DCASPRO use of the Basket method.

Smith, Raymond W.

Monterey, California. Naval Postgraduate School

DCASPRO USE OF THE "BASKET METHOD"

Raymond W. Smith

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

DCASPRO USE OF THE "BASKET METHOD"

by

Raymond W. Smith

June 1982

Thesis Advisor: John W. Creighton

Approved for public release, distribution unlimited

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): DCASPRO USE OF THE "BASKET METHOD"	5. TYPE OF REPORT & PERIOD COVERED: Master's Thesis June 1982
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Raymond W. Smith	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Postgraduate School Monterey, California 93940	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: Naval Postgraduate School Monterey, California 93940	12. REPORT DATE: June 1982
	13. NUMBER OF PAGES: 58
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report)
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release, distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DCAS
Sole Source
Sampling Technique

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The "basket method", a finite sampling technique, developed by Professor K.T. Wallenius for NAVPRO Grumman to reduce proposal backlogs, is examined for application in the DCASPRO environment. The "basket method" is discussed and the differences and similarities of the DCASPRO/NAVPRO

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

environment are considered. A survey of DCASPROs is utilized to ascertain the extent to which they meet certain preconditions for application of the "basket method". A simulation using data from DCASPRO Northern Ordnance is presented to provide an example of possible application of the method. The author concludes that the "basket method" may be a useful tool for DCASPROs that satisfy the required preconditions.

Approved for public release, distribution unlimited

DCASPRO Use of the "Basket Method"

by

Raymond W. Smith
Lieutenant Commander, United States Navy
B.S., Utah State University, 1970

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the
NAVAL POSTGRADUATE SCHOOL
June 1982

ABSTRACT

The "basket method", a finite sampling technique, developed by Professor K.T. Wallenius for NAVPRO Grumman to reduce proposal backlogs, is examined for application in the DCASPRO environment. The "basket method" is discussed and the differences and similarities of the DCSAPRO/NAVPRO environment are considered. A survey of DCASPROs is utilized to ascertain the extent to which they meet certain preccnditions for application of the "basket method". A simulation using data from DCASPRO Northern Ordnance is presented to provide an example of possible application of the method. The author concludes that the "basket method" may be a useful tool for DCASPROs that satisfy the required preccnditions.

Executive Summary

The author investigates the possible usefulness of the "basket method" as a tool in reducing proposal backlogs in the DCASPRO environment. The conclusion is that in many instances the "basket method" would provide a vehicle for reducing proposal backlogs of low dollar proposals.

The "basket method" is a finite population sampling technique that was developed by Professor K. T. Wallenius, of Clemson University, to aid NAVPRO Grumman in disposing of a considerable backlog of sole source proposals. The "basket method" creates samples (baskets) from the backlogged population of low dollar value proposals. Each basket is balanced so that it resembles each other basket and maintains the characteristics of the parent population. A basket is selected at random and its proposals are negotiated in the usual manner. The decrement from proposed price to negotiated price of the sample is applied to the entire population.

The "basket method" provides an unbiased indicator of the population characteristic so that neither party to the acquisition will benefit from its use in the long run, nor will either party be able to game the system for its benefit or the other parties detrement. Through utilization of a simulation program it is possible to determine the precision of the system, a level of confidence in the precision, and to select sample sizes that will provide the precision and confidence that is required by the parties.

The "basket method" has proven itself to be an effective tool in backlog reduction in those Navy ACO offices where it has been applied over the past eight years.

While the ACO function of a DCASPRO is not different in its mission from that of the NAVPRO or SUPSHIP, the environment in which the function takes place is different. It tends to be more structured by regulation and less self-contained than its Navy counterparts. The environment is further complicated, in many instances, by the administration of contracts from many organizations, including all the service branches and other federal agencies. The unique environment of the DCASPRO does not alter the fact that, according to the research, a significant number of commands experiance a proposal backlog problem.

The thrust of the research was to ascertain if the solution to the proposal backlog problem that had been developed and used successfully in the NAVPRO environment could be used by DCASPROs. In the authors opinion the answer is a qualified yes. The "basket method" can be applied to reduce backlog problems in DCASPROs, provided that the basic preconditions of the method are met. Those preconditions as stated in chapter two are:

1. the existance of a proposal backlog
2. a proposal generating process that is uniformly applied
3. proposals that are similar in nature or capable of being grouped in similar categories
4. the perception of value being derived from more timely processing of the backlog
5. proposal prices that are within the funding constraints of the requisitioner

Based upon the responses to the questionare discussed in chapter three, there are DCASPROs that meet the preconditions. Those offices could benefit from initiation of the "basket method". Implimentation would require an approved request for deviation from the established mode of operations and acceptance of the system by the contractor

and customer agencies. As a tool, like all other tools, the "basket method" is neutral. Its value lies in its proper application. Properly applied the "basket method" reduces low dollar value proposal backlogs with known and statistically acceptable risk.

TABLE OF CONTENTS

I. THE "BASKET METHOD"

A. BACKGROUND

The subject of sole source procurement tends to create anxiety in many circles. The congress views it as wasteful of tax dollars, and have mandated competitive bid as the prefered method of contracting. Many of the chosen single source's competitors view it as "sweetheart dealing" and profess that if given the opportunity, they could certainly perfcrm as well at less expense. The public in general feel that compitition is the American way and limitation of that time honored system flies in the face of free enterprise and the free market system. To a significant extent, they are all correct, however, a review of procurement statistics for fiscal 1980 shows that 45.6% of all actions and 53.9% of all dollars spent were procured on a sole source basis. There are some excellent reasons for this phenomenon. They are matters of record in many congressional hearings and in the professional literature.

One of the areas where sole source procurement is not subject to dispute, is in the changes, provisioning and spare parts arena. When a contractor has won a contract through bid or negotiation he becomes a sole source for the above mentioned items because of this position. Changes to the contract are certainly sole source to the contractor, and on complex systems changes can become prolific. Likewise, provisioning items such as special test equipment, technical manuals, and spare parts are logical candidates for sole source procurement to the contractor who is perfcrming the production contract. Frequently the

production contractor owns proprietary data that would make competition impossible as well as impractical.

Accepting the fact that there are valid sole source procurements, a brief discussion of how those procurements are concluded is in order. A requirement is generated and a determination and findings (D&F) is prepared in accordance with the Defense Acquision Regulation (DAR), section III, part 2, stating the reason that the procurement is exempt from the ccmtetitive bid environment. Blanket D&F's can be used to cover a multitude of purchases if the same exception and reason apply. A request for proposal (RFP) is then issued to the contractor who is generally allowed forty-five to sixty days to propose a price for performance of the work. The proposal from the contractor is subjected to cost and pricing analysis as necessary. This analysis may include audit by technical personnel and or the Defense Contract Audit Agency (DCAA), and may take from thirty to forty-five days to complete. The proposal and pricing case, which contains the governments negotiation position is then forwarded to the contracting officer for negotiation and definitization. The entire process is extremely time consuming. Depending upon the requirement placed upon the contractor, work may be going forward and costs may be being incurred during the proposal, pricing, and negotiation phases of the procurement.

The above system was designed to safeguard the tax payer by insuring that a fair and reasonable price was achieved through the negotiation process. There are , however, numerous situations in which the system breaks down and its safeguards become ineffective. For example, if all perfcrmance is ccmpleted on the contract prior to its being definitized, the actual costs have all been accrued and the

only element open to real negotiation is the fee. This results in what amounts to a cost plus percentage of cost type contract (the percentage of cost being the negotiated fee), which is a prohibited contract type for government procurement. While this clearly violates the spirit of the law, the letter of the law is preserved by the fact that the actual assigned contract type can be stated to be any of a number of permissable types, from firm fixed price, to cost plus fixed fee. The point is that the contractor does not incur any cost risk in the perfcrmance of the contract and therefore has little incentive to perform efficiently. On the contrary, since fee is generally computed as a percentage cf cost, it is in the contractors best intrest to load as much cost as possible on an undefitized contract.

It is certainly in the governments best intrest, then, to definitize contracts as early as possible. Where a large volume of proposals and the time required to definitize is linked with a chronic shortage of personnel, a problem of considerable proportions is created. This is descriptive of the situation that developed at the Naval Plant Representative Office (NAVPRO) at Grumman Aerospace Corpcration, Bethpage, New York.

B. DEVELOPMENT OF THE "BASKET METHOD"

The administrative contracting officer (ACO) at Grumman was responsible for the negotiation and definitization of contract modifications, change orders, spare parts, and provisioning items on the F-14 weapons system. The NAVPRO was suffering from considerable backlog problems and as a result the difficulties related above were apparent. The NAVPRO requested the assistance of Professor K.T. Wallenius, of Clemscn University, to assist them in formulating a statistical sampling method that would enable them to more

expeditiously definitize the contracts and maintain the safeguards that were designed into the negotiating process. The result of Professor Wallenius' work was the "basket methcd", a statistical sampling method for sole source contract negotiation. The "basket method" was reduced to a set cf computer programs and included in the Copper IMPACT system. The Copper IMPACT system is a government owned software system designed primarily for use by procurement perscnnel, and is available on a timeshare computer network.

The "basket method" creates balanced samples of the backlcg population which are then negotiated and the ratio of the proposed to the negotiated price for the sample is applied to the entire population. Because the method is unbiased (neither the contractor nor the government would benifit from its use in the long run) and reasonably precise (the precision can be adjusted by changing the sample size) it has proven to be a very effective tool in reducing backlcg and definitizing contracts in an expeditious manner.

Because the DAR required a certificate of cost and pricing data for all procurements in excess of $100,000, the "basket method was used only on those proposals valued at less than that amount. The ceiling for certified cost and pricing data has since been raised to five hundred thousand dollars and the "basket method" is being utilized at Grumman for proposals under the new ceiling.

