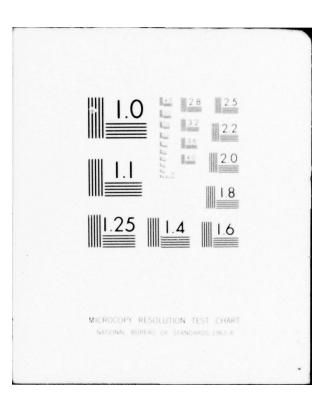
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### FOREWORD

This report covers work conducted in-house by the System Evaluation Group (AAA-3), Synthesis and Analysis Branch, System Avionics Division, Air Force Avionics Laboratory, Wright-Patterson AFB, Ohio 45433, under PE 62204F, Project 2003 "Avionics System Design Technology", Task 200309, "Avionics System Cost-Effectiveness", Work Unit 20030902 "Avionics Life Cycle Cost". The time period of work was June 76 through August 76.

Significant contributors to this report were Capt Boundon and Capt White both from Electronic Systems Division, Hanscom AFB, MA. Great appreciation is extended to Capt. Ken Almquist (AFAL/AAA-3) for his participation.

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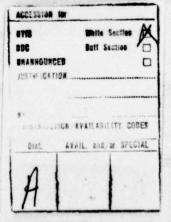
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20. ABSTRACT (Cont'd)

phases of the life cycle, but have yet to be validated. The purpose of this report is to present some of the more popular software cost models and to encourage validation studies to determine which methods or models provide greatest promise for accuracy. It is hoped that this report will stimulate research and analysis into software cost estimating similar to the work being done in hardware cost prediction techniques.



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This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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FOR THE COMMANDER

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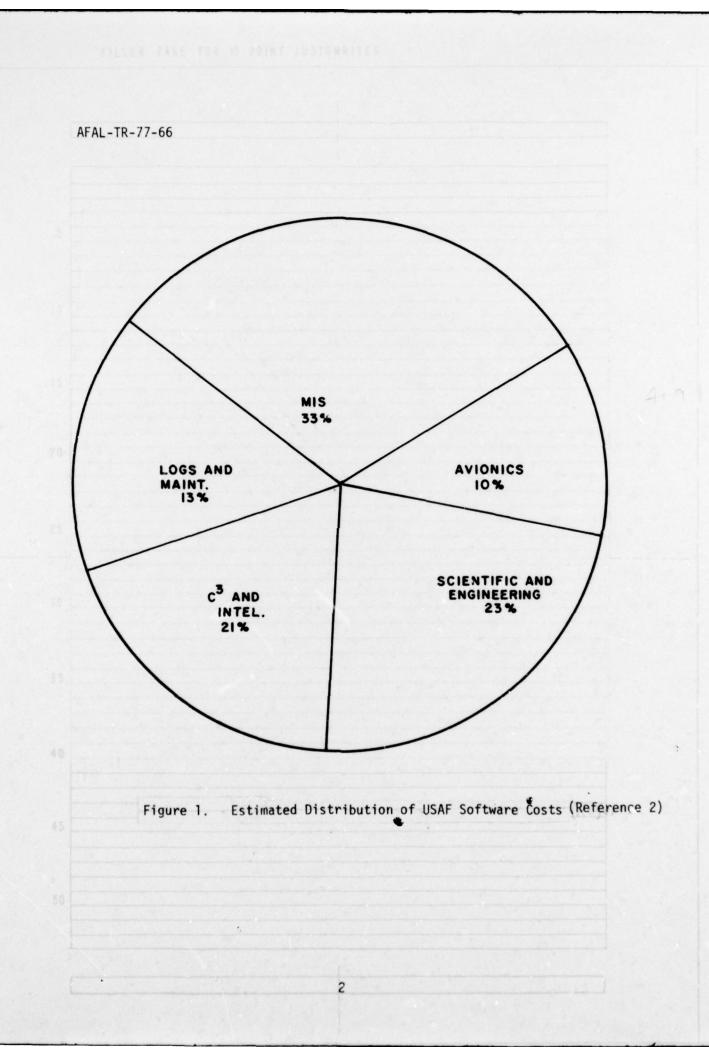
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#### SECTION I

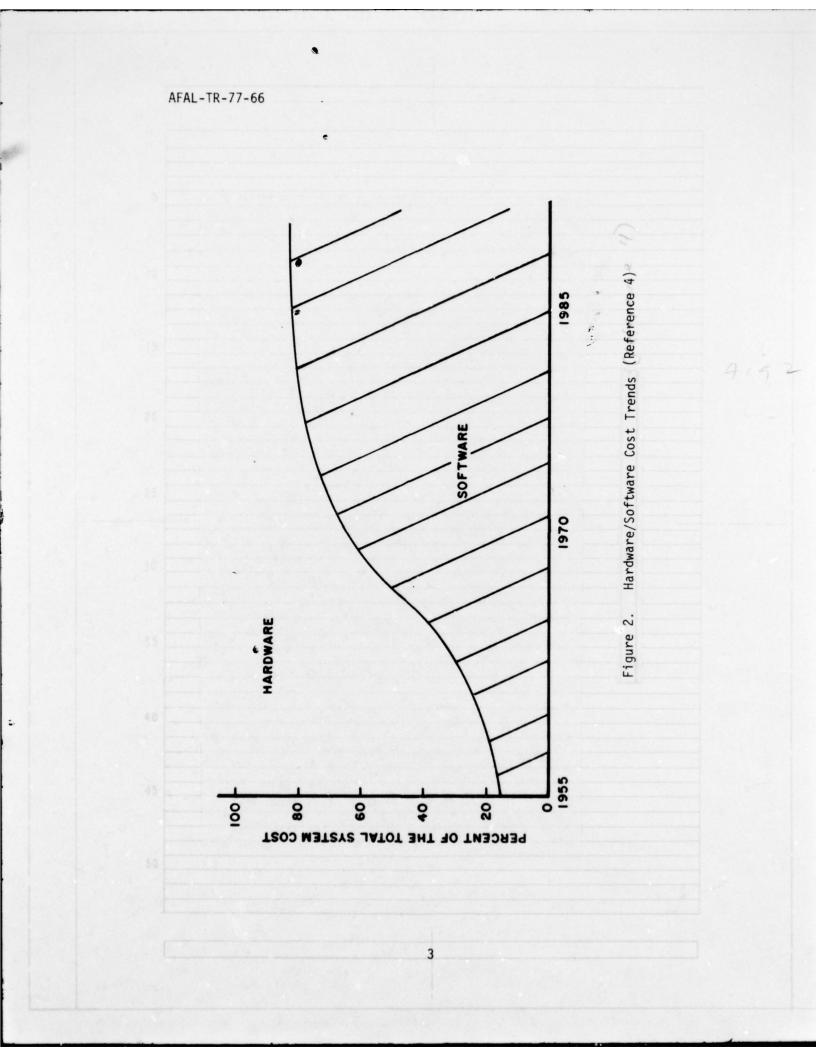
## INTRODUCTION AND SUMMARY

In a recent USAF study of information processing requirements it was shown that in almost all applications, computer software was the major source of difficult problems, a major contributor to operational performance penalties, and potentially the largest source of life cycle cost. During the acquisition cycle of a weapon system, the military spends half of the total system acquisition cost on software (Reference 1). The Air Force spent between one and one and one-half billion dollars on software alone in 1972, which represented an expenditure of about four to five percent of the total Air Force budget (Reference 2). In comparison, the Air Force spends only \$300 to \$400 million per year on computer hardware. There have been large expenditures for software packages in the recent past, and yet it appears that software development costs are continually rising (\$6 to \$30 per line of code and upwards to \$150 per line of code for very complex space systems) (Reference 2). In a July 1976 "Newsweek", it was stated that in the 1950's the rate of computer hardware costs to software costs was 4 to 1, compared to the present figure of 1 to 4, a complete turn-around in a little over 20 years (Reference 3). Decreasing hardware production costs and increasing personnel costs, are partly the explanation for this turn of events. Figure 1 is an estimated distribution of the total portion of the USAF budget spent on software. Figure 2 shows the relationship of hardware to software costs projected to the year 1985 (Reference 4).

In addition to the constantly rising cost for software development, software reliability, unresponsiveness, and indirect costs associated with slippages in software developments are of major concern to the USAF. A number of reports stress the fact that in software products acquired by the military, the quality or "relaibility" of the software produced is generally unacceptable (error rates of over 1 error per 100 lines of code (Reference 2). The CCIP-85 report (Reference 5) states that military software is extremely unreliable and unacceptable at the present time. A number of examples were given which indicate that software errors have



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caused considerable loss in terms of hardware equipment. Current Air Force software reliability problems indicate that software errors could cause the Air Force to lose critical command post or satellite capabilities in a strategic crisis situation.

