense Logistics Agency (DLA) Defense Contract Management Command (DCMC) manages more than 25,000 contractors having almost 375,000 contracts with a value of nearly $850 billion. To accomplish this it has 33 Defense Contract Management Area Offices (DCMAOs) and 51 Defense Plant Representatives Offices (DPROs). Currently, the staffing of these offices (not including the three district headquarters, DCMC International, and DCMC Headquarters at Fort Belvoir) totals approximately 13,900. In today's dynamic government reinvention and DoD downsizing environment, total and individual office staff sizes are being questioned. What is the proper size for efficiently accomplishing this important mission?

In order to equitably and consistently determine the staffing needed at each office, DCMC has instituted a Resource Utilization Council (RUC). This council will use analytical models, DCMC Field Organization input, and judgments by its members to determine the individual office as well as the overall staffing level for DCMC field offices.

DCMC requested that the DLA Operations Research Office (DORO) develop models for use in the RUC process. The models will serve as a starting point in setting appropriate Contract Administrative Office (CAO) staffing levels. These models cannot incorporate all the special requirements unique to individual CAOs. Therefore the models will not result in a final staffing level. They do provide a consistent starting point based on the general workload. From this starting point the RUC will then consider other factors that may affect staffing at the CAO, including special requirements or situations. The RUC, in conjunction with input from the District Commanders, will determine final staffing levels.

1.1 OBJECTIVE

The objectives of this study were to:

a. Search the literature, including both formal and informal documentation, on applicable contract management staffing estimating techniques, if any.

b. Identify statistically valid and intuitively logical workload indicator(s), external to DCMC if possible, for DPROs, and separately for DCMAOs.

c. Develop a credible DPRO resource estimator, and a credible DCMAO resource estimator.

d. Use the DPRO and DCMAO resource estimators to make estimates of staffing requirements that the RUC can use as a starting point for the RUC process.

e. Develop a methodology for projecting outyear DPRO staffing requirements for the POM process; develop a separate methodology for projecting DCMAO requirements.

f. Make a seven year projection of total DPRO staffing requirements and do the same for DCMAOs.

1.2 SCOPE

The workload indicators and models were identified and developed within the scope outlined below:

a. District Headquarters staffing, DCMC International, including San Juan, PR, and Ottawa are not included in this study.

b. The workload indicators are to be external to DCMC if possible.

c. Military workyears are included in the analyses since the corresponding work output is included in the workload indicators.

d. The resource models, to the extent possible, should estimate "should-be" staffing levels.

SECTION 2

METHODOLOGY

An extensive literature search was conducted and previous studies in this general area were reviewed. After that, candidate workload indicators were identified based on previous surveys of field experts as well as recent discussions with CAO advisors to this study. Finally, workable models were developed that are easily understood, equitable, resistant to gaming the input data, and intuitively logical.

2.1 LITERATURE SEARCH

Previous Plant Representative Office (PRO) staffing studies and models include the Air Force MET model, a 1981 Naval Air Systems Command (NAVAIR) PRO model, and the 1989 Defense Analysis Studies Office (DASO) study, "Staffing of Service Plant Representative Offices." The MET model used regression analysis to make an all-inclusive estimate of each Air Force PRO's workhours requirement using contractor employees as its indicator. This was then converted to workyears. The DASO study developed a regression model based on a sample of both DLA and Service PROs. It used contractor sales and employees as workload indicators. In investigating this model we found that the sales indicator no longer provides the explanatory power that it did when this model was first developed. Contractor employees still does. We also reviewed the NAVAIR model. We found that it would not be feasible or possible to collect data for all the indicators in this model. Even if it were, some of those indicators should not have been included in the model. There were no previous documented DCMAO models except those developed by DORO, probably because DCMAOs are unique to DCMC. These DORO models are no longer appropriate because of DCMC's move to teaming.

2.2 CANDIDATE WORKLOAD INDICATOR SELECTION

The indicators tested in this study were primarily those suggested by CAO field personnel during previous DORO studies. Each of these were believed to have a strong, logical relationship with workload. The indicators tested for the DPRO model were contractor employees and contractor sales. Among the indicators tested for the DCMAO model were; number of contractors, number of contracts on hand, number of contracts received, dollar value of contracts received, unliquidated obligations, and number of progress payments. In testing these indicators, only active contracts were included. We also looked at using Unit Cost System workcounts as indicators in the model. (These are not external indicators, but we were strongly urged to look at them after previous DORO models were developed. UCS was designed to have a significant role in monitoring completed work.) We computed the total standard costs for each CAO using the UCS workcounts. We tested the viability of using separate standard costs for DCMAOs and DPROs and of modifying the points of count (e.g. the way that Part B contracts are treated). We tried using contracts received vs. contracts closed. None of these avenues gave results that were better than the final models, nor could we find a way to use them to improve the final models.

2.3 MODEL DEVELOPMENT

The DCMAO model, as well as the AF MET model for AFPROs, were developed with the same overall methodology. This methodology, which uses regression analysis, is endorsed by DLA in DLAM 1100.2, Integrated Management Engineering System Manual, which implements the requirement for "effective use of ... statistical techniques" called out in DoD Directive 5010.31, DoD Productivity Program, for the purpose of work measurement. Regression analysis picks indicator(s) with the strongest correlation with workload and constructs the mathematical relationship that best fits the data. Regression analysis quantifies the relationship between variables thought to be logically linked, for example between workyears and number of contractors. The change in one variable is directly related to the change in the other, but the change in one does not necessarily *cause* the change in the other. For example, the number of contractors does not cause Contract Management work. Although the workload indicator (in this case number of contractors), does *not* cause work, it may serve as a proxy for other variables that *do* cause work. These other variables may not be included in a model for a number of reasons. For example, they cannot be identified, they cannot be measured, or data cannot be collected for them.

The indicator(s) in the model explain part of the variation in the level of staffing. One part of the variation (the error) is due to variables that it was not possible to find, or to put into the models. Another part is due to a number of random causes, for example, a personal view on how Contract Administration should be staffed or, for example, staffing guidelines differ among districts.

Regression analysis also compares activities with each other. In so doing, it does not find ideal solutions. For our purposes in ascertaining proper staffing, if all activities were over-resourced or under-resourced (on average), then models developed with such data would have (again, on average) the same bias. To see if activities, in aggregate, were over- or under-resourced when the models were developed and to be able to make adjustments if necessary, we reviewed historical productivity rates. For DPROs, the model was developed by the Air Force MET with 1987 data. This is at, or near the point of highest DPRO productivity for a 20 year period. Until recently the point of highest productivity for DCMAOs was in the 1987-89 timeframe, but current DCMAO productivity exceeds that rate. Tables given later in Sections 3.1 and 3.2 compare workload and staffing changes since 1989. Attachment 1 shows DLA productivity in years prior to 1989.

Military workyears are included in the estimates because military personnel contribute to work output. Eliminating them would cause significant variations where the percentage of military personnel differed between activities.