The success of the program at NAVPRO Grumman led to its adoption at other NAVPRO's and by certain Supervisors of Shipbuilding (SUPSHIP). The "basket method" is not a new or untried system, it was initiated at NAVPRO Grumman in 1974 and has proven to be an excellent tool in those areas where it has been utilized.

The focus of this paper will be a critical assessment of the utility of the "basket method" in the Defense Contract Administration Service Plant Representative Office (DCASPRO) environment. The NAVPRO/SUPSHIP environments will be compared and contrasted with that of the DCASPRO. The prerequisite assumptions of the "basket method" will be examined in an attempt to devise a screening proceedure that could be utilized to determine the probable usefulness of the "basket method" in a new application or at a new activity.

C. THE TECHNIQUE

There are four basic components to all sampling and estimation problems such as the one being discussed here. They are:

1. A well defined population.
2. A sampling plan.
3. An estimation rule.
4. A statement of probable error.

The population in the "basket method" is composed of backlogged proposals valued at less than $100,000. Some proposals may be excluded from the population by mutual agreement between the contracting officer and the contractor. examples of proposal types that might be excluded are research and development proposals and overhaul and maintenance proposals. Each proposal of the population contains certain elements that are readily determinable such as the proposed price, the proposed contract type, and the type of material or service being procured. Some or all of these elements may be useful in estimating the contract price.

The sampling plan must be given serious consideration, as the method of drawing a sample can have a significant effect upon the data derived and the inferences drawn from that data. Statistical analyis has sometimes been refered to as a contest between the statistician and nature, where nature sets the values of the unknown and the statistician gathers imperfect information by sampling and makes inferences about the entire population. Nature, in this case is generally viewed as a neutral participant who does not stand to gain or lcse no matter what inference the statistician makes. In the instant case, however, it is the contractor who should have the best idea of the value of any work he would undertake, who also controls the most significant element of data in the population, namely the proposal price. While it should not be inferred that it is expected that a contractor would attempt to selectively pad proposals in order to explcit this advantage in a vulnerable system, it would certainly be in the governments interest to formulate a sampling plan that was not vulnerable to such gaming. The sampling plan in the "basket method" is based on an algorithm in the computer program that is unbiased and is not subject to gaming.

The estimating rule is the mechanism by which the partial information derived from the sample is manipulated in order to draw the inference about the entire population. The "basket method" utilizes a ratio estimating rule where the ratic of the negotiated price of the sample to the proposed price of the sample is assumed to be equal to the unknown, but infered, negotiated price of the population to the propcsed price of the population. After the sample propcsals are negotiated, the equation in Figure 1 can be solved for the unknown and its value thus inferred.

$$\frac{\text{NEGOTIATED PRICE OF THE SAMPLE}}{\text{PROPOSED PRICE OF THE SAMPLE}} = \frac{\text{UNKNOWN PRICE OF THE POPULATION}}{\text{PROPOSED PRICE OF THE POPULATION}}$$

Figure 1

THE RATIO ESTIMATION RULE

The statement of probable error is part and parcel of the sampling and statistical analysis arena. The error is defined as the difference between the actual value of the variable (forever unknown to the statistician) and the value of the variable determined from the analysis. Error free estimation is not possible. To be certain that the inferred value was in fact the actual value would require a 100% sample. However, the probable error can be controled by adjusting the sample size until the error is suitably small as to be tolerable considering the cost of increased sampling. Generally the probable error is determined from the hypothesized distribution of the variable and the variation of the variable (either assumed or estimated from the sample data). In the instant case, no assumption is made about the underlying distribution of the variable (ie., whether it is normal, exponential, etc.) so no theoretical statements are made as tc the probable error. Instead, a population of past proposals that have been negotiated are entered, and a simulation of the "basket method" is run, pulling samples from the population, forming the samples into baskets, and comparing the value of the variable inferred from the sample basket to the actual value of the sample. The simulation is repeated a large number of times (500 or 1000) and the data is portrayed in histogram form and in tables. This method of determining the probable

error for various sample sizes presupposes that the historical data upon which the simulation was based is representative of the proposals to be accepted in the future, ie. there is no change in proposal formulation and the same or similar types of materials or services are being produced.

The "basket method" is based upon finite population sampling technique. Each proposal in the population is processed through the algorithm into a basket and the sample is chosen by choosing at random one of the baskets. This process limits sample sizes to simple fractions of the total population, so that forming two baskets and choosing one would yield a 50% sample while forming four baskets and choosing one would yield a 25% sample and so on.

A representative sample or balance in the sample is an important issue in statistical analysis. There are over seventeen trillion possible samples of size ten that can be drawn from a population of one hundred, most of them ,ie. the high ten and low ten are not at all representative of the whole population. The "basket method" imparts excellent balance in that each basket formed is as nearly as possible a mirror image of the others and a miniature version of the whole population. The algorithm that creates the baskets creates excellent balance to the second moment. This balancing is created by rank ordering the population by proposal price from highest to lowest. Assuming that 25% sample is desired, four baskets would be formed in the following manner. The high four proposals would be placed in baskets 1 through 4 respectively. The next four would be placed in reverse order (highest in basket 4, lowest in basket 1). From that point each succeeding group of four proposals would be allocated to baskets on the following

basis, the high proposal going into the basket with the lowest sum of present occupants, the next highest in the basket with the secound lowest sum etc. Once the baskets are thus formed they are scrutinized to see if better overall balance can be achieved by swapping pairs of numbers between baskets. The final product would consist of baskets that are extremely well balanced and representative of the total population.

The following simple example which forms two baskets from a population of eight proposals was taken from "The Basket Methcd for Sole Source Contract Negotiation", NCAR Report 81-1, December 1981, by Professor K.T. Wallenius. The propcsal prices are 79, 76, 61, 54, 39, 34, 24,and 10. Forming two baskets would go as follows. The first two groups are assigned in the obvious way resulting in:

BASKET	BID PRICES	SUBTOTALS
1	79,54	133
2	76,61	137

Since basket one now has the smaller subtotal, it receives the largest unassigned proposal (39) with the other member of the third group (34) being placed in basket two resulting in subtotals of 172 in basket one and 171 in basket two. The largest unassigned prcposal (24) goes to the basket with smaller subtotal (basket two) and the other proposal (10) goes to basket one. This results in an initial assignment of:

BASKET	BID PRICE	SUBTOTALS
1	79,54,39,10	182
2	76,61,34,24	195

The subtotals can be brought into closer agreement by swapping 61 for 54 resulting in:

BASKET	BID PRICE	SUBTOTALS
1	79,61,39,10	189
2	76,54,34,24	188

No additional swapping will imporve the balance so the algorithm stops at this point. Note the "balance" or similarity between the two baskets. The average of the propcsals in basket one, basket two, and the population are, respectively, 47.25, 47.00, and 47.125. The standard deviations are, respectively, 29.7, 23.0, and 24.6.

II. THE ACO CONTRACTING ENVIRONMENT

A. INTRODUCTION

Chapter II will examine the ACO function. It will compare and contrast the NAVPRO and SUPSHIP environment, in which the "blanket method" has been introduced, with that of the DCASPRO. Similarities and differences in function and procedures will be considered with particular attention to those areas where implementation of the "basket method" might be affected. The purpose of this chapter is to develop and disclose the environment that is favorable to the preconditions necessary for sucessful implementation of the "basket method".

B. THE ACO FUNCTION

The DAR, in section 1-406, lists seventy-five respcnsibilities of contract administration offices. These respcnsibilities form the primary charter for all contract administration offices. Amoung them are the following four items which deal specifically with negotiations that are of a sole source nature:

1. negotiate prices and execute supplemental agreements for spare parts and others items selected thru provisioning procedures;
2. when authorized by the purchasing office, negotiate or negotiate and execute supplemental agreements incorporating contractor proposals resulting from change orders issued under the Changes clause (prior to completion of negotiations and issurance of the supplemental agreement, any delivery schedule change shall be coordinated with the purchasing office.);
3. when authorized by the purchasing office, negotiate price and execute priced exhibits for unpriced orders issued by the procuring contracting officer under basic ordering agreements;
4. when authorized by the purchasing office, issue change orders and negotiate and execute resultant supplimental

agreements under contracts for ship contruction, coversion and repair;.

Ship construction, coversion and repair is administered soley by the SUPSHIP organizations, so the last item listed above applies only to those organizations, however, the other responsibilities are shared by DCAS activities, NAVPROs and SUPSHIPs.

C. THE DCASPRO ENVIRONMENT

The Defense Contract Administrative Service (DCAS) was established in 1965 as a part of the Defense Supply Agency (DSA) which has since had its name changed to Defense Logistics Agency (DLA). DCAS is comprised of nine regions (DCASRs) each region is subdivided into management areas (DCASMAs), which have jurisdiction over a specified geographic area (excluding those plants serviced by resident DCASPROs), and the DCASPROs (which have jurisdiction over contracts in their assigned plants).

The contract administration functions listed in DAR section 1-406 are divided between region, management area and plant representative office. The region maintains many of the contract administration functions leaving those such as quality assurance, production surveillance, and negotiation of specified changes, provisioning items and basic ordering agreement (BOA) calls to the plant representative office. If the management area is in the same geographic area as the plant they (the DCASMA) may also provide services of an administrative nature to the DCASPRO.

The DCASPRO operates under regulations and instructions from DOD (the DAR), DLA (the Contract Administration Manual for Contract Administration Services, DLAM 8105.1), the DCASR (regional implementing instructions and regulations)

and its own internal instructions and operating procedures. The multiple layers of administrative control tends to impare individuality and innovation at the working level.

DCASPRO personnel tend to be fairly specialized and because they are located geographically in separate areas there is not a great deal of movement of personnel into and out of offices. This creates a reasonably stable workforce but, in the authors opinion, can also lead to stagnation and lethergy. Longstanding relationships with the contractor personnel develop on the the personal and proceedural level. These habituated relationships act as stabilizing forces which support the status quo.