Also, software is frequently unresponsive: 95 percent of the SAC Automated Command and Control System (465L) software package delivered to SAC had to be rewritten to meet SAC's operational needs and 67 percent of the Seek Data II software used during the Vietnam conflict had to be rewitten (Reference 6). In addition, it has been established that indirect costs of software slippages generally far exceed the direct costs (Reference 7).

The above examples emphasize the general criticality of military software, where many operations have to be performed in a few seconds or less. As a result, the military is taking a closer look at software development procedures and a greater portion of its R&D resources are being allocated to the software verification and validation (V&V) and development tools. However, in order to reduce the costs of software, the Air Force should have a defined method which will allow the analyst, software engineer, and/or project manager to estimate software development and support costs, given the basic requirements of the new system being developed. There exists today computerized models to predict the cost of hardware in terms of research and development, acquisition, and operation/ support costs. These models, some of which have been validated, are widely used. (NOTE: There are those who will disagree that the military possesses the models to accurately predict hardware costs, but "life cycle cost" models for hardware do exist). Hardware has been in existence longer than software yet there is still no widely agreed-upon hardware life cycle cost methodology. Hence, the expectation that a validated/proven software life cycle cost model will come along in the next few years may not be realistic but it is certainly worth working toward.

The purpose of this report is to investigate the field of cost estimating as applied to computer software, primarily for the purpose of estimating the total life cycle cost of software for new avionics equipment under development. In this report past, present, and future efforts to derive a valid methodology to predict software life cycle costs will be discussed. Several methods or "models" which are usable today will be presented or referenced. The statistical confidence with which one may use the methods, however, is quite low. Therefore, they are presented not as tested, well-proven tools, but as guidelines to be used in conjunction with additional techniques, experience, and judgement. It is hoped that the reader will acquire some knowledge as to what is being done to predict software costs. The acquisition of software, the support of software, and the reliability of software are topics permitting unlimited discussions. This report will deal with each area in as much detail as time permits, primarily focusing on the acquisition costs of software. Due to limited time and space, the models are described in very concise terms in this report. Before actually applying a model, the reader is referred to the source document containing a more detailed discussion of a particular equation/model.

The following types of computer software programs were analyzed by various organizations in an attempt to derive a software cost estimating procedure: Management information systems (MIS); avionics; scientific and engineering; logistic and maintenance; command, control and communication, and intelligence. The question of whether avionics software is more costly than MIS software, etc., does not seem to be addressed to the point of defining a definite relationship, although it is thought that space and avionics software are more costly due to required testing and more detailed design effort.

#### SECTION II

## DEFINITION OF TERMS

Most persons that will read this report are already familiar with the terms that have and will be used. Since, however, most readers have their own definition of terms such as software, reliability, operation and support, etc., these terms will be defined to insure a common foundation for the discussion to follow.

#### 1. SOFTWARE

AFAL-TR-73-341 defines software as "the programs and routines used to extend the capability of automatic data processing equipment." To expand the definition of software as defined in AFAL-TR-73-341, this report also considers software as the programs and routines used to extend the capability of computers which are imbedded within weapon systems (not merely automatic data processing equipment). Software is further broken down into two types, basic software and application software. For purposes of this report, the term software will include all necessary documentation from functional specifications to flowcharts and users' manuals as well as the actual computer code.

a. <u>Basic software</u> comprises those routines and programs designed to extend or facilitate the use of particular automatic data processing equipment, the requirements for which take into account the design characteristics of such equipment. This software is usually provided by the original equipment manufacturers and is normally essential to and a part of the system configuration furnished by him. Examples of basic software are executive and operating programs, diagnostic programs, compilers, assemblers, utility routines, file management programs, and data management programs.

b. <u>Application software</u> consists of those routines and programs designed by or for automatic data processing equipment users, to accomplish specific mission-oriented tasks, jobs, or functions using the automatic data processing equipment and basic software available. Except for general purpose packages which are acquired directly from software vendors or from the original equipment manufacturers, this type of software is normally developed by the user in-house or through contract services.

# 2. REAL TIME SOFTWARE

A real time computer software system is defined as one which controls an environment by receiving data, processing them, and taking action or returning results sufficiently quickly, to effect the functioning of the environment at that time. "Sufficiently quickly" refers to the time which "allows users to interact with the computer on a time scale appropriate for human beings -- on the order of a few seconds between responses."

#### 3. SOFTWARE ACQUISITION COST

The term acquisition cost of software is used in the same sense as acquisition cost of hardware. It includes the cost of analysis, design, programming, checkout, test, and documentation.

#### 4. SOFTWARE RELIABILITY

Software reliability is the rate at which errors are detected in a program, i.e., number of errors per unit time of operations. A more formal definition of reliability states "Reliability - the characteristic of an item expressed by the probability that it will perform a required function under stated conditions for a stated period of time." (Reference 3). "Reliability is the measure of the frequency of failure of the computer software." (Reference 5).

# 5. MAINTAINABILITY

Maintainability is defined as a measure of the ease with which errors in a computer program can be corrected and system function and capability can be expanded or added. Unlike hardware, software maintainability entails some "redesign."

# 6. OPERATION AND SUPPORT

The operation/support (O&S) or maintenance costs of software include the costs associated with using or "running" the computer programs, modification or adaptation of an existing program to a computer system or to accommodate changes in system software, and the general day-to-day reprogramming that must be accomplished to keep the program operational. The operation/support costs are directly related to the reliability (number of errors) and the maintainability (cost to fix the errors).

## 7. LIFE CYCLE COST

The life cycle cost (LCC) of software is the total of the research and development, acquisition, and operation and maintenance costs.

#### SECTION III

## REQUIREMENTS TO FORECAST SOFTWARE COSTS

The requirements to forecast software costs can be broken down into three areas of concern. The first and primary area is, what are the different methods available today for deriving a software cost estimate. Once the method has been determined, how are the historical data items collected to utilize the method. The method of deriving a software cost estimate plus the management responsibilities and proposed work breakdown structure for the collection of software data will be discussed in the following paragraphs.

### 1. METHODS FOR DERIVING SOFTWARE COSTS

In October 1974, a government/industry software workshop was held at Hanscom AFB, Massachusetts, sponsored by Electronic Systems Division (ESD) (AFSC). The purpose of the workshop was to "improve communications between industry and government in the problems of forecasting software development costs" (Reference 8). The objective of agencies dealing in software is to improve the accuracy/credibility of future software cost estimates for electronic defense systems. The workshop listed several methods for deriving software cost, the principal ones being factors, experts, ratio to previous experience, ratio to total system dollars, and probabilities.

The factors method involves identification of cost drivers and the formulation of an equation/series of equations relating these drivers to cost. These equations, cost estimating relationships, (CER's) are derived through the application of statistical methods to appropriate historical data. During the ESD Workshop the following dominant cost drivers were identified: (1) number of instructions in the program, (2) type of programming language (Higher Ordered Language (HOL), Machine Ordered Language (MOL)), (3) real time application, (4) type of program, (5) desired quality, (6) amount of documentation, (7) hardware constraints, (8) schedules, (9) size of data bases, (10) complexity, and (11) personnel

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and management functions. Table 4 lists the driving factors the government and industry agreed upon and best guesses as to the effects these drivers have on software costs. NOTE: Items 1, 2, and 10 are common factors seen in the majority of CER's developed thus far. The factor method is good from the standpoint that it provides a quantitative relationship which is easy to apply. A major drawback of the factors method is that some inputs are subjective in nature, such as the complexity of the program, the skill level of programmer, etc. Development of reliable software cost estimating relationships (SCER's) using the factors method is currently limited by the quality/quantity of historical software cost data available. The data problem and what is being done to overcome it, will be discussed later.

The method of "experts" (delphi technique) has been used much in the past. This method, as the name implies, is dependent upon subjective opinions of a group of experts in the software field. Results are obviously only as good as the participants of the group. The method of experts, very similar to the corporate approach, is directed more along the lines of engineering estimates than statistically derived CER's. After estimating program size and complexity (usually by comparison with similar previous programs), historical corporate productivity data is applied to estimate direct labor hours (and thus direct costs) for coding and debugging. Costs for all other phases and factors in the development process are then estimated as (historical corporate) percentages of this direct labor cost.

The two methods of ratio to previous experience and ratio to total system dollars both have the same characteristics. Their good feature is that the ratio is developed on real experience and the drawback is the degree with which the results represent the actual cost incurred. In both ratio methods the data problem appears again; that is, there is the need for better data collection and analysis.

The difficulty of understanding the procedure used detracts from the probabilistic method. This method reflects reality by using past programs but it is harder to sell its use to someone with no understanding of probability theory. Again, to develop "good" best fit probability models, the need for data is ever present.