In developing the regression models, typically two or three activities at extreme variation from the trend line (outliers) were eliminated and the models recast. Including the outliers would influence the resultant models. This is a conventional technique. The variations of the outliers, in this study, are believed to be due to special situations or influences that are not present for other activities, rather than random variation. Also, one activity that was much larger than the rest of the group was eliminated (Baltimore). It was not excluded because it might have been an outlier, but rather because such an activity would have had an undue large, mathematical impact in determining the model.

Contractor employees was ultimately identified as the best workload indicator for DPROs. For DCMAOs, the number of contractors was ultimately found to be logically and statistically the best. However, since 1990 more than 30 smaller DPROs have been absorbed into DCMAOs. Most of these former DPROs still have personnel in contractor plants. As a result, in order to best estimate the resources needed for DCMAOs, the work and workyears at these DPRO-like activities (that have been absorbed) should be separated from their "core" DCMAO. The core DCMAO and its DPRO-like activities can then be estimated separately and added together to get the total DCMAO estimate.

SECTION 3

RESULTS

3.1 DPRO MODEL

3.1.1 Background

We found an adaptation of the Air Force Manpower Engineering Team's (MET) AFPRO model to be the best model for estimating staffing levels at DPROs. The methodology was validated and then successfully used by the Air Force during the approximate period 1986 through 1989. The AFPRO model was reviewed in 1989 during a Defense Analysis and Studies Office study and found to be viable for assessing should-be DPRO staffing. The model uses the number of contractor employees as its external workload indicator.

The number of contractor employees also serves as a proxy for the monetary factor as well as for nonquantifiable factors such as volume and complexity of business, and priority of programs. These factors represent risk to the government which should trigger Contract Administration Service oversight (work). The contractor employees indicator provides a uniform way of translating this risk (triggering work) into DPRO staffing. The advantages to using this indicator are that it is:

- Visible: Information about layoffs and increased hirings is often well publicized. So is information about winning and losing contracts. At the plant level, empty or shrinking office space and plant capacity is a visible signal. At longer distance, media reports of planned layoffs are also a signal that DPRO staffing plans should change. Expansion plans are taken into consideration when documented in contractor business plans.

- Understandable: People understand that high levels of contractor employees correlate to big payrolls and high levels of contractor business activity, and vice versa. They can also grasp that using the model to link DPRO staffing to contractor staffing will result in implementing CAS oversight in proportion to the contractor's activity, as translated by DoD spending of taxpayer dollars. On the other hand, since the relationship is not perfectly precise, the RUC will make adjustments on an individual basis.

- Credible: The contractor employees indicator was successfully used in the AF MET model, and validated by the AF. Later, it was favorably reviewed in a Defense Analysis and Studies Office report.

- Able to Account for Complexity: Complex projects usually involve more intensive engineering efforts, more spending, and higher employment levels. In situations where employment is primarily production related, the model will indicate higher DPRO staffing than might be needed at this stage of the program.

The RUC will take this into account by considering the phase of the program.

- Responsive to Contractor Sensitivities: Some contractors want DPRO staffing to decline when their staffing declines. Some contractors are extremely concerned about this. Establishing a DPRO to contractor employee linkage should help relieve contractor concerns.

- A Leading Indicator: Contractor employees generally leads other indicators of contractor activity such as contract disbursements or contractor sales. Using this indicator will enable DCMC to ramp up and down in coordination with contractors, and with the need for timely oversight and contract administration. Experts have observed that, in the past, staffing changes have had a tendency to lag contractor activity.

- External to DCMC: The contractor controls this indicator. It is watched by DCMC's cost monitoring function and so is available. Outyear reporting on this indicator is done through the Industrial Analysis Support Office (IASO). DCMC in-plant personnel help IASO get the information from the contractor.

3.1.2 Adaptation of the MET AFPRO Model

The original model, derived and validated by the Air Force's Manpower Engineering Team (MET) is as follows:

Staffing = 47 + (0.00852 X No. of Contractor Employees)

Contractor employees were those employees working on AFPRO contracts, in facilities over which the AFPRO had cognizance. The constant term, 47, included both "fixed" (or indirect) management and administrative type workers as well as "variable" (or direct) workers. This constant was adjusted upward by 2 if the AFPRO had flight operations. The coefficient 0.00852 was derived using regression analysis. The model was adjusted to add workyears to two AFPROs with NASA work, based on the average number of monthly mandatory inspections.

Using the model as the starting point, the Air Force made further adjustments based on a qualitative evaluation of a number of other factors affecting the current workload at the AFPRO such as: the contractor's five year workload projections, the complete business environment of the contractor, and the number, status, and phase of all key programs in-plant.

3.1.3 Reformulation for use in DCMC Resource Estimator (DRE) for DPROs

The MET AFPRO model described above was reformulated for use in DCMC as follows:

Staffing = 42 + (0.00825 X No. of Contractor Employees)

Contractor employees in the reformulated model are defined as those working on DoD contracts. The constant, 42, and coefficient, 0.00825, in this reformulated model have been revised because of restructuring and mission loss (to nearby DCMAOs). See Attachment 2 for the composition of the constant term. (A group of DPRO experts met at Headquarters DCMC to re-derive this constant.)

Adjustments are to be made for:

- Flight operations: add 3 to the constant (other flight operations personnel that are needed are included in the variable term)

- Small DPROs: Subtract 8.25 workyears for each 1,000 contractor employees below 3,260. *This is an adjustment to the constant of 42.* (The AF had no small DPROs but DLA does. This adjustment is needed so as not to double count the variable staffing needed. The AF also included some variable resources in its constant term.)

The table below tests the "should be" reasonableness of this model. It shows that the output from the model for FY 94 results in a change in staffing from FY 89 to FY 94 that tracks the change in the business level of the contractor over the same period. (The 33.4% decrease in DPRO staffing based on the DCMC Resource Estimator (DRE) falls between the 27.2% decrease in contractor shipments and the 41.1% decrease in contractor employees.) FY 89 is an appropriate year to choose as a baseline year for this comparison because based on an OSD study "Reassessment of Defense Agencies and DoD Field Activities", it was a very productive year for DLA. This 1987 study found that "within the past 12 years alone, DLA has achieved a 60% productivity improvement... the chart [at Attachment 1] compares the increase in workload that DLA has undergone without a corresponding increase in staffing".

DPROs Change In Business Level and Staffing *
(as of end of FY 94)

	FY 89	FY 94	% Chng
Contractor Business**:			
Contractor Empl	550,876	324,453	-41.1
Shipments FY 95$ (Bill)	109.31	79.62	-27.2
DPRO Staffing**:			
Actual vs. Actual	7,192	5,121	-28.8
FY 89 ACT vs. FY 94 DRE***	7,192	4,792	-33.4

* The number of DPROs has been continually declining. The chart measures the change only for those existing at the end of FY 94

** Without Michoud (all work is for NASA)

*** DCMC Resource Estimator (DRE) for DPROs

Had the change in overall resources indicated by the model (-33.4%) been outside the range of the change in contractor business activity (-27.2% to -41.1%), the model could have been adjusted. Attachment 3 shows DPRO staffing and workload trends since 1989, the first year for which such data is available. Attachment 4 displays staffing requirements at DPROs, using the DRE.