D. THE NAVPRO ENVIRONMENT

At the time DCAS was instituted, certain plants which were felt to be critical to the success of the mission of a particular service were not included in the DCAS transition but were instead retained by the services (both the Navy and Air Force retained cognenance over critical plants, the Army transfered all contract administration to DCAS). The contract administration organisations at those plants retained by the Navy became known as NAVPROs.

The NAVPROs fall under the jurisdiction of either the Naval Sea Systems Command (NAVSEA) or the Naval Air Systems Command, (NAVAIR). NAVPROs are fairly autonomous commands. They are free standing, self sufficient organizations which perfcrm all the required contract administration functions called out in DAR section 1-406. Policy guidance is provided by the Navy Material Comand (NAVMAT) and either NAVSEA or NAVAIR (as appropriate) Because NAVPROs are staffed by Navy personnel who are generally in the same major command as the program manager, they tend to be

considered part of the project team and are responsive to the demands and influences of the PCO's and project officers they serve. The criticallity to the mission of the parent service also tends to motivate excellence in performance.

E. THE SUPSHIP ENVIRONMENT

The SUPSHIP organizations like those of the NAVPROs are self sufficient commands that perform all required contract administration for contracts involving the construction, conversion, or repair of Navy ships. The complexity of the products and of the contracts for their construction sets SUPSHIP organization apart from other plant representative organizations. NAVSEA provides considerable regulatory guidance to the SUPSHIPs. Because of this and the fact that their mission tasks are more closely linked, there is more homogeneity in their structure than would be found in NAVPROs. SUPSHIP activities, on the average, tend to be larger than other contract administration offices.

F. COMPARISONS AND CONTRASTS

DCASPROs NAVPROs and SUPSHIPs all perform similar functions in the acquisition process. While NAVPROs and SUPSHIPs perform more functions than the DCASPROs, those functions that have a bearing on the subject of this paper, namely the negotiation of sole source procurements, are perfcrmed by all three types of activities.

DCASPROs are less autonomous than NAVPROs and SUPSHIPs. They are dependent upon the region, and in some instances the management area, for both administrative and functional suppcrt. NAVPROs and SUPSHIPs are far more independent and are less encumbered by the layers of regulation that exist in the DCASPRO environment.

DCASPROs tend to be more bureaucratic in their approach to problem solving. The DCASPROs appear to be more method oriented while the NAVPROs appear to be result oriented. This method oriented approach lends itself well to standardization and routine application, while the results oriented approach is better suited to the exception prone environment that tends to be found in the critical mission essential, major systems, environment that is the bailiwick of the NAVPRO.

While a NAVPRO or SUPSHIP will administer all contracts in their plant there is usually a major system that provides the vast majority of the workload. DCASPROs administer a more mixed bag of contracts and are more likely to have contracts from multiple sources in the plants over which they have cognizance.

G. PRECONDITIONS FOR THE "BASKET METHOD"

The "basket method" is a tool. It is a special tool developed for a specific purpose. To effectively use this tool certain preconditions must exist, and certain other subsequent requirements must be met.

The preconditions that must exist prior to implementation of the basket method include:

1. a backlog of proposals
2. a proposal gererating process that is uniformly applied
3. proposals that are similar in nature or can be grouped in similar catagories
4. the perception of value being derived from more timely processing of the backlog
5. proposal prices that are within funding provided by requisitioner

Each of the above items will be discussed in greater detail below.

Because the "basket method" is a tool developed to deal with a backlog of proposals it is necessary that this problem exists prior to instituting action to implement the methcd. There is an adage that states this quite plainly, "If is ain't broke, don't fix it." There are costs associated with implementation of the system. It would be unwise for cost to be incurred to introduce a cure for which there is no known disease. This is not to be interpreted in such a way, however, to preclude a casual factor in this requirement. A manager could institute the system to cut workload and move those people who had been performing the contracting function to other more beneficial areas. The manager would in this case be creating the backlog and solving the backlogproblem concurrently.

The assumption that a uniformly applied proposal generating process exists within the contractors operation is necessary to draw conclusions as to the precision of the "basket method" in practice. The precision is based on perspective analysis of the historical relationship between bid and negotiated prices as it apples in each local case. That is, the assumption must be made that the relationship which existed in the past between proposed and negotiated prices will persist into the immediate future. This assumption can only be justified if the proposals are generated in some uniform manner and are not subject to great fluctuations of a random and uncontrolable nature.

The assumption that proposals are similar or at least readily grouped into similar populations is necessary if sampling is to be meaningful. Sampling implies that characteristics of a whole can be discerned by examining a sample. If the elements of the population are disimilar such extrapolations are not likely to be valid. The "basket

methcd" does allow a degree of freedom in this area in that if the elements of the population can be grouped into similar subpopulations baskets can be formed that will provide proportional representation to all the different subpcpulations and thus allow the characteristics of the entire population to be more accurately predicted.

The final attribute, that more rapidly processing of the backlog has value may appear at first to be a triviial point. Closer consideration, however, shows its importance particutarly if considered from a pragmatic point of view. There are costs involved in implementing a "basket method" system. Implementation training, machine time, are direct outlays and are worthy of consideration in their own right, however there is also an increased element of risk in any sampling method. While the system is designed to be unbiased over the long run each application of the process is subject to deviation from the actual values of the populations sampled. In fact the probability of the sample providing the exact value of the population is zero. To be of use then, the value of more rapid definitzation must exceed the cost of implementation plus a factor taking into consideration the added risk involved in using a sampling technique. There may in fact be situations where a moderate backlog in low dollar proposals would not be viewed as a problem at all.

The requirement that the proposed prices be within funding authorized by the requisitioner takes into consideration the fact that if additional funds are necessary , a justification for those additional funds would be required. If the item requiring justification was not one cf those included in the sample no pricing analysis or negotiation position would be available to support the

request. This is viewed as an untenable situation by those contracting officers who have instituted the "basket methcd."

If all the preconditions for implementation exist there is another major step that must be taken prior to implementation. A bilateral agreement between the contractor and the government, as represented by the Plant Representative Office, must be drawn up and signed setting forth the groud rules to be followed in the application of the "basket method" at the plant in question.

This document should lay out the parameters of the populations to be formed and any exclusions allowable from that generalized population. It should also deliniate the procedures to be followed in forming populations, drawing samples, and computing the decrements. A well documented agreement should alleviate disagreements once the process has begun.

The importance of the agreement can not be overly stressed. The risk involved in sampling is shared equally by the contractor and government (the system is inherently unbiased with underaward equally as likely as overaward). The contractor must be convinced that the "basket method" is a fair game and that it has value to him. The "basket methcd" will not work in an environment of mistrust and antagonism.

A copy of the bilateral agreement between NAVPRO Grumman and Grumman Aerospace Corporation is included as Appendix A.

III. THE DCASPRO SURVEY RESULTS

A. INTRODUCTION

The data presented in this chapter were gathered via a survey of DCASPROs. A sample of twenty-four offices was selected from the population of thirty-five currently established DCASPROs. The sample included offices from each region and covered a broad range of manufacturing products and technologies. Two of the DCASPROs contacted chose not to participate in the survey, thus reducing the the useful sample size to twenty-two.

The survey was conducted by telephone. The respondent was the head of the contracts division or an ACO in every case except two where the respondent was the DCASPRO commander. The interviews lasted an average of fifteen minutes. A prepared questionare consisting of eight questions was presented. Respones to the preprared questions were noted, and related areas were then probed in an unstructured format in order to more accurately assess the environment at each DCASPRO. The survey was designed to discover if the preconditions discussed in chapter two existed in the organization, and what other factors might impact upon a decision to introduce the "basket method".

B. THE RESPONSES

Of the twenty-two DCASPROs which participated in the survey, eleven (fifty percent) stated they did not have a propcsal backlog problem, six (twenty-seven percent) stated that proposal backlogs occured from time to time, and five (twenty-three percent) stated they had a current proposal backlog problem. See Figure 2.

Question One

Dc you currently have, or have you from time to time experianced , a backlog of sole source proposals ?

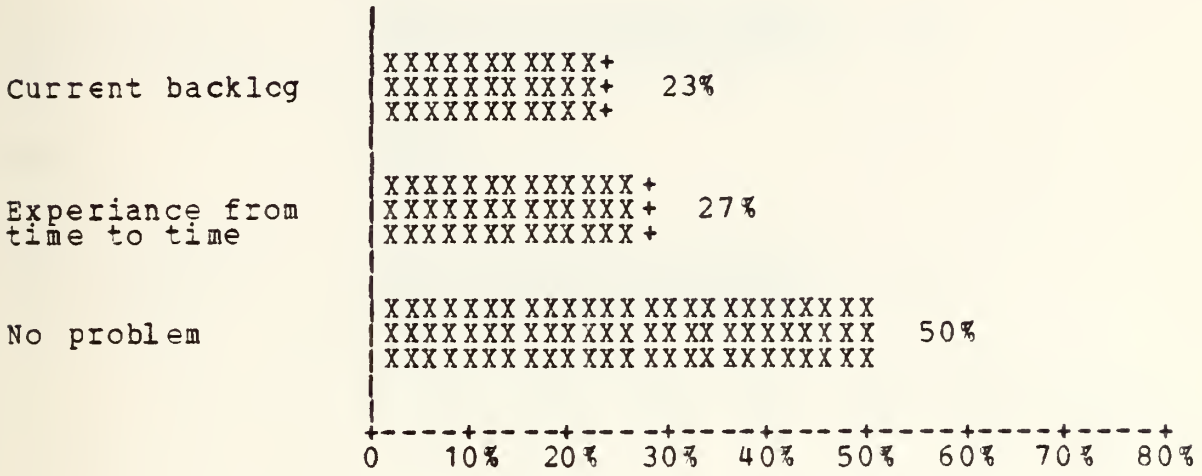


Figure 2

RESPONSE TO QUESTION ONE

When thcse offices which identified proposal backlogs as a prcblem were asked to comment on the frequency of the propcsal backlog problem, five (forty-five percent) stated the problem was occasional in nature, one (nine percent) stated it was often a problem, and five (forty-five percent) stated that the proposal backlog problem was a continuous problem. See Figure 3.