### 2. MANAGEMENT VISIBILITY

Management control, visibility of the software structure, and a standardized framework for collecting historical costs, sizing and requirement data, is greatly needed by the Air Force today. A point stressed during the ESD Workshop (Reference 8) is the need for good specifications early in the program. "A good specification is fundamental to building a realistic software cost estimate." Costing in the Air Force Avionics Laboratory and throughout the R&D community is done at various stages in the system life cycle, but the original most crucial costing is done in the conceptual phase. During this timeframe high level management often wants to be able to make a "go or no go" decision as to system development, usually based on a cost-benefit analysis (costs to develop, deploy, and maintain the system versus the benefits to be gained by acquisition of the system). In these early stages the costing study is extremely difficult because system documentations are usually incomplete or lacking in detail and may be inconsistent or ambiguous. The appropriate time at which an initial software cost estimate should be attempted is at the earliest possible point after functional design specifications are completed (Part I Specifications). Once the functions and/or modes the software program will deal with are known, the "size of your program" and a "rough" estimate of the software cost can be developed from analysis of the functions of the program. The cost of deriving a good software cost estimate is high since much preliminary design work is required. However, the software workshop agreed that in order to accurately predict software costs, a considerable amount of design work and project planning must have been accomplished.

According to industry comments, the majority of software cost estimates are obtained from elementary sizing parameters of the "estimated number of instructions" usually derived from historical experience and/or engineering judgement. Once the size of the program is determined, then manpower requirements are estimated, leading to the cost of the software package development. Both rule of the thumb and mathematical methods do exist but none are very reliable or validated.

Reference

#### 3. WORK BREAKDOWN STRUCTURE

A major problem in the process of comparing or tracking actual software development cost is that there is a lack of a common language, methodology, and work breakdown structure (WBS) which would provide a basis for developing and comparing cost estimates. In a report prepared for NAVSEA, "Interim Guidance for Preparation of Cost Estimates for Tactical Software Programs," Oct 74, an interim work breakdown structure was provided as the frame-ofreference for all NAVSEA tactical software program cost estimation (Reference 9). The report provided a brief description of a typical software development process and how the various activities relate to the work breakdown structure. Worksheets or summary report formats were presented to cover each of the following topics:

a. Cost Estimate for XXX Tactical Software.

- b. Cost Incurred Schedule.
- c. Tactical Software Program Summary
- d. Milestone/Resource Allocation

The problem and the inability to apply WBS methods to software development can best be summed up in a quote from the NAVSEA Report: "In the past, industry and NAVSEA project managers/engineers have not been able to describe or define the software programs for a tactical system at levels parallel to that which have been developed for technical management of hardware. This inability to develop realistic work packages and milestones for management of software programs has resulted in ineffective monitoring and cost forecating. In addition, the lack of a suitable common structure of WBS language has limited the development of norms and valid data banks for transferring experience and interfacing with industry." (Reference 9)

It is quite possible that the approach of the NAVSEA report has been adopted in MIL-STD-881, but it appears that the WBS has not yet been fully utilized by managers of software packages, which leaves the cost estimators in a state of flux.

## 3. DISTRIBUTION OF SOFTWARE DEVELOPMENT EFFORT

A majority of the models presented in Section V of this report arrive at a total cost for software development. A distribution of software development effort or allocation of effort during this phase is sometimes desired. The development process can be broken down into three major phases: Analysis and Design, Coding and Debugging, and Integration and Test. Documentation costs will be included in Integration and Test. Table 1 represents some findings into how the three phases are distributed as a percent of the development effort. A general consensus of a 40, 20, 40 percent distribution can be drawn (i.e., 40% for Analysis & Design, 20% for Coding and Debugging, and 40% for Integration and Test). If only airborne and space programs are considered, it can be seen that more emphasis is being given to Analysis and Design and a great deal to Integration and Test. In airborne programs, coding and debugging are a smaller part or percent of the effort.

# TABLE 1

# DISTRIBUTION OF SOFTWARE DEVELOPMENT EFFORT

SOURCE	PROGRAM/COMPANY	ANALYSIS AND DESIGN	PERCENTAGE AND DEBUGGING	INTEGRATION AND TEST
Ref 2	SAGE/NTDS	35 %	17 %	48 %
Ref 2	TRW(COMMAND/CONTROL)	46	20	34
Ref 2	GEMINI/SATURN	34	20	46
Ref 2	05/360	33	17	50
Ref 2	TRW (SCIENTIFIC)	44	26	30
Ref 100	RAYTHEON (BUSINESS)	44	28	28
Ref 10	INFORMATIES CORP	46	16	48
Ref 11	TITAN III	33	28	39
Ref 11	X-15	36	17	47
Ref 11	APOLLO	31	36	33
Ref 11	GEMINI	36	17	47
Ref 11	SATURN V	32	24	44
Ref 11	AIRBORNE DAIS (EST.)	38	15	47
Ref 11	GRC EXPERIENCE	30	20	50
Ref 11	SKYLAB	38	17	45
Ref 11	TRW	40	20	40
Ref 11	SETS/BL	42	18	40
Ref 12	IBM	30	40	30
Ref 12	AEGIS	38	26	36
Ref 12	AN/BQQ-5	31	43	26
Ref 13	COST-BY-FUNCTION MODEL	34.5	18.0	47.5
	AFAL (AAA-3)	38.7	21.7	39.6
AVERAGE		36.8%	22.9%	40.7%

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#### SECTION IV

# PAST/PRESENT AND FUTURE STUDIES (STATE OF THE ART)

The alarming increase in software development costs and the decreasing dollar resources available for software development have forced the government and especially the military to find new ways of producing quality software within very limiting constraints. These costs, coupled with the fact that the quality of software produced is generally unacceptable (error rates of over 1 error/100 lines of code), has spurred several Air Force organizations into conducting various studies on software cost estimating procedures and development methods.

#### 1. ROME AIR DEVELOPMENT CENTER (RADC) EFFORTS

The Rome Air Development Center has begun an extensive study of the software development field. The goal of the RADC program is to achieve higher quality, lower priced software through the reduction of intrinsic error rates; the improvement of programmer productivity (by using better programming languages, better design, coding and testing techniques, and better management control) and improvement of the readability, portability, documentation, and maintainability of software code.

To achieve the Air Force objectives in the software development area, the RADC approach is to develop a system of software facilities, all linked to a centralized software data base. Three facility development efforts are currently under negotiation at RADC for facilitating development of the automated analysis system. The first is a multiregression facility for statistically correlating various data with respect to reliability, cost, and productivity. The second is a facility to use RADC's On-line Pattern Analysis and Recognition System (OLPARS) to use the pattern recognition for determining software reliability. The third is a language control facility for collecting various information on language usage and relating errors to specific language constraints.

Principal functions of the centralized software data base will be to: (1) collect software production data, (2) provide a computerized data base of raw data for reliability, cost and productivity analysis, (3) provide analytical tools for data analysis and modeling, and (4) generate standard reports on information contained in the repository. The necessity for collecting software data is based on the fact that no clear conclusions or predictions can be made about quantities of interest, such as the reliability of software or an accurate estimation of software production costs, without the historical data base. The repository data related to the design, coding, testing, and maintenance of software will include software error data, software cost, complexity and productivity data, and computer language. Once centralized software data bases have been established, a number of efforts can proceed. For example, information on the cost of software developments as related to the techniques used to develop the software and on error rates as a function of a particular language or a language feature are important areas of investigation that will be aided significantly by the repository.

A major requirement for effective use of the software data base is a software modeling facility. This type of facility would enable researchers to model various aspects of the software development process. For example, cost estimating models based on factors like functional requirements, problem complexity, and programming experience, and sizing models for determining necessary computer resources, are critical for accurate software cost estimates. Reliability models for predicting the occurrence or number of software errors in operational software are important in answering questions related to the release of software for operational use and the progress of software testing. These models, plus software complexity and production models, can lead to a true appreciation of the significant factors underlying software development, thus leading to increased control over the software process. Contractors involved in RADC software programs include System Development Corporation (SDC), Illinois Institute of Technology Research Institute (IITRI), Polytechnic Institute of New York (PINY), and the MITRE Corporation.

The System Development Corporation (SDC) is conducting a data collection study for RADC. SDC is studying the general area of data collection, storage, and retrieval. Major emphasis has been placed on the problems related to the collection of software production data. They also analyzed previous efforts by IBM, TRW, and MITRE (Reference 1) in the software data collection area.

The Illinois Institute of Technology Research Institute (IITRI) is under contract with RADC to investigate, among other things, the specifications for a pilot repository facility at RADC. Thus, SDC and IITRI are working closely to develop specifications for a Software Data Collection & Repository System at RADC.

The MITRE Corporation has developed models for measuring structural complexity of software, and is currently developing a Software Implementation Monitor (SIMON) for RADC to automatically gather and analyze data during software development.