3.2 DCMAO MODEL

There are no prior applicable models for DCMAOs other than previous DORO models, (these are no longer appropriate due to the move to teaming). While the DPRO model which follows cannot be adjusted for DCMAO use, its general structure can be used for the "CORE" DCMAO model.

Staffing Level = constant + (coefficient X workload indicator)

The overall DCMAO model has 3 components: DPRO-like activities that have been absorbed into the DCMAO, the core DCMAO, and unique functions.

3.2.1 DPRO-like Model Component

Staffing for DPRO-like activities (that is single contractor DCMOs, and residencies that were DPROs on or after June 1990) will be estimated using the model:

DPRO-like Staff = 2 + (0.00825 X Contractor Employees)

This is based on the DPRO model. The constant was reduced from the value in the DPRO model by consensus of a group of DCMAO and DPRO experts. This model advisory group determined, after considerable review, that the constant for the DPRO-like model should be set at 2. Their assessment was that this constant, representing the commander and a secretary, was appropriate because other overhead would be provided by the DCMAO.

3.2.2 Core DCMAO Model Component

The next step in building the model was to establish the value of the constant for the core DCMAO. Although the MET model had fixed and variable staffing in the constant, it would be difficult to determine how much variable staffing should exist in the DCMAO constant. After reviewing the relevant modeling and staffing issues, the constant was defined as the fixed management and administrative staffing of the storefront for a DCMAO, and set at 31. (This figure includes only the fixed staffing, it has no variable staffing. See Attachment 5.)

In order to identify the best workload indicators that correlated with DCMAO staffing, we adjusted staffing to make it more consistent between DCMAOs, and called it Core DCMAO staffing. The first adjustment was to take out the actual DCMC staffing at the DPRO-like activities discussed above. The next adjustment was to subtract people performing unique functions; not only those that may not be performed at all DCMAOs, but also those performed for CAOs other than the host activity. The model advisory group determined that the following functions were to be considered "uniques".

Reimbursables	International Logistics Office
Plant Clearance	Safety
Transportation & Packaging	Navy Nuclear
Small Business	Customer Liaison
Counsel	Defense Corporate Executive
Terminations	Functional and Systems Support Team
Contractor Insurance /Pension Review	Flight Operations
Contractor Purchasing System Review	Automated Data Processing Equipment Support
Lumber (Seattle & Atlanta only)	Automated Data Processing Equipment Review
Propellers & Shafts	Precious Metals
Corporate Administrative Contracting Officer	Fuels Quality Assurance
Defense Criminal Investigative Service Support	

The staff performing the unique functions is not estimated. (As of 6/30/95 there were only 1,292 uniques out of total DCMAO staffing of 8,841.) The actual staff for these unique functions was subtracted from the total actual staffing before we did the regression, then added back to the estimate obtained from the regression analysis.

In contrast, the actual staff for the DPRO-like activities is subtracted from staffing before regression is done, but what is added back is an estimate of staffing for these activities, using the formula described above:

DPRO-like Staff = 2 + (0.00825 X Contractor Employees)

We then performed regression analyses to identify the best DCMAO workload indicator. Dollar value of shipments would logically have been the first candidate to test as a workload indicator, but we did not have complete shipment data on all the contractors. In assessing these indicators, we found that traditional workload indicators that had previously correlated well with staffing no longer did so. This means that for DCMAOs having nearly the same level of an indicator, say Unliquidated Obligations (ULO), there is relatively wide variation in their staffing. Likewise, for those DCMAOs having nearly the same staffing, there is relatively wide variation in their ULO. (The degree of variation in this type of comparison is referred to as scatter.) Relatively wide scatter was also evident with number of contracts received and dollar value of contracts received. The weak correlation between staffing and some workload indicators are possibly the result of recent rapid organization and workload changes. (In doing these analyses we did not subtract the fixed management and administrative staffing constant of 31 since our objective at this point was only to find the best indicator.)

The workload indicator having the best correlation with staffing was a composite made up of the number of Part A contractors plus 30% of Part B contractors. (Contractors with *both* Part A and Part B contracts were counted only once.) Part A contracts are expected to require extensive controls by the Administrative Contracting Officer (ACO), but Part B contracts are expected to require work by the ACO only on a "management by exception" basis. A 1981 Philadelphia District study found that only 22% of Part B contracts required ACO involvement. In testing the correlation of the indicator with staffing we found 30% Part B to be slightly better than 22%. Unlike the Philadelphia study, our tests included all core DCMAO functions (excluding uniques), not just the ACO functions.

A benefit of using the number of contractors, instead of the number of contracts, is that it helps avoid inaccurate counting, if contracts are not expeditiously moved from Contract Administration Report (CAR) Section 1 to Section 2. The scope of this potential problem is reduced when the number of contractors is used because most contractors have more than one contract. So if a contractor had one (or more) contracts properly listed in Section 1, and several that were not, the contractor count would be one and would be appropriate. (If contracts had been the indicator the count would have been distorted.)

The number of contractors indicator had an "R-squared" of about 72%. R-squared is a statistic that, in this case, measures the amount of change in staffing that is explained by the change in the workload indicator. The remaining 28% is explained by other variables that could not be brought into the model, as well as random variation. This indicator counts only normalized contracts, that is those where production is not complete, thus avoiding inactive contract counts. (It also removes any potential benefit from letting inactive contracts remain open.) The staffing figures used in this regression analysis took out DPRO-like and unique actual staffing, but not the fixed and administrative constant of 31 (which is taken out in the next step). This allows regression to select a constant and determine the R-squared for the selected indicator. When the constant is fixed (set to 31) in the next step and the regression is run through 0, the R-squared is no longer a meaningful statistic.

The last step in building the model was to determine the coefficient of the workload indicator with the constant set at 31. (The fixed administrative and management staffing level derived by the model advisory group). This was done with regression between the modified staffing levels (as of 30 June 1995) and the composite workload indicator, *while holding the constant term at zero*. Staffing levels were modified to make them consistent between DCMAOs, subtracting the staffing for DPRO-like activities and uniques as before, but now also subtracting the fixed administrative and management staffing constant of 31. Values for the composite workload indicator were an April through June 1995 average. Staffing data as of 30 June 1995 was appropriate to use, since it is the time DCMAOs were the most productive. (We can calculate the productivity from the data in the chart in Attachment 6. It is workload divided by staffing.) From this regression analysis the coefficient was determined to be 0.602.

Thus we have a value of 0.602 for the coefficient of the composite indicator term, *if the model had a constant of zero*. This enabled us to add back the 31 (that was previously subtracted from the staffing) that represents the fixed administrative and management staffing, which was the constant in the model. This technique must be used to determine the value of the coefficient in a model where the constant has been prespecified. What this means is that 31 people are "fixed", or indirect, and do not vary as the workload varies. The remaining variable, or direct, staff (not including DPRO-like and unique staff) increases by about 6.02 people for each 10 added composite work units (the number of contractors with Part A contracts + 30% of the number of contractors with Part B contracts).

Putting the two terms together results in:

Core DCMAO Staffing = 31 + (0.602 X Composite Work Units)

Where: The composite work units = Number of Part A Contractors + 30% of the number of Part B Contractors

Adding the *actual* staff required for the unique functions listed above and the *estimate* for the DPRO-like activities to the staffing estimated in the above formula results in the *total estimated* staffing for a DCMAO.