Questions three and four were designed to indicate the degree to which the backlog could be attributed to low dollar proposals and the reletive importance of the low dollar proposals compared to the entire backlog problem. A high percentage of numbers of proposals, coupled with a low

Question Two

With what frequency do proposal backlogs occure ?

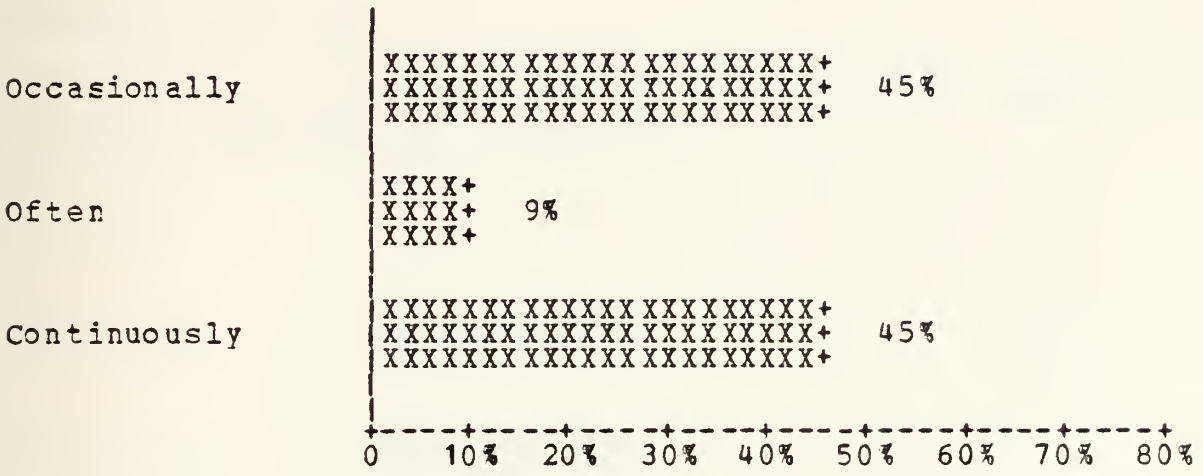


Figure 3
RESPONSE TO QUESTION TWO

percentage of dollar value of the backlog would indicate an ideal candidate for sampling, as it couples a large workload with a relatively smaller proportion of the dollar resources. A large volume of low dollar proposals is in its own right a candidate, but is somewhat less attractive from a risk allocation point of view. There are significant backlogs, particularly when the low dollar limit is set at $500,000. The backlogs are consistently greater in volume than dollar value. Figures 4 through 7 apply.

The majority of the eleven DCASPROs which identified a propcsal backlog as a problem, did not have significant funding problems. Four (thirty-six percent) stated that less than twenty percent of all proposals exceeded the funds provided by the requisitioner, three (twenty-seven percent) stated that the figure was between twenty and forty

Question Three (A)

Approximately what percentage of the backlogged number of propcsals would be under $100,000 ?

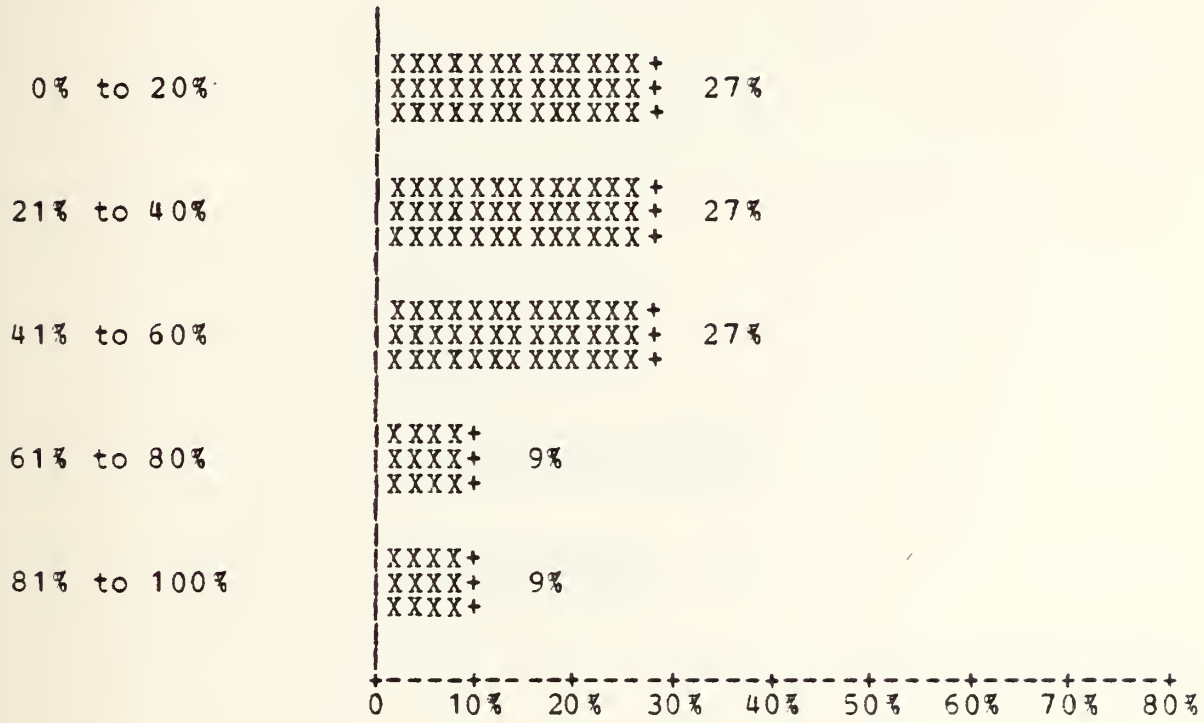


Figure 4

RESPONSE TO QUESTION THREE (A)

Question Three (B)

Approximately what percentage of the backlogged number of propcsals would be under $500,000 ?

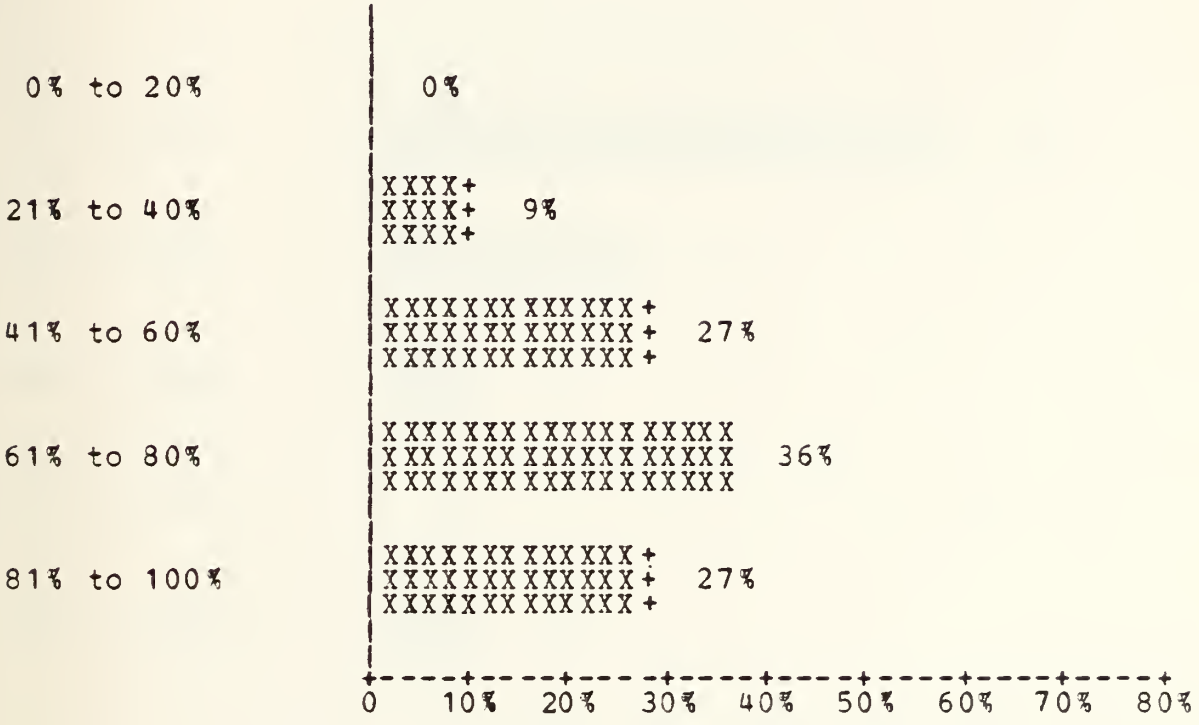


Figure 5
RESPONSE TO QUESTION THREE (B)

Question Four (A)

Approximately what percent of the

dollar value

of the backlog would be accounted for by proposals under $100,000 ?