Polytechnic Institute of New York (PINY) is currently investigating modeling techniques, similar to those used for hardware reliability, for use in the software area. For example, PINY has developed a model for predicting the reliability of software based on the use of Markovian processes to determine the probability that a given software system is in either an "up" state (no errors present in the system) or a "down" state (an error has occurred and is being corrected). Other areas which PINY is investigating at this time include:

a. Models to measure software complexity and develop relationships among error content, debugging effort, program size and run time.

 A study of the effects of modular and structured programming on program errors.

c. Models to test effectiveness in removing software errors.

.

d. Development of models for comparison of different programming languages with respect to such features as core size, run time, development test, and debugging costs.

With respect to software reliability/maintainability, RADC is currently planning an effort to develop software reliability models based on the Bayesian statistical theory. Along with this, methods will be developed for making acceptance or rejection decisions about a software package during software testing using these Bayesian models and Bayesian techniques. Also planned by RADC is the evaluation of computer programs and designs in terms of a quantitative measure of maintainability, and the restructuring of computer programs for reliability and maintainability improvement. As part of this effort, a maintainability model will be developed which tracks and measures the propagation of modifications and/or errors through a system of software modules, thus leading to a measurement of maintainability.

# 2. ELECTRONIC SYSTEMS DIVISION (ESD) EFFORTS

Two Electronic System Division (ESD) organizations, ESD/MCIO and ESD/ACCI, are conducting studies analyzing the software development cycle and predicting software costs.

On 1-2 October 1974 an ESD workshop entitled, Government/Industry Software Seizing and Costing was held at Hanscom Air Force Base, Bedford, Massachusetts. The primary output of the workshop was a list of factors and details on how these factors affect the cost of software development. This list is what is referred to in this report as the "ESD Model", and is described in detail in Section V-3. The dominant factors affecting software costs were identified as the number of instruction, programming language, real time application, type of program, desired quality, amount of documentation, hardware constraints, schedules, size of data base, complexity, stability of requirements, and personnel and management required. Certain procurement procedures such as subordination of software design goals to hardware design goals also were identified as having a decided effect on software costs. The workshop agreed upon, one general point, i.e., that deriving a good software cost estimate is very expensive.

Another point of interest was the need for an improved work breakdown structure (WBS) and the fact that MI1-STD-881 has not been fully utilized to decompose complex software projects into manageable work packages.

To further the software cost estimating techniques that exist today, ESD/MCI has two major efforts at the present time (Reference 6). The first is a study entitled "Life Cycle Costing of System Software/Computer Resources," being conducted by General Research Corporation (GRC). The objective of the study is to develop WBS down to a level sufficient to identify software cost elements and functional requirements. The second step of this effort will be to collect data against this WBS. After these two steps have been taken, GRC will employ statistical methods to develop CERs relating previously identified cost elements to resource expenditure for each phase of the software life cycle. A follow on effort entitled "Software Cost Prediction Aids" will render these CERs compatible with a generalized life cycle cost model like the MITRE Electronic Systems Cost Model, or a functional description tool like the Computer Aided Requirements Analyses (Reference 14). Development of a total life cycle cost model for software is expected to be completed in October 1976. The results of the GRC effort under contract F19628-76-C-0180 are documented in a preliminary draft report entitled "Cost Reporting Elements and Activity Cost Tradeoffs for Defense System Software." The six month study investigated the problems of software cost estimation, hypothesizing relationships, gathering and analyzing data, and examining reporting systems. There exists equations relating cost (in terms of estimating the man-months) to the different phases of the software life cycle. The equations are not presented here since it would be worthwhile to wait for the final report to be released. The following quote exhibits the confidence of the derived relationships: "Our second major objective was to develop improved software cost estimating relationships. A significant amount of work had been previously devoted to this task. The work was performed by competent groups and focused on estimating total man-hours or costs. Results have been disappointing, with derived relationships exhibiting large variance." Some of the major findings by GRC include the following.

a. Accurate estimating relationships for each life cycle phase cannot be developed independent of the other phases

b. Estimating the tradeoffs between the life cycle phases is of prime importance.

c. Estimating the tradeoffs can also lead to the development of rules for optimal allocation among life cycle phases.

The GRC study to date is the most current and complete effort accomplished to determine operation and support cost of software.

The second major effort is the Air Force Software Library. ESD/MCI has developed a software library which is presently on-line in prototype form at ASD? The library is designed to collect technical data on existing software packages. The library at the present time contains a description of the software program and the person or organization to contact for additional information. An effort is now underway to collect and store data, where available, on resources expended in developing and maintaining these programs.

In a draft of a proposed in-house research program for improving software cost estimating, ESD/ACCI proposes to develop two models, one a "robust regression model", the second a "software development simulator" (Reference 14).

The robust regression model will be developed to handle small sample sizes. AFSCM 173-1 describes the ground rules and methods of utilizing the linear statistical model as a standard technique for developing estimating relationships. AFSCN 173-1 adopts the principle of least squares which is based on possessing a normal or "bell-shaped" statistical distribution. When the variations are not distributed normally, these properties cannot be proven to be true. Furthermore, AFSCM 173-1 states that "when sufficient data points are available, the distribution of sample means will remain normal to a satisfactory degree of approximation." According to the ESD/ACCI draft report, 30 data points are generally a large enough sample for the normality assumption to be sufficiently approximated. In the area of software cost estimating, data definition and collection problems do not generally give us 30 data points, (homogenous

sample sizes). "Thus, there is no reason to believe, a priori, that standard statistical techniques will produce accurate CER's, and the failures of SDC, GRC, and Tecolati are not all that surprising." (Reference 14) The "robust regression technique" suggested by Capt Bourdon (Reference 14) to handle this data problem is to employ the Kurtosis (fourth standardized moment) of the least squares residuals. This method has been demonstrated for the simple, two-variable model and quite possibly can be applied to a multivariate model. The Kurtosis then can be used when random variables are not known to be distributed normally. According to Capt. Bourdon, this method is as good or better than least squares regression down to sample size of four.

The second model proposed is the software development simulator which would employ a Monte Carlo sampling technique. The simulator envisioned is predicated on the hypothesis that cost is an explicit function of the time usage of direct labor and computer hours. An estimation of the labor and computer hours consumed as a function of time can be made and in turn the cost arrived at by applying standard factors for engineering management, overhead, etc. "Thus the simulator serves to generate and tabulate statistics on the consumption of labor and computer resources by simulating the software development process." (Reference 14)

ESD/ACC pointed out in Reference 14 that there is a definite need for an ad hoc planning group to guide future research in the software cost estimating area, to eliminate duplication of research dollars spent and time and effort devoted to similar tasks. ESD/ACC recommends that they be designated the software cost estimating research focal point for all activities in the area conducted by agencies under the operational control of the ESD Commander. The proposed ad hoc planning group would be responsible for:

a. Defining, monitoring, and reporting on the progress of all in-house and contracted efforts aimed at bettering the ability to predict the cost of software.

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b. Coordinating on all Statements of Work and serving on all source selection boards for procurements associated with software cost estimating methodologies.

c. Organizing and coordinating periodic symposia and seminars for the exchange of data, ideas, and findings between government, industrial, and academic institutions active in software development and cost estimating.

#### 3. TRW EFFORTS

TRW is currently investigating the types of errors which are made most frequently and an error classification scheme. TRW is also analyzing how personnel, hardware problems, hardware interfaces, operational timing, and input requirements contributed to errors which occurred. TRW has developed a Mathematical Theory of Software Reliability (MTSR) for predicting the reliability of software systems based on the complete set of possible data input, values, and the logical structure of the component modules. They are currently applying this theory to an actual software development project and are further analyzing the theory to determine the effects of errors removal on reliability and the variance in sampling techniques for measuring the reliability.

# 4. RCA "PRICE" SOFTWARE ACQUISITION MODELS

RCA is currently developing a software acquisition cost model analogous to the proprietary hardware acquisition model. At the present time, numerous DoD and contractor organizations utilize the PRICE model to develop cost-estimates for new hardware equipment/systems, in terms of development and acquisition costs. Business Week, 7 June 1976, "RCA's Uncanny System for Estimating Costs" states that "Altogether, Systems Command will spend \$200,000 on PRICE this year. Some Air Force procurement agencies even require that bidders' proposals include data in the specific form need for PRICE input." Over the past two or three years, RCA has been working to develop a software cost estimating technique that is similar to the RCA PRICE model. It would be unfair to the reader to try to predict the format, or the accuracy of the model at this time, but based on the

hardware model, PRICE, it is safe to state that this model looks promising with respect to prediction of software development costs. The extent to which the new software cost estimating model will be used depends upon the cost charged the user by RCA and validation results. The model should appear on the market for use sometime during the summer of 1977.