Attachment 7 discusses the DCMAO model regression statistics. Attachment 8 displays staffing requirements at DCMAOs using the DRE.

The following table demonstrates the "should-be" reasonableness for DCMAOs. The output from the model for FY 94 results in a change in staffing from FY 89 to FY 94 that tracks the change in the business level of contractors over the same period. In this case however, both the actual staffing and model output have exceeded the decline in the contractor business level since FY 89. Shipments are a better measure of workload for DCMAOs than contractor employees. This is because the number of contractor employees, working on DoD contracts vs. non-DoD, is much more difficult to identify and collect than the value of DoD shipments for these smaller contractors. As a result, FY 94 is now a more productive year than FY 89 and also more relevant to use as the baseline for developing the DCMAO model.

DCMAOs Change in Contractor Shipments* and Staffing**
(as of end of FY 94)

	FY 89	FY 94	% Chng
Contractor			
Shipments FY 95$ (Bill)	24.2	18.5	-23.6
(Sample of Total)			
DCMAO Staffing:			
Actual vs. Actual	12,223	9,164	-25.0
FY 89 ACT vs. FY 94 DRE***	12,223	8,683	-29.0

* Based on Industrial Analysis Support Office (IASO) sample

** DCMAOs are continually absorbing DPROs. Therefore to make the comparison consistent it is based on those DCMAOs in existence at the end of FY 94 with their FY 89 organizations reconstructed to include any DPROs (or DCMAOs) they have absorbed since.

*** DCMC Resource Estimator (DRE) for DCMAOs

Attachment 6 shows DCMAO staffing and workload trends since 1989, the first year for which such data is available.

3.2.3 Unique Functions

Staffing of unique functions in DCMAOs is driven by considerations not directly related to the number of contractors. For this reason they are not included in the core DCMAO part of the model. They are not estimated. They are included in the DCMAO total at the current actual level. As a result, there is no need to report or review unique staffing during the RUC meeting. The adjustment for uniques in the DCMAO total will have already been made. Further discussion of uniques only confuses the issue of whether the remaining staff (the core DCMAO and DPRO-like activities) are properly matched to workload.

3.3 LONG RANGE PLAN PROJECTIONS

These models may also be used to make outyear projections. The DPRO projections are made simply by inputting contractor employee outyear data that was supplied by contractors to the Industrial Analysis Support Office (IASO). (See Attachment 3.) Such a projection has the advantages of being bottoms-up as well as driven by data that is, to the extent possible, external to DCMC. (The IASO data has projections for three years. The remaining outyears were extrapolated by DORO, using individual contractor trajectories.)

The DCMAO projection cannot be made using *TOTAL* shipments values. This is because we only have the projected shipment values for a sample of the contractors in each of the DCMAOs. It would not be possible or practical for IASO to try to gather data for all DCMAO contractors. However, the sample, in view of both the number of contractors and relatively high value of the shipments, was deemed to be representative. It includes 250 large DCMAO contractors DCMC-wide. As a result, the total value of shipments is not available in the base year or the outyears. Nor can it be estimated for either the base year or outyears. However, because the sample is representative, we can infer that the year-to-year change in the sample is the same as the year-to-year change in total shipments (even if we do not know the value of total shipments).

Therefore, to project DCMAO staffing requirements, we start with the FY 94 estimate of variable workyears from the DCMAO model (not including the DPRO-like activity estimate) and change it from year to year in proportion to the change in the sample data for the DCMAO shipments value (all $ values are expressed in constant FY 95 dollars):

> Variable component of FY 94 estimate X (FYXX Shipments /FY94 Shipments)
> + fixed component (including uniques) + DPRO-like activity estimate.

The projected estimates are in Attachment 6. The part of the DCMAOs made-up of DPRO-like activities were projected at the overall DPRO rate of change and included as such in the DCMAO projection in Attachment 6.

SECTION 4

CONCLUSIONS

The models set a uniform methodology for staffing CAOs throughout DCMC. They are easy to visualize, and offer a basis for comparing activities. Field personnel often claim that certain activities are "different". The models, in view of the parametric comparisons they make, will help determine whether perceived differences are real.

4.1 ESTIMATED VALUES

Staffing levels, workload indicator values, and DRE estimates for DPROs are in Attachment 4. Corresponding data for the DCMAOs is in Attachment 8. Attachment 9 is a discussion of control limits.

The estimate values are a starting point from which the RUC will consider other factors affecting workload. For example in the case of DCMAOs it may look at the proportion of contracts with higher risk, and the proportion of contracts not involving Quality (e.g., consulting contracts). In addition, the RUC will review information and analyses regarding other measures not used in the model. Such indicators could include: ULO, dollar value of contracts received, normalized contracts on hand, and where relevant, the geographic concentration of contractors.

4.2 STAFFING OF UNIQUE FUNCTIONS

Unique functions are not estimated, they are included in the model results at their current actual level. As a result, they do not affect model results and there is no need to review them during the RUC meeting.

4.3 BENEFITS

These models will enable DCMC to better allocate resources and more effectively evaluate the impact of changes in budgets, policy and operations. They use statistical measures to compare workload. They show imbalances. Results can be used, for instance, to shift resources from a DCMAO that is over resourced by 30 workyears to one that is under resourced by 30. The use of a leading indicator such as contractor employees allows the model to identify potential resourcing problem areas. For example, it could identify an accelerating weapons system program that is relatively understaffed. Also, it could identify contractor downsizings that will impact DPRO staffing. Both the DPRO and DCMAO models will give DCMC a defendable, fair, analytical tool for resourcing decisions, and should help minimize the effort and time required leading to these decisions.

4.4 USE IN LONG RANGE PLAN

DCMC is using the models to make outyear projections for the POM.

SECTION 5

RECOMMENDATIONS

The Resource Utilization Council (RUC) should use the DPRO and DCMAO resource estimators as tools to identify parametric staffing levels. The RUC is then in a position to apply the special staffing requirements that are unique to individual offices.

As the RUC gains experience and more data becomes available, the model can be adjusted to reflect experience gained in the final staffing process.