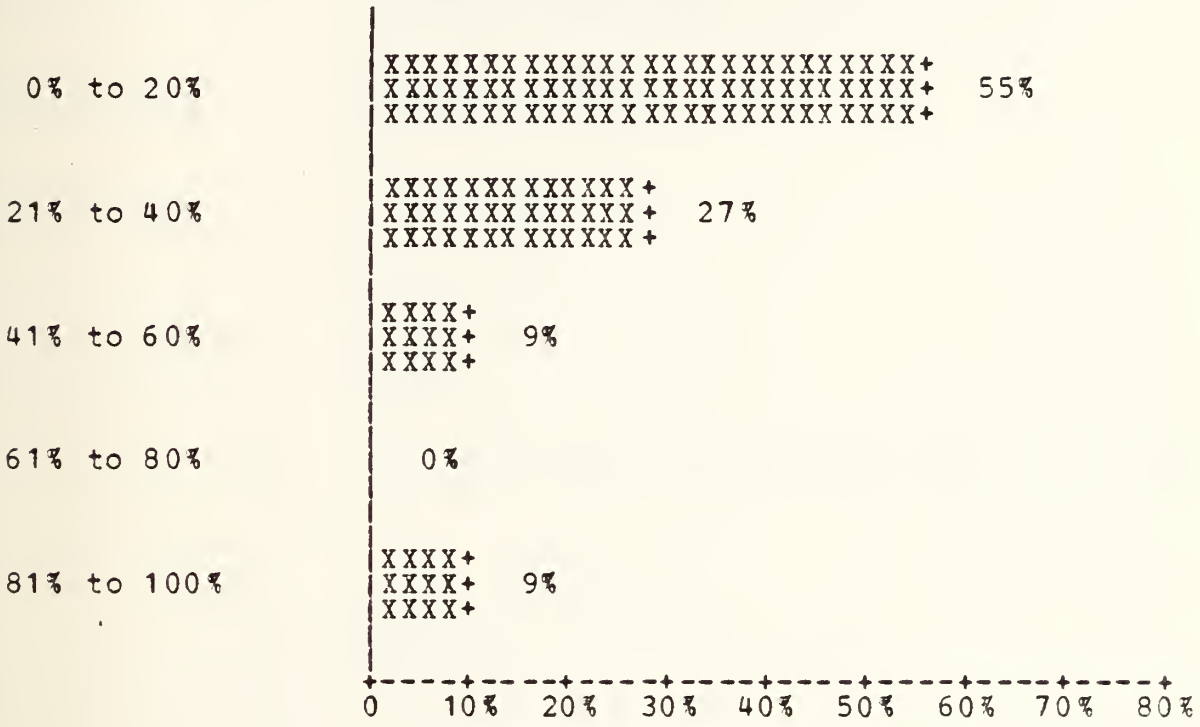


Figure 6

RESPONSE TO QUESTION 4 (A)

Question Four (B)

Approximately what percent of the dollar value of the backlog would be accounted for by proposals under $500,000 ?

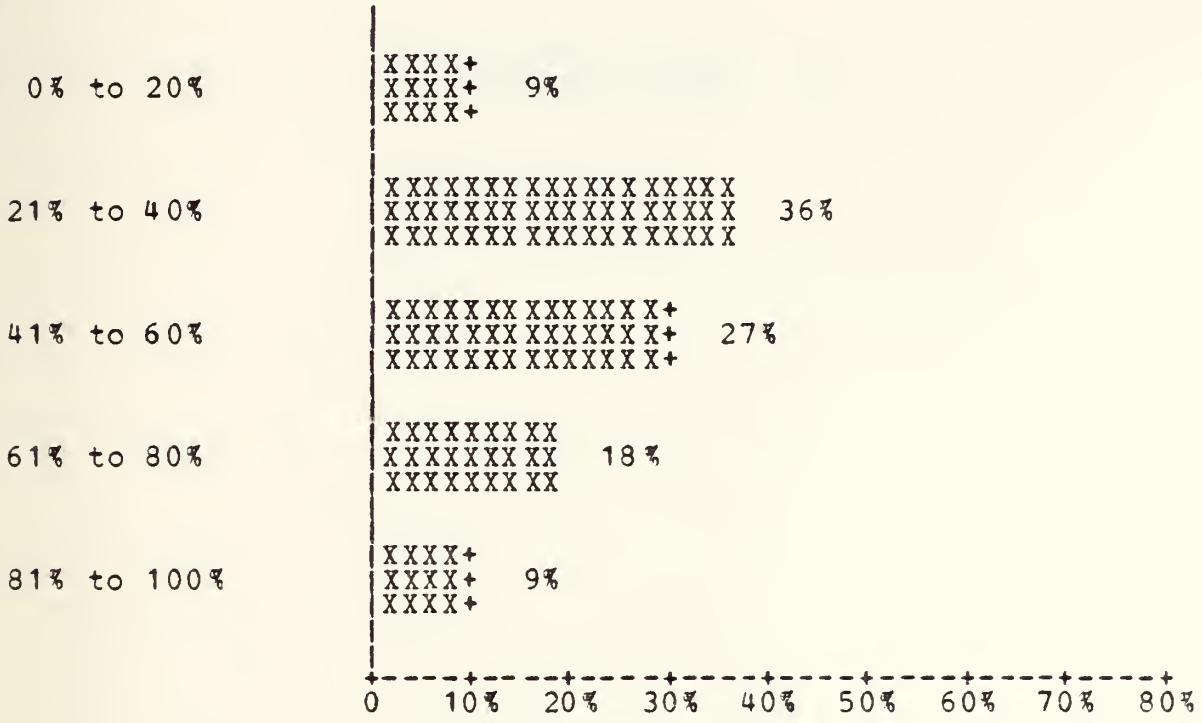


Figure 7
RESPONSE TO QUESTION 4 (B)

percent. The remaining four were distributed as follows, one (nine percent) between forty and sixty, two (eighteen percent) between sixty and eighty and one (nine percent) between eighty and one hundred percent.See Figure 8.

All respondents, whether they indicated a proposal backlog problem or not were asked if they used any form of

Question Five

With approximately what frequency do the proposals exceed the funding provided by the requisitioner ?

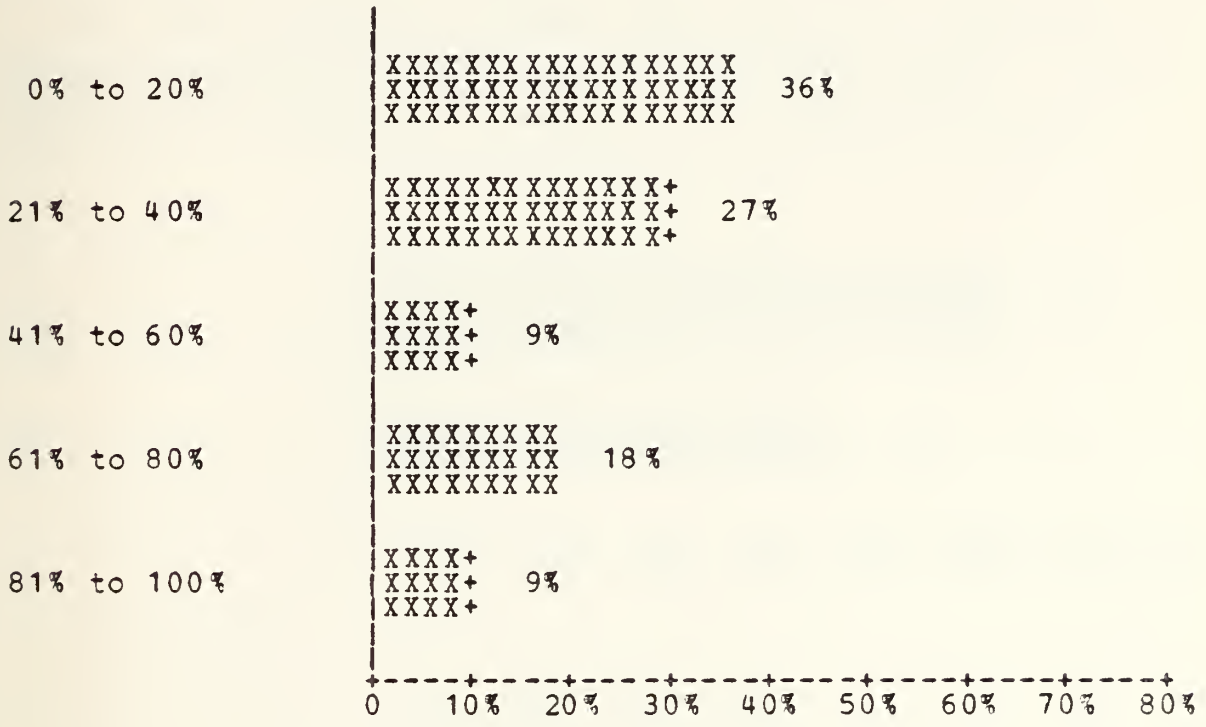


Figure 8
RESPONSE TO QUESTION 5

sampling, or other proposal evaluation technique to reduce the time required to evaluate and negotiate proposals. Fourteen (sixty-four percent) of the respondents stated that some form of expidited handling was used. Of the eleven who identified a proposal backlog problem eight (seventy-two percent) were using some form of expidited handling. Some of the procedures mentioned were: use of spare parts pricing formulas, partial waiver of price analysis and audit, and

comparison of present proposals to historical actual production data. See Figure 9.

Question Six

Dc you currently utilize some form of sampling or propcsal evaluation technique to reduce the amount of time required to evaluate and negotiate backlogged proposals ?

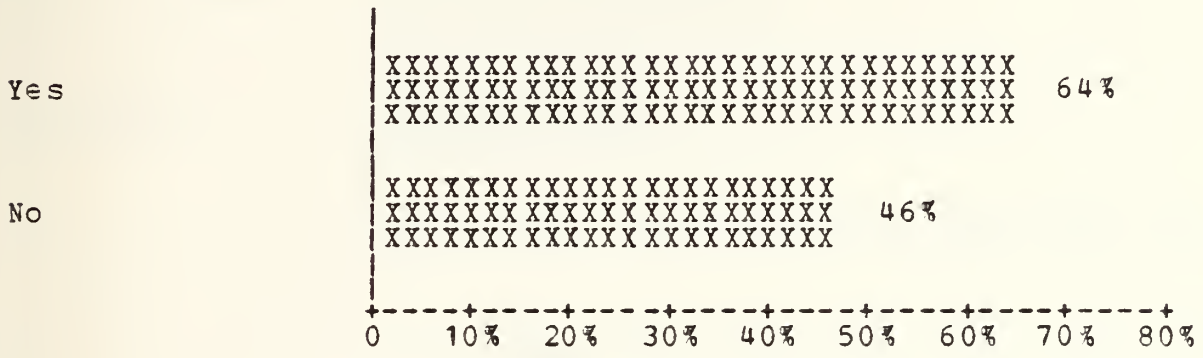


Figure 9
RESPONSE TO QUESTION 6

All respondents were asked to judge the nature of their propcsals as to whether they were similar, capable of being grouped into similar groups , or dissimilar. Seven (thirty-two percent) ranked proposals as being similar in nature, nine (forty-one percent) as capable of being grouped and six (twenty-eight percent) as being dissimilar. See Figure 10.