#### SECTION V

### SOME SOFTWARE DEVELOPMENT COST ESTIMATING MODELS

In this section, several software cost estimating models are presented. It is generally agreed that no software cost estimating relationship (SCER) or model has been adequately validated. Hence, the use of these models must be viewed in this light. Section VI includes demonstrations of the use of each of these models on actual software development programs but it should not be viewed as a validation or even an evaluation study. Actual costs of software development programs required for such an evaluation were not available. (Only two computer programs analyzed have actual costs associated with them). The majority of models considered are based upon an initial estimate of the number of instructions to be written (sometimes arrived at by estimation of the number of functions of a software program and general information as to number of instructions per function). This implies that even if the SCER were to have say an  $r^2 = 0.95$ , the number of instructions estimated or "guessed" drives the SCER output total cost. (NOTE:  $r^2$  refers to the coefficient of determination which is a measure of dispersion showing the proportion of total variance accounted for by the estimating relationship). Another general observation about the models is the fact that most were developed on relatively small data bases (as small as two programs and as large as 169 programs).

## 1. THE WOLVERTON MODEL

In November 1973, Ray W. Wolverton of TRW Systems Group presented a paper entitled "The Cost of Developing Large Scale Software" (Reference 10). This, most probably, was not the first attempt at a software cost estimating model, but has become the most widely referenced work on software cost estimation. The Wolverton model is the most widely used and accepted software cost estimating technique developed thus far. This methodology is applicable to large scale software development programs which utilize a "structured programming" design approach. Structured programming implies modular form.

The basis for the model is a TRW proprietary data base containing historical information in the form of cost per instruction. Wolverton assumes that the development cost varies proportionately with the number of instructions. For each identified routine, the procedure combines a user supplied estimate of the number of object instructions, category, and relative degree of difficulty with relationships based on the historical data base to determine a trial estimate of the total software development cost.

The first step in the procedure is to estimate the number of instructions in each category. The categories which Wolverton defines are as follows:

a. (C) Control routine, which controls execution flow and is non-time critical.

b. (I) Input/output routine, which transfers data into or out of the computer.

c. (P) Pre- or post-algorithm processor, which manipulates data for subsequent processing or output.

d. (A) Algorithm, which performs logical or mathematical operations.

e. (D) Data management routine, which manages data transfer within the computer.

f. (T) Time critical processor, which is a highly optimized machine dependent code.

To obtain a relative degree of difficulty there are basically two substeps involved. First, determination of whether or not the routine is an "old" or a "new" program. Unce that determination has been made (old or new), then the program must be classified as to whether it is an

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easy, medium, or a hard program to code/design. Therefore, the possible degrees of difficulty are:

Program	Easy	Medium	Hard	
01d	OE	OM	ОН	
New	NE	NM	NH	

where 0 = old, N = new, E = easy, M = medium, and H = Hard. The results of step one are then multiplied by the significant cost per instruction (CPI) expected for the type and difficulty categories. The total expected cost of the program is the sum of the above calculations. Table 2 is a breakdown of the Category/Type and the cost per word expected. As Capt. Gaumer pointed out in his thesis, the costs associated with Wolverton's categories were extracted from actual historical costs incurred by TRW, Inc. based on 1972 dollars (Reference 15). Using Capt. Gaumer's method and the Implicit Price Deflators index listed in the "Survey of Current Business", Wolverton's 1972 figures are multiplied by an inflation factor of 1.27. Hence, the figures in Table 2 are in 1976 dollars.

		TA	BLE 2			
	CATEG	ORY/TYPE	VS TYPE P	ER WORD		
OLD	С	1	Р	A	D	1
E	\$27	\$23	\$22	\$19	\$30	\$9
м	34	30	29	25	39	95
H.	38	34	33	28	44	95
NEW	с	1	Р	A	D	1
E	\$42	\$36	\$36	\$30	\$47	\$95
м	51	44	43	38	58	95
Н	62	55	53	44	71	95

The major pitfall with the Wolverton model lies in the initial estimation of the numbers of instructions by degree of difficulty and category. Once these estimates are obtained the model is easily applied. Results naturally depend on the accuracy of the initial estimates.

## 2. MODIFIED WOLVERTON MODEL

The System Evaluation Group, of the Air Force Avionics Laboratory developed a computerized version of the Wolverton Model for rapid analysis of software development costs. As the title suggests, this model is based on the TRW work conducted by Ray Wolverton.

The only required input to the computer program is the number of instructions by type (i.e., number of C,I,P,A,D, and T instructions) as defined in Section V-1. The program utilizes ten equations to obtain the cost per instruction for each type. These equations were obtained through regression analysis using the data displayed in Figure 12 of Reference 10. The cost for time critical processor type (T) instructions is assumed constant as in the Wolverton Model. Costs associated with the level of effort are computed as follows: (1) total cost of the program is calculated from the number of instructions and cost per instruction by type; (2) analysis is 20 percent of total cost, design is 18.7 percent, coding is 21.7 percent, testing is 28.3 percent and documentation is 11.3 percent.

The Modified Wolverton Computer Program generates program development costs for "new" and "old" code, for programs ranging in "percent difficulty" from 10-90 percent. The user must, based on subjective decisions relative to these characterizations, select the appropriate cost figure from the spectrum of data generated. For the Modified Wolverton Model, Wolverton's categories of easy, medium, and hard are redefined as "percent difficulty" on a scale of 10 to 90 percent. The relationship between these categorizations is presented in Table 3 below.

TABLE 3. PERCENT DIFFICULTY

Easy	
10-20-30%	

<u>Medium</u> 40-50-60% Hard 70-80-90%

The following characterizations of easy, medium, and hard programming tasks developed by IBM may assist the user in assigning "percent difficulty" figures when utilizing the Wolverton or modified Wolverton models.

a. Easy: Very few interactions with other system elements. The class includes most problem programs or "application" programs. Any program whose main function is to solve mathematical or logical problems is probably in this class. Easy programs generally interact only with input/output programs, data management programs, and monitor programs.

b. Medium: Some interactions with other elements. In this category are most utilities, language compilers, schedules, input/output packages, and data management packages. These programs interact with hardware functions, with problem programs, with monitor, and with others in this class. Complicated by being generalized enough to handle multiple situations: I/O from many different I/O devices or management of class files with variable number of indices.

c. Hard: Many interactions with other system elements. All monitors and operating systems fall into this class because they interact with everything. Special purpose programs, such as a conversational message processor, may be in this class if they modify the master operative system.

The Modified Wolverton computer program listing and sample inputs and outputs are contained in Appendix A.

## 3. ESD MODEL

The summary notes of the October 1974 Electronic Systems Division sponsored software workshop (Reference 8) form the basis for what is referred to herein as the "ESD Model". Factors identified as impacting software costs are provided in Table 4.

# TABLE 4

# FACTORS INFLUENCING SOFTWARE COST

FACTOR	RELATION TO COST
Number of delivered source instructions	Linear, modified by other factors
Language	HOL: \$6-12/source instruction
	MOL: \$12-24/source instruction
Real-time application	RT: \$30-60/source instruction
Type (OS, application, utility)	If OS, multiply by 2.5
Point on learning curve	If unfamiliar, multiply by 1.5 - 2.0
Application area (MIS, avionics,)	Sometimes, as percentage of total system cost
	"Man-rated": test cost $\sim$ 40% of total
	Non-"man-rated": test cost $\sim$ 15% of total
Turnaround time	Approximately linear relation to testing cost
Amount of documentation	Approximately 10% of total; \$35 - 150/ non-automated page
Hardware constraints	Asmptotic
Schedule realism	Percent added cost = percent of schedule acceleration
Amount of previous software used	Breakout and subjective
Size, structure of data base	Subjective
Complexity	Subjective
Stability of requirements	Subjective
Stability of development environment	Subjective
Representativeness of development environ- ment	Subjective
Personnel	Subjective; approximately 5:1 variability
Development methods (e.g., structured programming)	Subjective; systematic approaches cheaper
Management	Subjective: high variability

The primary step in using this model is the determination of the number of delivered executable source instructions where delivered implies designed, integrated, tested, and document (Reference 8). Source instructions which for this discussion exclude comment cards, is considered a better estimation factor than the number of object instructions which is then used in the Wolverton and Modified Wolverton models.

Once the number of instructions and the language are known, cost factors presented in Table 4 are used to arrive at the basic cost figure. As can be seen from the table, many factors affect the cost estimate, such as whether it is a real-time application program, familiar, or unfamiliar program, etc.