ATTACHMENT 1

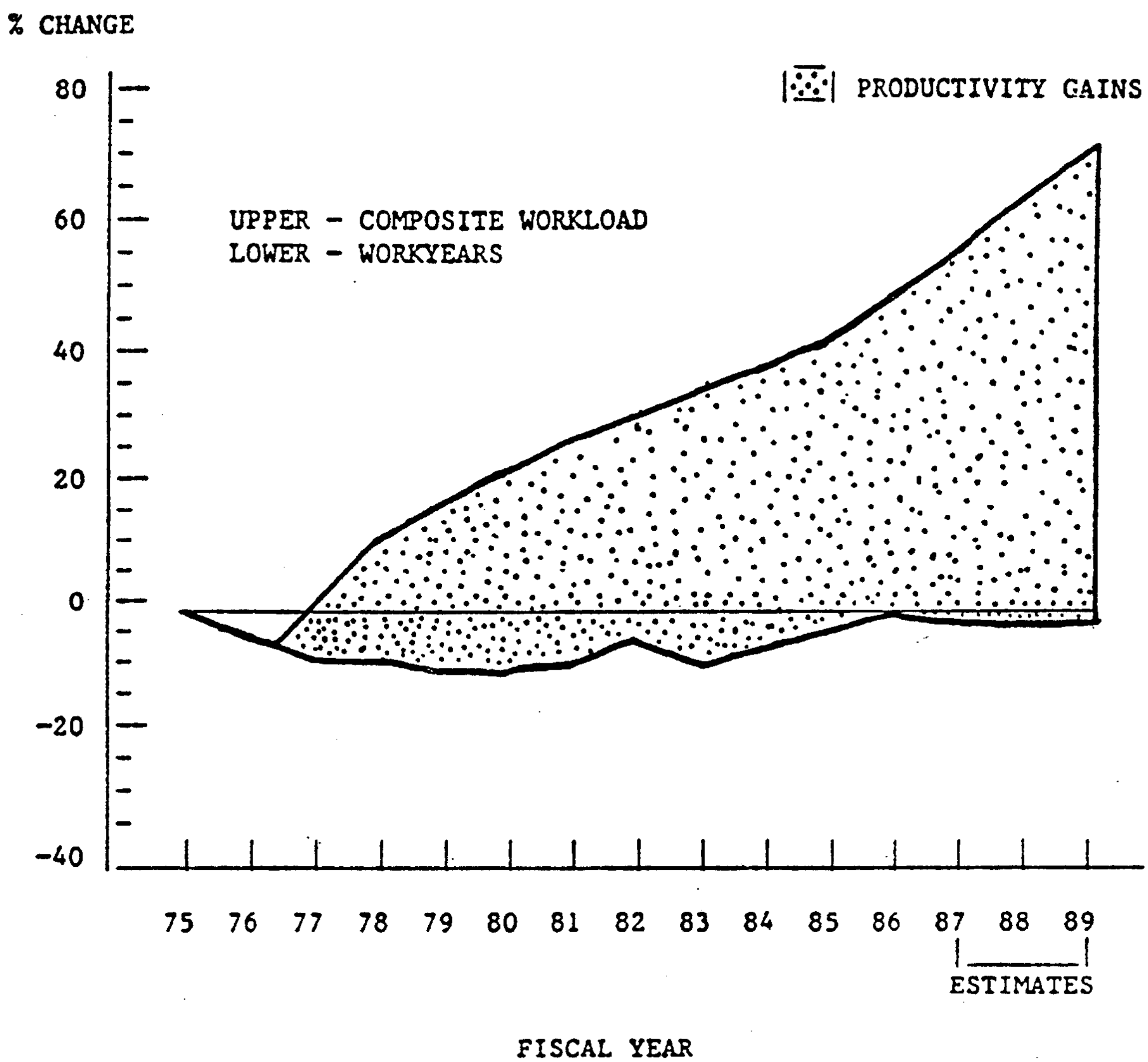
DLA Historical Productivity Chart

The chart on the following page is from the report "Reassessment of Defense Agencies and DoD Field Activities" that was done by an Office of the Secretary of Defense (OSD) study team in October 1987.

The top line on the chart represents DLA workload. The bottom line represents DLA staffing. The shaded area represents productivity which is shown to increase steadily from 1976 through 1989.

DLA PRODUCTIVITY

TOTAL DLA



Enclosure 5

ATTACHMENT 2

List of DPRO Storefront Positions

	AFPRO "Open-the Door"		Revised for Restructuring/Teaming and Loss of Mission (For Large PROs with More than 94 People)	
	Fixed	Variable	Fixed	Variable
COMMANDER'S OFFICE				
Commander	1		1	
Secretary	1		1	
Deputy			1	
SAFETY & FLIGHT OPERATION				
Safety Manager	1			
MANAGEMENT SUPPORT				
Inf. mgmt. function		1		1
Inf. mgmt. function		1		1
Security, budget, etc.	1		1	
CONTRACT MANAGEMENT				
Division Chief	1		1	
Secretary	1		1	
Contract Administrator		1		1
Contract Administrator		1		1
Contract Administrator		1		1
Contract Administrator		1		1
Procurement Assistant		1		1
Price Analyst		1		1
Price Analyst		1		1
Divisional ACO (DACO)				1
SUBCONTRACT MANAGEMENT				
Assist. for Subcont Mgmt.		1		
ENGINEERING				
Division Chief	1		1	
Admin. Clerk	1		1	
Engineer		1		1
Engineer		1		1
Engineer		1		1
Program Integrator				1

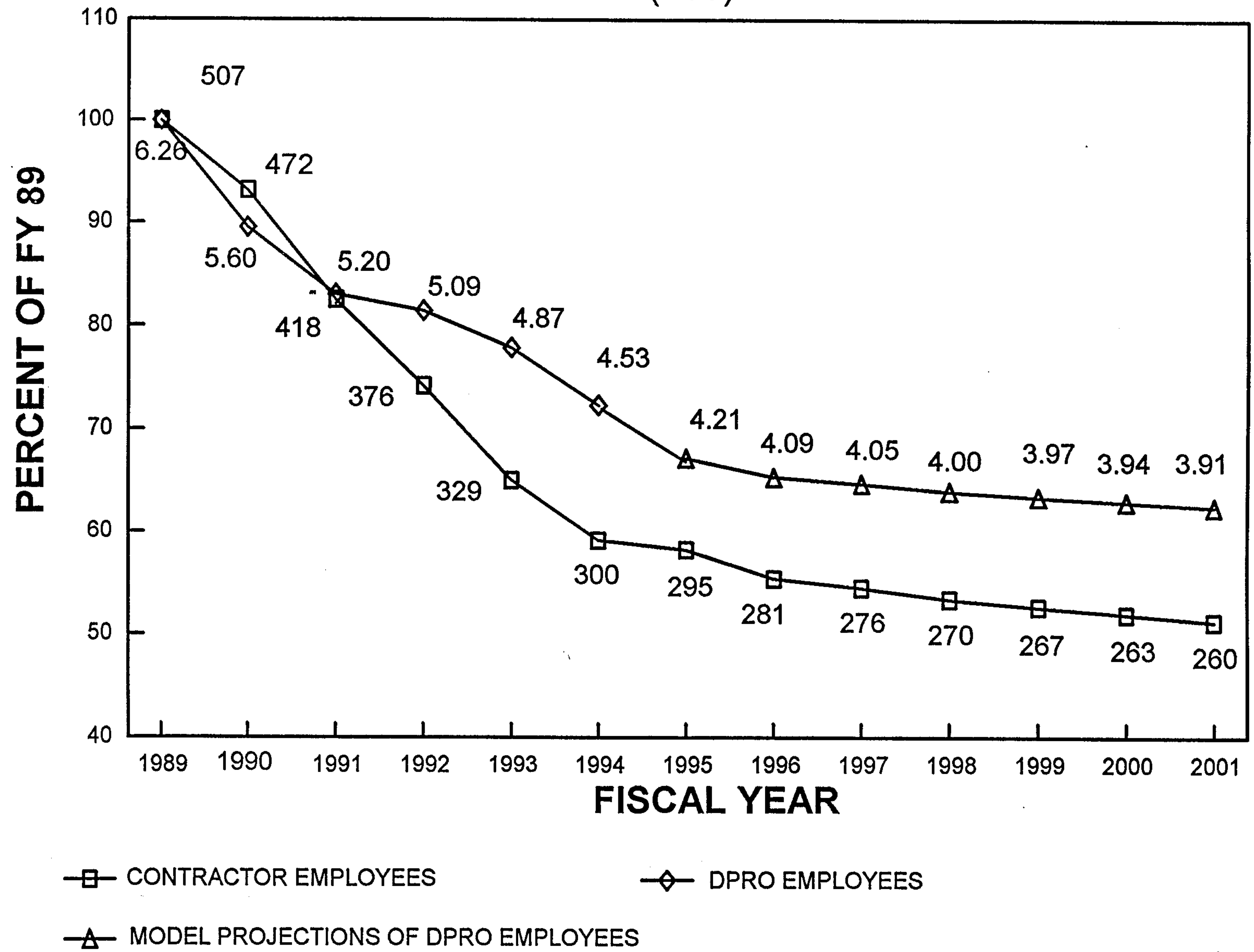
List of DPRO Storefront Positions (Continued)