Of the eleven who indicated proposal backlog problems, five (forty-five percent) stated that proposals were similar, five (forty-five percent) that proposals could be grouped and one (nine percent) that proposals were dissimilar.

Question Seven

Are the proposals in the backlog similar in nature or easily divided into similar groupings ?

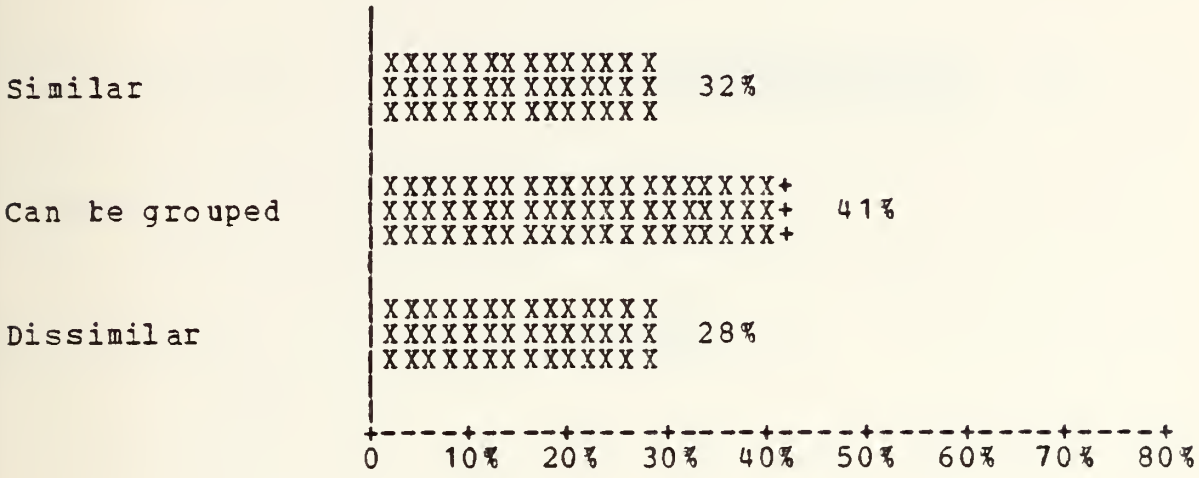


Figure 10
RESPONSE TO QUESTION 7

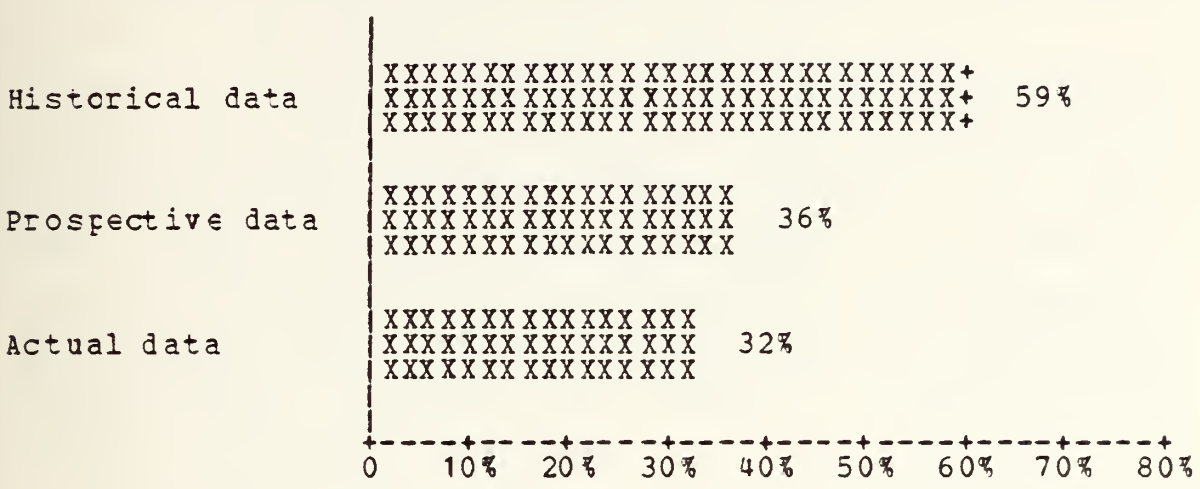
The final question requested information on how the government most often arrived at its negotiating position. The responses total more than twenty-two because some respondents used multiple methodologies. Thirteen offices indicated they based their position on historical information, eight based positions on prospective pricing data and seven based their positions on the actual production data for the item being negotiated. See Figure 11.

Additional considerations that may impact upon the ability to implement the "basket method" that were discussed during the unstructured portions of the interviews included:

1. Contracts from different departments and agencies in the same sample population.

Question Eight

Are negotiations generally based upon historical data, prospective data, or actual performance ?



Note: Use of more than one type data by contractors yields total percentage in excess of 100%.

Figure 11
RESPONSE TO QUESTION 8

2. Regulating restrictions against implementation.
3. Lack of confidence in a sampling technique by either the DCASPRO or, by DCASPRO inference, the contractor.

C. DISCUSSION OF DATA

It is apparent from the data displayed above that the propcsal backlog problem is significant in the DCASPRO areana, but not pervasive. For those DCASPROs which experiance problems in this area, there are widely divergent

characteristics that describe the extent of the problem and the composition of the backlog. There is also a divergence in the way the proposal backlog is handled by the managers of the various DCASPROs. Based upon the survey responses, the effectiveness of the management approach to the backlog problem is questionable in some instances.

Review of the responses taken on a case by case basis, disclosed five offices that appear to meet the preconditions for consideration of use of "basket method". In each of these cases a proposal backlog exists; the number of propcsals in the low dollar categories is large compared to their dollar value; adequate funding was not a significant problem and the proposals were similar or capable of being grouped intc similar categories.

The preconditions requiring a uniform proposal system and value in more rapidly disposing of the proposal backlog, were assumed to be valid for all elements in the sample. This assumption would require validation prior to implementation of the system in any new applications.

An analysis of the considerations raised by some of the respcndents that they felt might impact upon the ability to effectively implement the "basket method" yields only marginal impacts. The comments that the proposals generated from contracts from different service branches and in some cases even other departments of the government (ie. DOE), and are therefore not susceptible sampling procedures, raises a valid point. In its application at NAVPROs and SUPSHIPs the funding generally came from a single project officer or a single appropriation type such as aircraft procurement or ship repair. In this situation, Any error from the pricing of one proposal could be offset by an opposite error on another, and because the system is

unbiased, all the errors cancel each other out in the long run. This is complicated when multiple funding sources are intrcduced. While the positive and negative errors may cancel it could be that one services or department might benefit at the expense of another. This phenomoncn could be mitigated to a great extent by balancing the baskets on funds type. Each basket would have an equal representation of each fund type and the sample would be less likely to impact any source of funds at anothers expense. Another methcd would be to form separate populations from each fund type and then perform the "basket method." In any case since we are dealing with relatively low dollar values the impact of any sampling error on a particular source of funds is likely to be minimal.

The second consideration, that there were regulatory restrictions against an implementation of this sort of sampling system is more easily and straightforwardly dealt with. Paragraph 1-109.3 of DLAM 8105.1 states:

> Incvation to attain desirable objectives will occasionally require deviations from DAR, DoD Directive, and this manual. It is the responsibility of ACO's to request such deviations through command channels whenever they are in the best intrest of the government.

Regulatory restrictions are not a deathblow to the "basket methcd". Deviations can and should be made where necessary to implementation of the system.

The final consideration, that of a lack of confidence in the system by either the DCASPRO or the contractor, cannot be sc easily dismissed. In order for the "basket method" to be implemented it is necessary for both parties to understand the method and support its use. The simulation program provides a capability to preview the accuracy and effectiveness of the "basket method" in a graphic and easily

understandable manner. However, no matter how useful a tool it may be for proposal backlog reduction, it is not capable of opening a closed mind.

A qualitative analysis of the data presented in this chapter would imply that while it is not universally applicable, the "basket method" may be a useful tool for a significant number of DCASPROs and that implementation is not beyond the scope of an innovative manager.

IV. A SIMULATION

A. INTRODUCTION

The purpcse of this chapter is tc provide an example of the implementation of the "basket method" in a DCASPRO environment. DCASPRO Northern Ordnance, Minneapolis, Minnesota, was chosen as the subject for the example as it met the basic requirements and it had been designated as the authcrs next duty station. The information discussed in this section was gathered during a visit to DCASPRO Northern Ordnance in February 1982 and represents the status of the backlog at that point in time. The simulation provided in this chapter was based upcn a sample of one hundred actual bid prices and negotiated prices on proposals that had been definitized in the six mcnths prior to the visit.

B. THE COMPANY

FMC Northern Ordnance Division, manufactures the Mark 45 five inch gun, the Mark 75 three inch gun and the Mark 26 guided missle launcher for the United States Navy. They also provide spare parts and maintenance support for all systems currently in production and those that have been manufactured in the past. Navy contracts make up more than 85% cf their business. They also perform some manufacturing and maintenance for the Army and engage in some purely commerical production, primarily in their foundry. The plant is a Navy Industrial Reserve Ordnance Plant and is eighty percent Navy owned. The companies government contracts are administered by DCASPRO Northern Ordnance. The DCASPRO has forty-nine civil service employees assigned to quality, production, and contract administration tasks.