The "relation to cost" for several of the factors identified as invluencing software cost are listed as "subjective". The size and structure of the data base is an extremely important parameter. Quite naturally, the effect on cost is more for large data file oriented projects but as of yet, no quantitative relationship similar to those developed for cost-per-instruction has been established. The complexity factor as of yet has not been defined in a way so as to be used reliably in a cost formula. Attempts have been made to correlate costs with such factors as number of interfaces, percentage of branch statements, and number of paths through a program, but without any highly reliable correlations. The effect on cost that the development environment has is merely the added cost required to adapt software to actual operational conditions such as different computer configuration and operating procedures; can be quite significant, upwards to 95 percent in some instances, but can only be estimated subjectively.

Quality of personnel is considered by many experienced estimators to be the most important factor affecting software development costs. Productivity variations of 5:1 between individuals are common. Yet to be developed is the quantitative effects on cost of using development techniques such as structured programming, top-down development, chief programmer teams, and automated aids. It is agreed that systematic

approaches to software development are better than disorganized ones. Possible payoffs for the use of systematic software development techniques are in operation and maintenance costs because of ease of debugging and rebuilding the program.

To sum up the ESD approach, the basic cost is arrived at by utilizing the number of instructions times the cost per instruction and adding cost for type of program, unfamiliar, real-time, etc. Subjective factors are then applied to adjust cost to reflect the development technique, personel, etc.

## 4. THE TECOLOTE MODEL

In this report, the Tecolote Model refers to the basic equations extracted from a report entitled, "A Provisional Model for Estimating Computer Program Development Costs," Dec 1974, (Reference 16) prepared by Brad C. Frederic of Tecolote Research, Inc., Santa Barbara, California, for the Resource Analysis Branch, Office of the Chief of Naval Operations, Department of the Navy specifically for estimating development cost for tactical software. Tactical software is defined by Frederic as any complete set of computer programs that resides in and drives a computer system within a fire control system. Mr. Frederic stressed the point that the model was a "provisional model," that is, serving only for the time being.

The report emphasized the problem of obtaining data to perform statistical analysis and noted that three large software cost data bases had been already compiled at System Development Corporation (SDC), TRW, and North American Autonetics (NAA). There were problems in the data collected by Tecolote (387 separate points from 15 source references) that proved insurmountable. Since the data had to be collected from rather outdated published sources, locating spokesmen familiar with the program to interpret the data was impossible. Therefore, the data base could not be treated or rationalized into a homogeneous base. Hence, Tecolote elected to undertake a small sample approach (5 data points) utilizing only data which they thoroughly understood, and where "the

estimating relationships developed would be more in the nature of engineering scaling laws than strictly derived statistical equations." (Reference 16)

The Tecolote analysis of software development included the following activities, as given by Wolverton (Section V-1):

- a. Software requirements generation.
- b. Preliminary software design (and release).
- c. Detailed software design (and release).
- d. Code and debug.
- e. Development testing.
- f. Validation testing.
- g. Operation demonstration (and handover).

The types of computer architectures which this study included were single Central Processor Units (CPU), democratic, and autocratic. Single CPU involves a single central processor with storage and peripherals. The democratic architectures consider multiple CPU's operating in parallel with pairwise communication, common storage, and peripherals. Autocratic is a combination of a single CPU's and democratic subsystems acting in parallel, under the control of a separate single CPU executive.

Mr. Frederic noted that computer system speed and fast storage capacity are the major drivers of software requirements. The size of the program in this model is the number of machine language instructions. The size can be input as either the number of operational instructions or the number of delivered instructions. In general, the number of delivered is greater than the number of operational instructions. Operational instructions are those produced during development that are eventually installed in the tactical hardware; delivered instructions are all those instructions produced during development. The instructions contained in a development "test bed" which simulates hardware interfaces are an example of delivered instructions which never become operational. According to Frederic, the

number of operational instructions increases for tactical software directly as either the number of targets terminal-tracked increases or as the target approach speed increases.

There are five basic cost estimating equations derived by Tecolote given in Table 5. Each equation requires the input of one of five self explanatory variables. The equation which the user utilizes depends on the input variable which he is more confident about. For example, if the user knows the number of delivered instructions (D) then the equation  $0.01(D)^{1.18}$ , D in thousands, results in total development cost. Likewise, if the user knows number of operating instructions (O) the equation  $0.01(0)^{1.24}$  gives you total development costs. Notes A, B, and C are helpful in terms of understanding the basic assumptions of the CER. The output is the total development cost in FY73 millions of dollars.

# 5. THE IBM MODEL

The IBM Model is documented in the IBM proprietary report "Estimating Software Life Cycle Costs: by John C. Malone, April 1975 (Reference 17). The report utilized software cost data which was derived from software projects performed by IBM, which, (1) employed top-down structured programming techniques and (2) utilized the Chief Programmer Teams Operation Concept. Structured programming techniques feature a simple flow of logic such that the program can be easily read and understood. Structured programming tends to improve both software reliability and maintainability but may not be efficient in terms of computer resource usage. Structured programming constrains the implementer to three basic constructs, "the straight line," "if then else," "do while (loop)." Top-down programming is starting development with the top module such that the real driver is used to test all submodules estimating interface problems.

	SUMMARY	-	SUFIWARE	AIR THREATS	(B) (SEE	NULE A) SEA THREATS	S (C)
INPUTS	M, TOTAL MAN~MONTHS LABOR	D, TOTAL DELIVERED INSTRUCTIONS (THOUSANDS)	0, TOTAL OPERATING INSTRUCTIONS (THOUSANDS)	01		TOA	T, TARGETS TERMINAL TRACKED
TOTAL DE VELOPMENT COST FY 73 \$M	0.0043(M) 0.01(D)	0.01(D) <sup>1.18</sup>	0.01(0) <sup>1.24</sup>	0.0026(s) <sup>1.79</sup>	0.30(T) <sup>1.88</sup>	0.0043(S) <sup>1.79</sup>	0.19(T) <sup>1.88</sup>
TOTAL MAN-MONTHS LABOR		2.43(D) <sup>1.18</sup>	2.52(0) <sup>1.24</sup>	0.59(S) <sup>1.79</sup>	69(T) <sup>1.88</sup>	69(T) <sup>1.88</sup> 1.01(S) <sup>1.79</sup>	45(T) <sup>1.88</sup>
TOTAL DELIVERED INSTRUCTIONS (THOUSANDS)			1.03(0) <sup>1.05</sup>	0.30(S) <sup>1.51</sup>	17(T) <sup>1.59</sup>	0.48(S) <sup>1.51</sup>	.12(T) <sup>1.59</sup>
TOTAL OPERATING INSTRUCTIONS (THOUSANDS)				0.31(S) <sup>1.44</sup>	14(T) <sup>1.51</sup>	0.48(S) <sup>1.44</sup>	10(T) <sup>1.51</sup>
TOTAL WORDS FAST STORAGE (THOUSANDS)					14.30(T) <sup>1.05</sup>		8.30(T) <sup>1.05</sup>

The chief programmer approach depends on top-down implementation, and matches personnel capability with the complexity of the modules they are to develop, i.e., the top-most complex modules are produced by a highly qualified software system specialist, referred to as the chief programmer. Less qualified personnel implement the lower lever modules under the control and guidance of the chief programmer. The chief programmer approach to software implementation is a good concept, but the staffing profile can make it difficult to employ. This model addresses only the software development phase. The data included costs for the development phase of both real-time and support software. The equations being of a proprietary nature could not be presented, however, the results of applying the model are presented in Section VI of this report.

# 6. NAVAL AIR DEVELOPMENT CENTER MODEL

The cost relationship (CER) discussed in this section was taken from a study done by Naval Air Development Center (NAVAIRDEVCEN or NADC) entitled, "A Cost By Function Model for Avionic Computer Systems", March 1971 (Reference 13). The NAVAIRDEVCEN developed an overall CER, comprised of several equations, which could be used for predicting total acquisition costs for research, development, test and evaluation, and production of future avionic computer systems. Reference 13 gives a complete computer listing of the "Cost-by-Function" model with its 10 basic modules. These 10 basic modules are as follows:

(1) Raw Technical System Requirements: Functional requirements of the system are translated by a function/structure requirements matrix to six variables denoting the raw technical requirements of the system.

(2) Total Technical System Requirements: The raw technical requirements are modified using system architecture factors to reflect performance needed.

(3) Modularized Technical System Requirements: Converts from total technical system acquirements to integral units of the selected hardware modules.

(4) Cost Trends Near Baseline: Cost trends with technical requirements are determined in the vicinity of each baseline. This module automatically recalibrates the model when new data becomes available.

(5) Programming Costs (RDT&E): The software requirements implied by module two are converted to RDT&E programming costs.

(6) Estimated Hardware Costs: RDT&E and First Unit Production: By utilizing the system performance characteristics, baseline characteristics and cost trends, the hardware costs are estimated. The model selects a baseline approximating the desired system.