	AFPRO "Open-the Door"		Revised for Restructuring/Teaming and Loss of Mission (For Large PROs with More than 94 People)	
	Fixed	Variable	Fixed	Variable
MANUFACTURING ENGINEERING				
Manuf. Engineer		1		1
Manuf. Engineer		1		1
Industr. Engineer		1		1
Industr. Engineer		1		1
Industr. Engineer		1		1
INDUSTRIAL MANAGEMENT				
Property Administrator		1		1
Plant Clearance Officer		1		
Procurement Clerk		1		
QUALITY ASSURANCE				
Division Chief	1			
Clerical	1		1	
Plan & Requ. Supv.	1			
QA Engineer		1		1
Software Specialist		1		1
Data Analyst		1		1
Data Clerk		1		
QA Specialist		1		1
QA Specialist		1		1
QA Specialist		1		1
QA Specialist		1		1
QA Specialist		1		1
Product Verification Insp. (PVI) Supervisor	1		1	
Secretary	1			
QA Specialist (PVI)		1		1
QA Specialist (PVI)		1		1
QA Specialist (PVI)		1		1
QA Specialist (PVI)		1		1
	13	34	10	32
AFPRO Open-the Door		47		42

ATTACHMENT 3

DPRO STAFFING & WORKLOAD TRENDS

(000)



SEE NOTES ON NEXT PAGE

ATTACHMENT 3
DPRO Staffing and Workload Trends
(Continued)

NOTES:

1. This data only includes the DPROs that are shown in Attachment 4 of this report. The list is as of 30 June 1995, with the exception of 4 DPROs in the Northeast District that were to be downsized to DCMOs in July 1995. The Northeast District reported these 4 DPROs as DPRO-like facilities and included the DPRO DCMC personnel in the DCMAO staffing. Therefore, these activities were not also counted as DPROs.

2. Contractor employee data shown are contractor employees working on contracts under the cognizance of the DPRO. It includes contractor employees working on NASA and other Non-DoD Reimbursable contracts. This is the definition used for the historical and projected data collected by IASO. The revised definition of contractor employees, used in the final DPRO model (the results of which are in Attachment 4), includes only those contractor employees working on DoD contracts.

3. Projections of DPRO employees were made using the DRE at the DPRO level, then rolled up to the DCMC level. They used the DPRO-level Contractor Employee projections provided by IASO, then updated by the Districts. The projections were made for the same DPROs that are covered by the current DRE.

4. Neither the contractor nor DPRO employee figures in this chart include DPRO Michoud or the Aircraft Program Management Office (APMO) in DCMD South. DPRO Michoud is fully reimbursable (by NASA) and is resourced to the extent the customer is willing to pay. The APMO is neither a DPRO nor a DCMAO (its a hybrid organization, with characteristics of both), and therefore does not fit the resourcing model for either. Contractor employee data was not provided by either the District or IASO for either organization.

ATTACHMENT 4

Model Results for Each DPRO

DPRO Name	District	Contractor Employees	Flight Ops. (1)	Reimb. FTE (2)	Actual Staff	Results of Model	Difference
Sikorsky, Strtfrd,CT	N	7,168	1	1	181	105	76
Grumman, Bethpage, NY	N	5,605	1	2	168	93	75
McDonnell Douglas,St L,MO	W	23,520	1	1	302	240	62
Gen Dynamics, Lima, OH	N	910	0	0	75	30	45
GE A/C Engine, Lynn, MA	N	4,357	0	0	122	78	44
Hughes Missile, Tuscon,AZ	W	7,177	0	0	143	102	41
Thiokol	W	1,180	0	47	115	82	33
Mart Marr Defense	N	2,674	0	0	91	59	32
Boeing Mil Airpl,Wchta,KS	W	2,700	1	0	91	63	28
Pemco Aeroplex,Brmnghm,AL	S	1,503	1	2	71	45	26
Unisys Great Neck, NY	N	2,621	0	9	89	68	21
Grumman, St. Augustine	S	870	0	0	49	29	20
GE A/C, Cincin, OH	N	6,674	0	0	115	97	18
Rockwell, Canoga Park,CA	W	617	0	60	102	86	16
Boeing Heli, Phil, PA	N	6,123	1	0	104	96	8
United Def LP, York,Pa.	N	1,384	0	0	45	38	7
Michoud (3)	S	4,131	0	85	126	126	0
Stewart & Stevenson	S	800	0	0	28	28	-0
Bell Heli Txtrn,Ft Wth,TX	S	5,266	1	0	87	88	-1
Lockheed (GD Ft Wth) TX	S	13,888	1	0	158	160	-2
Pratt & Whit, E Hrtfrd,CT	N	4,700	0	0	79	81	-2
McD Doug Heli, Mesa, AZ	W	3,116	1	0	67	70	-3
Hamilton Standard	N	2,404	0	4	55	59	-4
Westinghouse, Balti, MD	S	7,766	0	2	103	108	-5
Loral (IBM) Owego, NY	N	2,932	1	1	62	67	-5
Grumman, Melbourne	S	2,877	1	0	60	66	-6
Martin Marietta,Denver,CO	W	7,321	0	1	94	103	-9
Northrop, Hawthorne, CA	W	16,482	1	0	167	181	-14
Martin Marietta,Orlndo,FL	S	7,207	0	0	87	101	-14
Lockheed, Sunnyvale, CA	W	10,300	0	4	116	131	-15
Boeing, Seattle, WA	W	13,250	1	1	137	155	-18
Lockhd Aero Sys,Mariet,GA	S	10,983	1	0	114	136	-22
Douglas Air, Long Beach	W	10,125	1	0	105	129	-24
Raytheon Burlington	N	20,973	0	3	194	218	-24
LTV Aerosp&Def, Dallas,TX	S	6,893	1	3	78	105	-27
Pratt&Whit, W Plm Bch, FL	S	4,775	0	15	68	97	-29
E-Systems, Greenville,TX	S	4,009	0	0	46	75	-29
Texas Instr, Dallas,TX	S	10,406	0	0	99	128	-29
Lockheed Sanders, Nash,NH	N	4,172	0	0	47	76	-29
Allied Signal, Teterboro	N	4,310	0	1	47	79	-32
McD Doug Spce, Hnt Bch,CA	W	6,466	0	22	80	118	-38
Mart Marr Del. Vly	N	17,953	0	15	161	205	-44
Hughes LA	W	21,500	0	1	155	220	-65
Totals		300,088	16	282	4,483	4,419	64

NOTES:

1. The data in the Flight Operations column indicates whether or not the DPRO has Flight Ops. A "1" means there are Flight Ops, "0" means there are not.
2. Non-DoD Reimbursable Full Time Equivalents were derived from total FY94 reimbursable dollars as follows: dollars divided by FY94 hourly rate of $40.85 to get the number of reimbursable hours. Adjusted hours for leave (18%) and training (4%), then divide by 2,087 (workhours/year) to get Full Time Equivalents.
3. Since Michoud is fully reimbursable, the estimate shown is really the actual staffing.