C. THE BACKLOG

In February 1982 the DCASPRO Northern Ordnance had three hundred three orders, against six basic ordering agreements (BOAs) that had not been definitized. The value of the backlog based upon the estimated cost obligated by the requisitioner was $32,582,297. The backlog of orders for which proposals had been recieved from the contractor numbered one hundred. The government estimate of their value was $12,622,770 as compared to the contractors propcsed value of $16,834,154. There were seventy-four propcsals valued at less than $100,000 each by the contractor. The government estimate for these orders was $2,331,706. The contractors proposed price was $2,724,770. It should be noted that the backlog of proposals under $100,000 represents seventy-four percent of the total number of backlog proposals and only sixteen percent of the dollar value of the backlog. Of the two hundred three orders that did not have proposals from the contractor, seventy-seven were delinquent (the time allowed to the contractor to make a proposal had expired,) and the remaining one hundred twenty-six were not yet due.

D. THE SIMULATION

As discussed in chapter I, the simulation program draws samples from the population, forms them into baskets, chooses a basket at random, compares the proposed and actual prices for the basket , applies the decrement to the entire sample and then compares the total value of the sample derived from the "basket method" to its actual negotiated value. This process is repeated a large number of times and the results are displayed in histogram and tabular form.

The simulation program from the "basket method" package was run utilizing a data base consisting of one hundred five

Table 1

BACKLOG STATUS

	Number	Government Estimate	Contractor Proposal
Backlogged Orders	303	$32,578,297	XXX
Backlogged Proposals	100	$12,622,770	$16,834,154
Backlogged Proposals Under $100,000	74	$ 2,331,706	$ 2,724,770

actual bid price/negotiated price pairs from the historical files of DCASPRO Northern Ordnance. The data base is presented in Table 2.

One thousand replications utilizing a sample size of fifty were performed. The resultant histograms are presented as Figures 12 thru 15.

It should be noted that the mean for each histogram is within five hundreths of one percent of zero in all cases, this is a result of the unbiased nature of the "basket method" technique, and indicates that over a long term neither party to the contract would benefit from the use of sampling.

The asymmetry of the histograms is caused by a small number of elements in the data base with larger than average decrements. When these are included in a single sample they create an over large decrement for the entire sample causing the relatively large under awards in a small percentage of the samples. This situation could possibly be diminished by "scrubbing" those proposals that experiance would indicate to be extreme from the population prior to

Table 2

SIMULATION DATA

	BID PRICE	NEGOTIATED PRICE		BID PRICE	NEGOTIATED PRICE
1.	36.882	36.242	2.	61.578	60.514
3.	11.058	10.424	4.	58.463	46.795
5.	52.719	51.811	6.	43.311	30.536
7.	10.696	10.512	8.	18.869	18.617
9.	16.663	16.376	10.	30.742	30.212
11.	42.505	41.773	12.	44.463	43.358
13.	25.517	25.077	14.	78.331	78.120
15.	15.360	15.096	16.	63.085	61.773
17.	39.568	38.887	18.	15.089	14.829
19.	30.422	29.897	20.	77.897	76.554
21.	26.148	25.697	22.	10.145	9.971
23.	69.768	68.567	24.	52.838	49.831
25.	14.436	14.187	26.	10.326	10.148
27.	10.750	9.873	28.	31.063	30.574
29.	66.988	65.834	30.	36.439	35.812
31.	18.526	18.206	32.	18.450	18.132
33.	10.327	10.146	34.	11.505	10.381
35.	47.036	46.226	36.	18.089	17.777
37.	16.542	16.257	38.	27.174	26.706
39.	39.840	39.150	40.	50.837	50.389
41.	27.572	27.097	42.	46.928	46.120
43.	19.766	19.424	44.	12.055	11.847
45.	11.074	9.183	46.	16.747	16.458
47.	30.841	30.303	48.	36.092	35.883
49.	64.193	63.240	50.	81.023	79.616
51.	50.640	49.771	52.	23.420	23.304
53.	61.242	60.107	54.	10.304	10.126
55.	28.407	27.916	56.	79.497	78.120
57.	47.761	46.930	58.	12.857	12.224
59.	10.780	10.594	60.	21.770	20.123
61.	22.572	22.182	62.	29.855	29.339
63.	14.013	13.771	64.	12.841	12.620
65.	47.160	45.854	66.	14.740	14.451
67.	56.893	53.637	68.	17.602	17.298
69.	45.605	42.517	70.	21.253	20.887
71.	69.118	65.529	72.	29.250	25.786
73.	25.097	21.125	74.	51.178	50.295
75.	44.825	41.832	76.	14.743	14.129
77.	45.996	41.544	78.	30.046	29.524
79.	12.198	11.327	80.	29.127	26.381
81.	35.692	33.352	82.	92.872	90.593
83.	79.437	77.752	84.	70.204	66.080
85.	23.444	22.314	86.	16.805	14.124
87.	11.054	9.938	88.	13.846	13.195
89.	45.716	44.928	90.	13.154	12.744
91.	15.020	14.594	92.	20.791	13.595
93.	11.041	10.724	94.	18.579	15.985
95.	35.717	34.000	96.	47.903	47.000
97.	89.951	88.300	98.	66.638	65.562
99.	67.639	63.900	100.	18.629	17.690
101.	31.954	25.250	102.	54.378	47.243
103.	78.506	72.858	104.	14.216	12.752
105.	98.960	77.522			

CLASS INTRVAL CENTER	CUM REL FREQ	REL FREQ	0.1 0.2 0.3 0.4 0.5
-10.00	0.0	0.0	|
-9.00	0.0	0.0	|
-8.00	0.0	0.0	|
-7.00	0.0	0.0	|
-6.00	0.0	0.0	|
-5.00	0.0	0.0	|
-4.00	0.0	0.0	|
-3.00	0.019	0.019	|*
-2.00	0.101	0.082	|++++*
-1.00	0.333	0.232	|++++++++++*
0.0	0.649	0.316	|++++++++++++++*
1.00	0.886	0.237	|++++++++++*
2.00	0.982	0.096	|++++*
3.00	0.999	0.017	|*
4.00	1.000	0.001	|*
5.00	1.000	0.0	|
6.00	1.000	0.0	|
7.00	1.000	0.0	|
8.00	1.000	0.0	|
9.00	1.000	0.0	|
10.00	1.000	0.0	|

PERCENT ERROR: MEAN = 0.036 STD DEV = 1.193

Figure 12

RELATIVE FREQUENCY OF PERCENT OVERAWARD WITH 2 BASKETS

CLASS INTRVAL CENTER	CUM REL FREQ	REL FREQ	0.1 0.2 0.3 0.4 0.5
-10.00	0.0	0.0	|
-9.00	0.0	0.0	|
-8.00	0.0	0.0	|
-7.00	0.0	0.0	|
-6.00	0.001	0.001	|*
-5.00	0.005	0.004	|*
-4.00	0.027	0.022	|+*
-3.00	0.088	0.061	|+++*
-2.00	0.183	0.095	|++++*
-1.00	0.349	0.166	|++++++++*
0.0	0.582	0.233	|++++++++++*
1.00	0.834	0.252	|++++++++++*
2.00	0.953	0.119	|+++++*
3.00	0.997	0.044	|++*
4.00	1.000	0.003	|*
5.00	1.000	0.0	|
6.00	1.000	0.0	|
7.00	1.000	0.0	|
8.00	1.000	0.0	|
9.00	1.000	0.0	|
10.00	1.000	0.0	|

PERCENT ERROR: MEAN = -0.015 STD DEV = 1.629

Figure 13

RELATIVE FREQUENCY OF PERCENT OVERAWARD WITH 3 BASKETS

CLASS INTRVAL CENTER	CUM REL FREQ	REL FREQ	0.1 0.2 0.3 0.4 0.5
-10.00	0.0	0.0	|
-9.00	0.0	0.0	|
-8.00	0.0	0.0	|
-7.00	0.003	0.003	|*
-6.00	0.015	0.012	|*
-5.00	0.025	0.010	|*
-4.00	0.058	0.033	|+*
-3.00	0.115	0.057	|++*
-2.00	0.209	0.094	|++++*
-1.00	0.352	0.143	|+++++++*
0.0	0.574	0.222	|+++++++++++*
1.00	0.792	0.218	|++++++++++*
2.00	0.941	0.149	|+++++++*
3.00	0.995	0.054	|++*
4.00	1.000	0.005	|*
5.00	1.000	0.0	|
6.00	1.000	0.0	|
7.00	1.000	0.0	|
8.00	1.000	0.0	|
9.00	1.000	0.0	|
10.00	1.000	0.0	|

PERCENT ERROR: MEAN = -0.050 STD DEV = 1.926

Figure 14

RELATIVE FREQUENCY OF PERCENT OVERAWARD WITH 4 BASKETS

CLASS INTRVAL CENTER	CUM REL FREQ	REL FREQ	0.1 0.2 0.3 0.4 0.5
-10.00	0.0	0.0	|
-9.00	0.0	0.0	|
-8.00	0.001	0.001	|*
-7.00	0.004	0.003	|*
-6.00	0.019	0.015	|*
-5.00	0.035	0.016	|*
-4.00	0.068	0.033	|+*
-3.00	0.137	0.069	|+++*
-2.00	0.215	0.078	|+++*
-1.00	0.343	0.128	|++++++*
0.0	0.502	0.159	|+++++++*
1.00	0.718	0.216	|++++++++++*
2.00	0.919	0.201	|++++++++++*
3.00	0.990	0.071	|+++*
4.00	1.000	0.010	|*
5.00	1.000	0.0	|
6.00	1.000	0.0	|
7.00	1.000	0.0	|
8.00	1.000	0.0	|
9.00	1.000	0.0	|
10.00	1.000	0.0	|

PERCENT ERROR: MEAN = 0.031 STD DEV = 2.107

Figure 15

RELATIVE FREQUENCY OF PERCENT OVERAWARD WITH 5 BASKETS

basket formation, or through the assignment of "characteristics" that would cause these extreme elements to be balanced amoung the baskets.