(7) Production Cost Breakout by Year: A learning curve and quantity discount are employed and aggregated on a yearly basis via an input production schedule.

(8) Breakout of RDT&E Hardware Costs by Line Item: The results of module six are broken down by major line item.

(9) Breakdown of all RDT&E Costs by Year: RDT&E software costs and hardware costs are broken out by year using the input program management factors.

 (10) Summary and Report Generation: The annual programming costs generated by module five and the production cost breakout by year, module
 7, are summarized and a report is generated.

The following equation, referred to in this report as the NAVAIRDEVCEN software cost model, is basically module five, and provides an estimate of the total number of man-months required to develop a software package for an avionic computer system:

$$Y = 2.8X_2 + 1.3X_3 + 33X_4 - 17X_5 + 10X_6 + X_7 - 188$$
 (1)

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where Y = number of manmonths

X<sub>2</sub> = number of machine language instructions (thousands) in delivered program

 $X_2$  = number of man-miles traveled by contractors

 $X_A$  = number of document types produced

 $X_5$  = average programmer's experience with system (NOTE: The experience "for the system programmer is the sum of the average number of years of experience with the specific computer-type, application, and language.")

 $X_6$  = number of independent consoles

 $X_7$  = percentage of new instructions

Module two can be used to calculate the variable  $X_2$  based on the function of the program. An interesting comment found in a GRC report notes that the weighing factor applied to the documentation in this model is based upon pre-work standard (WS) 8506 experience. GRC, based upon a private communication, 31 Aug 73, states that the documentation costs can be expected to triple with the implementation of WS 8506. Hence, the  $X_4$  term would be modified and the equation would appear as:

 $Y = 2.8X_2 + 1.3X_3 + 99X_4 - 17X_5 + 10X_6 + X_7 - 188$  (2)

7. AEROSPACE MODEL

The model referred to here as the "Aerospace Model" was taken from a 1975 Aerospace Corporation report on cost estimating (Reference 18). The data used to develop the cost equations for this model were divided into two groups or types of programming efforts, real-time programs, and support programs. Included in the cost data are costs that accrued as a result of problems encountered in developing a large-scale software program. The real-time software program development problem areas identified were:

a. Limited core storage of computers.

b. Timing requirements

c. Accuracy requirements.

d. Fixed-point arithmetic.

e. Changing specifications.

f. Real-time simulations.

1. Inability to interface languages.

2. Nonstandardization of computers between machines and operational program or support program problem areas identified were:

(a) Timing and accuracy problems.

(b) Inability to transfer simulation activities of one contractor to another due to language and machine differences.

(c) Inadequate and changing specifications.

(d) Lack of an organized method of defining endpoints and products of various development phases.

The data base used to develop the cost equation for real-time software program costs consisted of 13 large-scale programs, primarily airborne and space oriented programs. The cost equation derived from a regression analysis of those 13 data points. The cost equation developed is as follows:

 $Man-months = 0.057 (Instruction)^{0.94}$ 

(3)

(4)

The sample size for operational support programs consisted of seven data points (both airborne and ground software programs were in the data base). The resulting equation for support software man-months estimation is:

Man-Months = 2.012 (Instruction)<sup>0.404</sup>

The comment about language type mentioned above holds true in this case as well.

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Once the number of man-months required for development is estimated using Equation 3 or 4, a dollar value per man-month is used to derive the total development cost. The estimated cost per man-month would obviously vary with the particular company performing the programming function. For planning purposes, an average of \$5,000 per man-month is used by Aerospace Corp.

## 8. GENERAL RESEARCH CORPORATION MODEL

The GRC model was taken from a report entitled "Estimation of Computer Requirements and Software Development Costs", March 1974, prepared by M. A. Taback and M. C. Ditmore of General Research Corporation (Reference 12). The purpose of GRC was to determine a means of quantifying computer software development cost from overall system requirements. GRC had previously developed a procedure for determining the data processing speed and memory required to implement various computer functions from system performance requirements. The report presents a cost estimating relationship for computer software development which models the effects of the following: (1) program size, (2) computer language, (3) complexity, and (4) hardware constraints. The key conclusion of the report was that the program size, used along with the effects of program complexity, high-level language, and hardware constraints, is a reasonable predictor of software development cost.

The first step in utilizing any of the GRC models or any other such model, that of estimating the number of instructions for the particular program, appears to be the critical step. GRC suggests that one should develop the algorithms that are required and then utilize Table 6, which is a table of typical functional requirements in terms of number of instructions required, to implement the algorithm.

The CER developed by GRC used the factors which they felt could be identified either prior to program start up or immediately thereafter. The major factors include:

- a. Estimated number of instructions.
- b. Language used.

200

# TABLE 6

# FUNCTIONAL TRENDS IN AVIONICS MEMORY REQUIREMENTS

Typical Current Applications	Instructions and Constants*
Navigation	2600
Air-to-Air Weapon Delivery	930
Air-to-Ground Weapon Delivery	1120
Data Link	630
Tacan & Steering	120
Radar Update	45.
Attitude Data	380
Displays and Control	1100
Self Test	570
Executive & Input/Output	1400
Common Subroutines	300
NADC Guidelines**	Instructions and Data
Radar Processing	16,000
Acoustical Processing	16,000
ASW Non-Acoustical Sensors	16,000
Navigation	8,000
Flight Control	8,000
Data Collection	8,000
Fire Control	8,000
Recon Data	8,000
Display Processing	16,000
Data Communications	8,000
Console and Cockpit	16,000
Projection for Near-Future Bomber	Instructions and Data
Navigation	17,000
Weapon Delivery	9,000
Target/Check Point Acquisition	4,500
Radar Homing, Location	14,500
Communications	10,000
Countermeasures	5,000
Mission Data Center	11,500
Controls, Display & Outputs	17,000
Miscellaneous	7,000
*Constants are fixed numbers that are prestored, along with the instruction	
<pre>*Minimum requirements, main storage (     estimated separately).</pre>	only (offline mass storage

c. Degree of difficulty or complexity.

d. Degree of saturation of the host computer, where degree of saturation refers to the amount of excess central processor speed and memory storage available to the programmer. The resulting CER provides the

$$C_s = 0.232 N_i^{-1.43}$$
 (5)

total software development cost in 1973 dollars assuming unlimited computer resources, where  $C_s = total$  software development cost and  $N_i =$ number of machine language instructions in the software development effort under consideration. Equation 5 does not include the extra cost incurred in the development of an operating system for a new computer or the modification of an existing operating system to accommodate the software program. Development cost for compilers, assemblers, and other support software must be handled as additional software to be developed.

Addressing software developments within the context of constrained computer resources, if we let P = fraction of maximum speed and memory capacity utilized the total constrained software cost,  $(C_c)c$  is

$$(C_s)c = C_s = \frac{0.7}{1 - \sqrt{P} - 0.5}$$
 for P > 0.5 (6)

If, for example, a system were to utilize 75 percent of its memory capacity (P = 0.75) then the CER reduces to:

$$(C_s)c = C_s \frac{0.7}{1 - \sqrt{0.25}} = 1.40 C_s$$
 (7)

GRC cited three primary effects of the use of a higher order language (HOL) and stressed the fact that these are a first approximation of the effect of an HOL:

1. One to three times as much storage space is required for a HOL as for a machine oriented language (MOL), depending on the type of language and the compiler used.

2. Execution of a HOL is one to three times slower than execution of MOL, depending on type of compiler.

 Programming costs for a HOL are one-half to one-third those of MOL.

9. THE SYSTEM DEVELOPMENT CORPORATION MODEL

The System Development Corporation (SDC) in 1967 published a report entitled, "Management Handbook for the Estimation of Computer Programming Costs," based on work sponsored by the ESD (Reference 19). This report includes qualitative discussions/guidelines to help managers estimate costs of computer programming. SDC spent considerable time analyzing a large amount of data in an attempt to identify the dominant factors impacting programming costs. Table 7 presents the distribution of software programs in the SDC data base by programming application.

Through regression analysis on the 94 variables displayed in Table 8, SDC identified 12 variables which were sufficiently significant to use as estimating indices. For this analysis 105 programs categorized as the large computer subsample were selected from their software data base. The large computer subsample consisted of software developed for machines with a monthly rental price or equivalent purchase price of \$750,000 or greater. Equation 8 estimates man-months per thousand instructions coded (Y) expressed in terms of the 12 variables identified.

 $Y = 0.049 + 15.2X_{6} - 0.23X_{25} + 0.528X_{30} + 4.50X_{37} + 0.091X_{46}$ - 17.5X\_{48.1} + 25.1X\_{51} + 22.0X\_{54} + 26.0X\_{56} - 0.25X\_{64} - 14.9X\_{65} + 10.4X\_{74} (8)

where:

 $X_6$  = Complexity of the program system interface. In the computer program, if more than 50 percent of the design effort is devoted to problems associated with transferring data to or from the program data point,  $X_6$  = 2; if between 10 percent and 50 percent effort is devoted to data transfer problems,  $X_6$  = 1; if less than 10 percent effort is devoted,  $X_6$  = 0.