ATTACHMENT 5

List of DCMAO Storefront Positions

Requirements that do not vary with DCMAO size.

(3) Command Section
- Commander
- Deputy
- Secretary

(3) Operations Group
- Operations Group Chief
- Secretary
- Management Assistant

(10) Technical Assessment Group (TAG)
- TAG Chief
- Secretary
- Management Assistant

Subject Matter Experts:

1102 - Contracts	800 - Engineer
1102 - Pricing	1103 - Property
1910 - QA Rep. (QAR)	1103 - Plant Clearance

1150 - Production - Industrial Specialist (IS)

(6) Special Programs:

6 people are the minimum resources to cover these special programs. (Product Quality Deficiency Report (PQDR), IASO, Safety, Pre-Award monitor Reimbursables, Process Oriented Contract Administration Services (PROCAS), FOCUS). Other programs will be captured with uniques (e. g., terminations.)

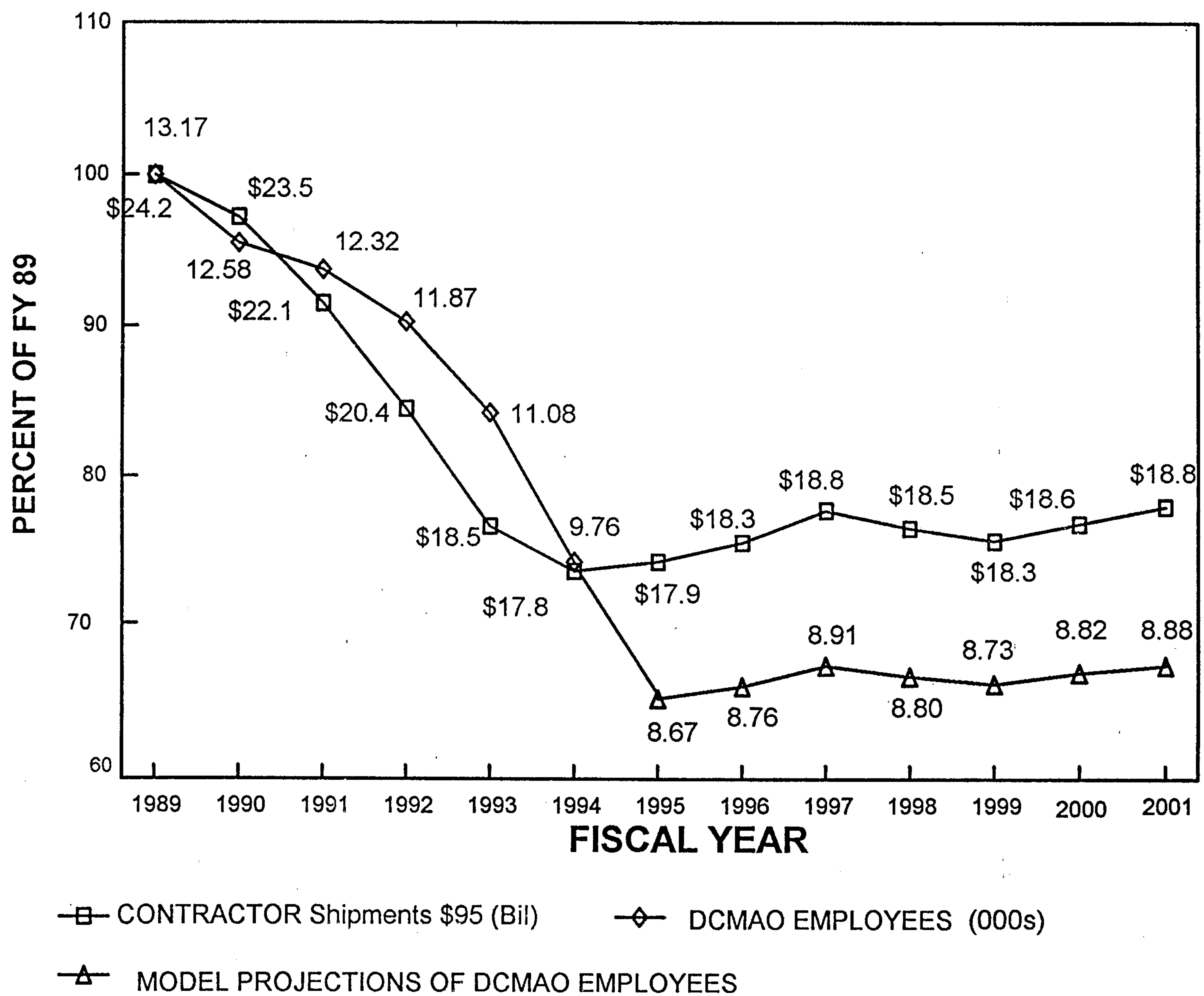
(7) Management Support Office:
- Management Support Office Chief
- Secretary
- Mgmt Analyst - Budget, Government Performance and Results Act (GPRA)
- Supply Clerk
- Mail
- Training Coordinator
- Computer Group - (Capture balance in variable)

(2) Special Staff:
- Small Business
- Legal

(31) TOTAL

ATTACHMENT 6

DCMAO STAFFING & WORKLOAD TRENDS



ATTACHMENT 6
DCMAO Staffing and Workload Trends
(Continued)

NOTES:

1. Contractor Shipments are based on an IASO sample of 250 contractors, and are shown as FY 95 dollars, in billions.

2. The number of DPRO-like activities, the DCMAO Fixed and Administrative constant (31 per Attachment 5), and the number of uniques were all assumed to be constant. Also, for the purposes of this projection, so that all DCMAOs are accounted for, Baltimore (which is not included in any of the estimates) is assumed to be constant at its 30 June 1995 actual staffing figure.

3. The part of the DCMAO DRE that is the variable portion of the DPRO-like activity estimate was calculated as that portion times the change in Contractor Employees for the remaining DPROs. The change in Contractor Employees for just those DPRO-like activities could not be used because there was not enough data available. IASO did not have complete data for many of these activities that were disestablished as DPROs more than one or two years ago.