Table 3

RELATIVE FREQUENCY OF PERCENT OVERAWARD

NUMBER OF BASKTS	PERCENT OVER AWARD INTERVAL +-1	+-2	+-3	+-4	+-5	+-6
2	0.785	0.963	0.999	1.000	1.000	1.000
3	0.651	0.865	0.970	0.995	0.999	1.000
4	0.583	0.826	0.937	0.975	0.985	0.997
5	0.503	0.782	0.922	0.965	0.981	0.996

Table 3 provides in tabular form the information from which a statement of probable error can be made.

For each sample size (number of baskets) a relative frequency for each of six degrees of precision (from +-1% to +-6%) is displayed. This relative frequency provides the level of confidence for the sample size/degree of precision pairs. By setting the parameters of any two of the three elements, the third may be discovered. For example, if a precision of plus or minus three percent were desired with ninety plus percent confidence, five baskets (a twenty percent sample) could be used. Assuming that the above presented parameters were acceptable and a twenty percent sample of the seventy-four proposals under $100.000 was made, fifteen proposals would be negotiated or fifteen percent of the number of backlogged proposals. This comes very close to matching the workload with the value of the backlog. In this case, fifteen percent of the number would

be negotiated to determine sixteen percent of the dollar value of the backlog.

E. SIMULATION ANALYSIS

Using a twenty percent sample (five baskets) and assuming a worst case, it would be possible to negotiate a one and three tenths percent underaward or a one half percent overaward for the entire backlog. The above figures were calculated in the following manner. Referring to Figure 15 it can be seen that one tenth of one percent of the time an eight percent underaward was made. Eight percent of the population of proposals under $100,000 is $217,982. $217,982 is one and three tenths percent of the value of the entire backlog. Similarly, one percent of the time a three percent overaward would be made. Three percent of the population of proposals under $100,000 is $81,743 which is half of one percent of the total backlog. Because the negotiation procedure itself lacks precision, variances of this order are not unacceptable. It must also be remembered that the numbers discussed above were worst case examples that would occure only one tenth of one percent, and one percent of the time respectively. Ninty-two percent of the time the over/under award would be within three percent of actual value or within one half of one percent of the total backlog value.

By using the simulation program and varying the sample size, degree of precision and level of confidence, it is possible to determine the effect that utilization of the "basket method" would have over a broad range of applications and enable decision makers to ascertain those values that best meet their requirements.

F. COSTS AND BENEFITS

A brief discussion of the costs and savings that would accrue to the DCASPRO is in order. The DCASPRO would be required to acquire a terminal with a telephone modem that is ccmpatable with the Ccpper IMPACT system. A terminal of this nature could probably be acquired from an excess list, but could be obtained on a rented basis for approximately $75 per month. The cost of system use is based upon CPU time utilized. The cost to run the "basket method" thru a single iteration is between thirty and fifty dollars. At DCASPRO Northern Ordnance it might be necessary to use the "basket method" twice a year. If all the terminal cost were charged to the "basket method", the total implementation costs would be approximately $1,000 per year. If the Copper IMPACT system were used for other applications the cost allocatable to the "basket method" would be considerably reduced.

I have specifically chosen not to quantify the benefits of the "basket method" through assignment of specific time pericds to specific contracting steps and stating that the application of the "basket method" saves a set number of hours at a specified rate per hour. Different proposals require very different amounts of time to process and it is a fallacious apporach to try to define an average procurement action, particularly when the "basket method" focuses specifically on low dollar value proposals. It is not expected nor should it be proposed that a three thousand dollar proposal would require or recieve the same amount of cost/price analysis or negotiating time as a three million dollar propcsal, nor would it be reasonable to average those propcsal times and apply a "basket method" saving in that manner.

The savings that accure thru use of the "basket method" are difficult to quantify but no less important for their apparent fuzzyness. Time and quality of effort are the problems that arrise from a backlog situation. The existence of a backlog indicates a lack of time to deal with the workload. When time is short and the work piles up it is human nature to sacrifice quality for quantity. The benefit of the "basket method" is that it allows this application of human nature to occur in a structured and statistically acceptable manner.

What the "basket method" allows you to do is simply to spend less time performing the contracting chores on the low dollar value proposals that tend to be more routine, making that time available for use in definitizing high dollar value proposals. The value of that time is greater than the wages the government pays for it. It has greater value in that better preparation for and analysis of high dollar value proposals should produce better final contracts. It makes the time available by reducing the backlog of low dollar proposals very rapidly, with known and acceptable risk.

APPENDIX A A SAMPLE BILATERAL AGREEMENT

MEMORANDUM OF AGREEMENT

Subject: Grcundrules for Negotiating Proposals under $100,000; by STATISTICAL SAMPLING METHOD

Agreement between the Grumman Areospace Corporation (GAC) and the Naval Plant Representative (NAVPRO), Bethpage, to negotiate under $100,000 proposals by use of Statistical Sampling.

In order to establish a realistic method of equitably and more rapidly negotiating the many pricing proposals submitted by the contractor which are individually less than $100,000 - the following procedure is agreed to:

I. GENERAL RULES

a. On a periodic basis (26 calendar days - beginning on a Monday and ending on a Friday) proposals under $100,000 will be grouped and negotiated by using the sampling technique described herein.

b. The proposals to be selected will be all those proposals issued by GAC for Supplies or Services under the negotiation cognizance of NPRO, not previously negotiated, with the exception of the following:

1. Repair of repairables
2. Publications
3. FMS effort (if pricing pattern differs from normal)
4. Proposals exceeding ceiling prices of orders issued

5. Cost Type/Fixed Price Incentive Proposals (if the number is less than the number of baskets - See Section IIb.)

However as the parties may agree, the types of proposals described in Ib., above, and/or proposals covering other commodities or services may also be segregated for negotiation either individually or by sampling under this agreement or as a separate homogeneous group.

c. Once the "Sample" has been selected, if it is determined during negotiation of the selected "Sample" that any of the "Sample" proposals are either overpriced or underpriced, neither revision of the price proposed nor removal from the "Sample" will be allowed, and the resultant negotiation differential from the original proposed price will be included in the determination of the decrement or increment applicable to the balance of the "Universe". If, however , a proposal included in the Universe or the Sample has been subsequently cancelled by the customer, said proposal will be excluded completely and totals adjusted accordingly, without readjusting the composite of either the Sample or the Universe.

II. PROCEDURE

a. On Monday immediately following the end of the preceding collection period, the NAVPRO Bethpage Stat Monitor will contact the GAC employee responsible for statistical sampling negotiations and furnish the said GAC emplcyee a list of all the proposals recommended for inclusion in the "Universe".

b. The proposals will be counted to determin the number of baskets to be created by the computer program. Based on

the number of proposals remaining in the "Universe", the number of baskets will be determined as followes:

NUMBER OF PROPOSALS	NUMBER OF BASKETS
1 to 15	no baskets, all proposals will be released for 100% negotiation
16 to 26	2
27 to 40	3
41 to 57	4
58 and over	5

c. The "Universe" will be separated into the appropriate number of baskets by the use of the NAVPRO computer program which will balance them by dollar value and type of contract to the greatest extent possible and the computer printout showing these baskets will be submitted to the NAVPRO Stat Monitor by the computer operator in a sealed envelope.

d. After receiving the sealed envelope, the monitor will, with the contractor representative, establish a mutually agreeable time for selection of a "Basket". At that time the contractor representative will roll a die until a number corresponding to one of the baskets turns up. Example: there are four "Baskets" and the contractor representative rolls a six. This does not correspond with the number of "Baskets" (1 through 4). Therefore, the contractor representative rolls the die again. This time a two appears. Since this number correspondes to "Basket" Number 2, that basket shall be the one selected for negotiation as the "Sample".

e. The selected "Sample" will be analyzed and negotiated individually.

f. Upon completion of the negotiation of the proposals constituting the "Sample", a decrement ratio shall be established, and applied to the balance of the proposals in the "Universe". The difference between the aggregate of the propcsed prices in the "Sample" and the aggregate of the negotiated prices of the same "Sample" is divided by the aggregate of such proposed prices and rounded to the nearest three decimal places to determin the "Decrement Factor", as illustrated in the following example:

(A.)	$250,000	Sum of Values in Proposed Sample
(B.)	$225,000	Sum of Negotiated Total of Sample
(C.)	$ 25,000	Decrement Total Dollars via Negotiation
(C.)	$ 25,000	
(A.)	$250,000	= .100 Decrement Factor

This factor is then applied to the remaining documents in the "Universe", to arrive at the negotiated price for each such proposal.

g. Where incentive or cost type proposals are involved and the target prices and ceilings are to be considered, the aggregate profit and average ceiling (to the nearest tenth of a percent) are to be determined by the results of the negotiated "Sample". These resultes shall then be applied to the balance of the unnegotiated Incentive and Cost Type propcsals in the "Universe", as followes:

(1) Using the decrement price of each of these proposals, divide that price by the profit + 100%, which will yield the computed target cost.
(2) The computed target cost times the profit percentage will determine the profit dollars, which, when added to the computed target cost totals to the decremented price.
(3) The negotiated average ceiling is applied to the computed target cost for each Incentive Type proposal in the balance of the "Universe" to arrive at the negotiated ceiling dollars for each such proposal.

h. The negotiated price or prices for the proposals in the "Samlpe" will be definitized within 15 working days after the price for the last proposal in the "Sample" is negotiated.

i. Supplimental Agreements definitizing the prices of the balance of the proposals of the "Universe" determined as in subparagraphs II.f and II.g above, will be prepared and executed within 30 working days after negotiation of the "Sample" described in subparagraph II.d above, is consummated.

III. ABRCGATION

Either party may recind this Agreement by providing, in writing, a thirty-day (30) notice of an intention to abrogate.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2.	Library Code 0142 Naval Postgraduate School Monterey, California 93940	2
3.	Department Chairman, Code 54 Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	1
4.	Professor John W. Creighton, Code 54 Cf Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	1
5.	LCDR Raymond W. Smith, SC, USN 510 South 4th East Logan, Utah 84321	1