4. The "core DCMAO" portion is projected as as described in Section 3.3. Shipment values are based on the 250 contractor sample from IASO and is the current FY shipments in FY 95 dollars divided by the FY 94 Shipments in FY 95 Dollars for those 250 contractors.

5. The DCMAO projections are the sum of the constant (31 times the number of DCMAOs), the uniques, the total DPRO-like constant, the DPRO-like variable estimate, and the core DCMAO estimate.

ATTACHMENT 7

DCMAO MODEL REGRESSION STATISTICS

R-squared, (described in Section 3.2) was determined using a conventional linear regression analysis (described in Section 2.3). The value was 0.719. This means that the change in the level of composite indicator explained about 72% of the change in the level of workload. The equation was:

$$\text{Core DCMAO Staff} = 94.8 + (0.42 \times \text{Composite Indicator}).$$

When a special regression analysis is performed that sets the constant term to zero as we did in developing the DCMAO model, the R-squared statistic derived with this type of analysis has no meaning. Therefore, as an estimate of R-squared we will use the 72% estimate from the conventional analysis.

ATTACHMENT 8

Model Results for Each DCMAO

	Staffing				DPRO-Like Activities				Core DCMAO			Total DCMAO		
DCMAO	Total 6/30/95	Unique Functns	DPRO-Like Activ	Core DCMAO	No. of Activ	Contr Empl	Actual Staff	Est Staff	Comp Ind(1)	Actual Staff	Est Staff	Actual Staff	Est Staff	Diff
Atlanta	282	41	36	205	2	3,450	36	32	411	205	278	282	352	-70
Baltimore (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Birmingham	267	33	0	235	0	0	0	0	294	235	208	267	241	26
Boston	452	75	62	315	2	3,739	62	35	556	315	366	452	476	-24
Chicago (3)	382	50	45	287	2	4,696	45	45	358	287	247	382	342	40
Clearwater	135	6	0	130	0	0	0	0	97	130	90	135	95	40
Cleveland	417	71	81	265	2	1,547	81	17	176	265	137	417	225	192
Dallas	335	51	32	253	2	1,776	32	19	335	253	233	335	302	33
Dayton	265	30	0	236	0	0	0	0	318	236	223	265	252	13
Denver	257	39	25	193	1	1,575	25	15	180	193	140	257	194	63
Detroit	258	20	57	181	2	2,666	57	26	184	181	142	258	187	71
Garden City	341	27	9	305	1	1,000	9	10	337	305	234	341	271	70
Grand Rapids	141	7	0	134	0	0	0	0	58	134	66	141	73	68
Hartford	254	27	14	213	1	550	14	7	366	213	251	254	285	-31
Indianapolis	240	26	77	138	2	6,678	77	59	124	138	106	240	190	50
New York	279	86	0	193	0	0	0	0	180	193	139	279	225	54
Orlando	151	20	37	94	1	3,323	37	29	186	94	143	151	192	-41
Philadelphia	358	93	0	265	0	0	0	0	615	265	401	358	494	-136
Phoenix	222	42	0	180	0	0	0	0	144	180	118	222	160	62
Pittsburg	128	26	0	102	0	0	0	0	127	102	107	128	133	-5
Reading	187	22	0	165	0	0	0	0	164	165	130	187	152	35
San Antonio	185	41	0	145	0	0	0	0	260	145	188	185	228	-43
San Diego	185	14	0	171	0	0	0	0	226	171	167	185	181	4
San Francisco	371	48	83	240	3	4,531	83	43	431	240	291	371	382	-11
Santa Ana	556	130	97	330	3	12,707	97	111	649	330	422	556	662	-106
Seattle	136	22	0	114	0	0	0	0	243	114	177	136	199	-63
Springfield	378	28	64	286	2	4,515	64	41	406	286	275	378	344	34
St Louis	191	43	0	148	0	0	0	0	142	148	116	191	159	32
Stratford	145	29	13	104	1	1,400	13	14	99	104	91	145	133	12
Syracuse (3)	261	25	16	220	1	1,441	16	16	195	220	148	261	189	72
Twin Cit. (3)	393	33	131	229	2	6,462	131	59	140	229	115	393	207	186
Van Nuys (3)	578	81	102	395	3	14,572	102	128	537	395	354	578	564	14
Wichita	111	10	0	101	0	0	0	0	60	101	67	111	77	34
Total	8,841	1,292	980	6,569	33	76,628	980	706	8,599	6,569	6,169	8,841	8,167	674

NOTES:

1. The Composite Indicator is the number of contractors in CAR Part A, plus 30% of the contractors in CAR Part B, without duplicating the count. In other words, if a contractor has eligible contracts in Part A and Part B, it will count as a Part A contractor only. Eligible contracts are normalized (they do not count as open if Production is complete in MOCAS), Source Inspected and/or Accepted, and with a ULO greater than 0.
2. Since the Compostite Indicator for Baltimore was so disproportionately large that it would have had an undo large, mathematical influence on the entire model, Baltimore was not included in the sample used to develop the model. All of its' data is noted as Not Applicable (NA). The values are a 3 month average for April through June 1995.
3. For 4 DCMAOs that have DCMOs that used to be separate DCMAOs, 2 was added to the DPRO-like estimate to account for fixed positions at the DCMO locations.

ATTACHMENT 9

Control Limit Methodology

An interval around the estimate could be used to measure the variation between the estimate and the actuals. We call the upper and lower numbers of this interval control limits. Control limits could be used to help decision makers determine when action might be necessary. One such interval that could be specified would correspond to a confidence level of 68 percent (symmetrical about the estimated value). In other words, the probability is 68 percent that an activity whose actual staffing lies within these control limits is staffed in the same manner (with the same relationship to workload) as other activities within the interval. Conversely, activities staffed at levels outside these control limits (either above the upper limit or below the lower limit) have only a 16 percent probability that they were staffed to have the same workload staffing pattern as activities within the interval. Staffing at activities outside the control limits should be reviewed.

The confidence interval concept is not directly applicable in this situation. The MET AFPRO model did not use one as far as we know. The Air Force had 22 DPROs. If a 90% confidence interval had been used 20 (90% of 22) would have been within the interval and 2 outside: one above and one below the interval. This is true whether the standard error, a measure of the scatter (scatter is described in Section 3.2), is small or large. The intent for the model was to identify for RUC review more than one or two activities that were potentially either under or over-resourced.

The DASO report, mentioned in Section 2.1, suggested a control limit of one standard error. At this level, the 16% of the activities furthest above their estimated value, and the 16% furthest below, would be reviewed. This approach is reasonable. It would mean that at least 5 DCMAOs, potentially over-resourced would get a close RUC review.

For the reasons mentioned above, and because fixing the DCMAO constant at 31 makes the "bell curve" normal probability distribution not applicable to the DCMAO model for statistically finding a confidence interval, we recommend an alternate approach. For both the DCMAO and DPRO models we can simply identify for RUC review, the 16% of the activities furthest above their estimated values as well as the 16% furthest below. With this approach it does not matter if distribution is not normal. Also, while we believe the Standard Error for the DPRO model was 31, we do not have documentation. Furthermore, our adaptation of the MET model would affect it's standard error. So this approach would also be appropriate for the DPRO model as well.