0	5	DISTRIBUTION OF DATA	BY	TABLE 7 RAMMING APPLICAT	TABLE 7 PROGRAMMING APPLICATION (REFERENCE 19) TYPE OF PROGRAM	19) Dgram	5
			DATA	BUSINESS	SCIENTIFIC	COMPUTER SOFTWARE	OTHER
GOVERNMENT	4T	U.S. AIR FORCE*	38	26	10	2	
COMPUTER	UTER	Company A	9	3		3	
SOFTWARE	MARE	Company B	-			-	
RESEARCH	ARCH	Company C	-	-		0	
AND		Company D	69	17	12	S	35
DEVE	DEVELOPMENT						
COMPUTER	UTER	Company E	2		2		
HARDWARE	WARE	Company F	e	2	1		
AND		Company G	21	19	2		
AERO	AEROSPACE	Company H	28	11		11	
		TOTAL	169	62	27	28	35

# TABLE 8

## COMPUTER SOFTWARE VARIABLES (REFERENCE 19)

X <sub>1</sub>	Vagueness	of	design	requirements	definition.	
----------------	-----------	----	--------	--------------	-------------	--

X<sub>2</sub> Innovation required.

X<sub>3</sub> Lack of knowledge of operational requirements.

X<sub>4</sub> Number of organizational users.

X<sub>5</sub> Number of ADP centers.

X<sub>6</sub> Complexity of program system interface.

X<sub>7</sub> Response time requirements.

X<sub>8</sub> Stability of design.

X<sub>9</sub> On-line requirements.

X<sub>10</sub> Total object instructions delivered.

X<sub>11</sub> Percent delivered object instructions reused.

X<sub>12</sub> Total nondelivered object instructions produced.

X<sub>13</sub> Total source instructions written.

X<sub>14</sub> Percent source instructions written in POL (Procedure Oriented Language).

X<sub>15</sub> Percent of total source instructions discarded.

X<sub>16</sub> Percent of total object instructions discarded.

X<sub>17</sub> Number of conditional branches.

X<sub>18</sub> Number of words in the data base.

X<sub>19</sub> Number of classes of items in the data base.

X<sub>20</sub> Number of input message types.

X<sub>21</sub> Number of output message types.

X<sub>22</sub> Number of input variables.

X<sub>23</sub> Number of output variables.

F

# TABLE 8 (Cont'd)

v	
×24	Number of words in tables, and constants not in data base
×25	Percent clerical instructions.
X <sub>26</sub>	Percent mathematical instructions.
X <sub>27</sub>	Percent input/output instructions.
x <sub>28</sub>	Percent logical control instructions.
X <sub>29</sub>	Percent self-checking instructions.
×30	Percent information storage and retrieval functions.
×31	Percent data acquisition and display function.
×32	Percent control or regulation function.
×33	Percent decision-making functions.
×34	Percent transformation functions.
×35	Percent generation functions.
X <sub>36</sub>	Average operating time.
×37	Frequency of operation.
x <sub>38</sub>	Insufficient memory.
X <sub>39</sub>	Insufficient I/O capacity.
x40	Stringent timing requirements.
x <sub>41</sub>	Number of subprograms.
X42	Programming language.
X <sub>43</sub>	POL expansion ratio.
X44	Support program availability.
X45	Internal documentation.
X46	External documentation.
X47	Total number of document types.
X48	Type of program (business, scientific, utility, other)

# TABLE 8 (Cont'd)

×49	Compiler or assembler used.
×50	Developmental computer used.
x <sub>51</sub>	First program on computer.
x <sub>52</sub>	Average turn-around time.
x <sub>53</sub>	ADP components developed concurrently.
×54	Special display equipment.
×55	Core capacity.
× 56	Random access device used.
×57	Number of bits per word.
× 58	Memory access time.
X <sub>59</sub>	Machine add time.
×60	Compute cost.
× <sub>61</sub>	Percent senior programmers.
×62	Average programmer experience with language.
×63	Average programmer experience with application.
X <sub>64</sub>	Percent programmers participating in program design.
×65	Personnel continuity.
X <sub>66</sub>	Maximum number of programmers.
×67	Lack of management procedures.
×68	Number of agencies concurring in design.
X <sub>69</sub>	Customer inexperience.
×70	Computer operated by agency other than program developer.
×71	Program developed at site other than the operational installation.
×72	Different computers for programming and operation.

# TABLE 8 (Concluded)

X <sub>73</sub>	Closed or open shop operation.
×74	Number of locations for program data point development.
X <sub>75</sub>	Number of man trips.
X <sub>76</sub>	Program data point developed by military organization.
X <sub>77</sub>	Program data point developed on time-shared computer.
x <sub>78</sub>	Complexity of system interface with other systems.
X <sub>79</sub>	Security classification level.
x <sub>80</sub>	Number of sources of system information.
x <sub>81</sub>	Accessibility of system information.
X <sub>82</sub>	Degree of system change expected during development.
×83	Degree of system change expected during system operations.
X <sub>84</sub>	Number of functions in the system.
X <sub>85</sub>	Number of system components.
X <sub>86</sub>	Number of components not off-the-shelf.
×87	Percent senior analysts.
X <sub>88</sub>	Quality of resource documents.
X <sub>89</sub>	The availability of special tools.
X <sub>90</sub>	Degree of standardization in policy and procedures.
X <sub>91</sub>	Number of official reviews of documents.
X <sub>92</sub>	Personnel turnover.
X <sub>93</sub>	Output volume.
X <sub>94</sub>	Input volume.

 $X_{25}$  = Percent of clerical instructions.

 $X_{30}$  = Percent of information storage and retrieval functions.

 $X_{37}$  = Frequency of operation. If this variable is not applicable,  $X_{37}$  = 0; if frequency of operation is less than one per month,  $X_{37}$  = 1; more than one per month and less than one per week,  $X_{37}$  = 2; more than one per week and less than one per day,  $X_{37}$  = 3; if daily,  $X_{37}$  = 4; if utility or on-line, (including compilers)  $X_{37}$  = 5.

 $X_{46}$  = External documentation. This is the number of pages written for, or distributed to, customers.

 $X_{48.1}$  = Business. For programs classified as business application,  $X_{48.1}$  = 1; the remaining applications,  $X_{48.1}$  = 0.

 $X_{51}$  = First program on computer. If it is a new machine or new to the installation and to the programmers,  $X_{51}$  = 1. If old or not new,  $X_{51}$  = 0.

 $X_{54}$  = Special display equipment involving use of graphic displays, CRTs, scopes, etc.  $X_{54}$  = 1 if used,  $X_{54}$  = 0 if not used.

 $X_{56}$  = Random access device used such as drum, disc, etc.  $X_{56}$  = 1 if used,  $X_{56}$  = 0 if not used.

 $X_{64}$  = Percent programmers participating in program design. This is the ratio of programmers participating in the design of the program to the total number of programmers assigned to the program development.

his

 $X_{65}$  = Personnel continuity, specifically, the number of personnel working for the duration of the project divided by the maximum number assigned at any time.

 $X_{74}$  = Number of locations for program development.

As GRC points out in Reference 12, this equation requires rather detailed previous knowledge of software parameters, and when such information is unavailable or cannot be estimated with accuracy, the technique cannot be used.

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### SECTION VI

# APPLICATION OF MODELS

All but one of the models presented in Section V of this report were used to analyze cost associated with six large scale computer programs. Because of the lack of sufficient data, the SDC model was not applicable. Actual expended costs were known on two of the six software packages analyzed. Although this exercise should not be considered as a validation or even an evaluation of the models, the results may assist software managers in becoming sensitive and aware of what factors affect such engineering economic estimates.

The six programs will be described in as much detail as was needed to apply the CER's and the basic assumptions that were made will be presented. Input data requirements for the eight models under consideration are presented in Table 9. Table 10 displays input data assumed for this exercise for each of the software development efforts analyzed.

# 1. DIGITAL AVIONICS INFORMATION SYSTEM (DAIS)

The Digital Avionics Information System (DAIS) Air Superiority Program contained 36,916 statements and was programmed in a higher order language, JOVIAL (J73/I). The program was broken down into nine modules (executive, navigation, weapon delivery, ECM, control/display, flight control, management, communications, DAIS Integrated Test System) by number of instructions and type of program, i.e., real-time, operating system, utility, or application. The following facts and assumptions were made pertaining to each module: (1) executive is an operating system containing 4000 instructions, (2) navigation containing 3848 instructions was real-time program application type, (3) weapon delivery is a real-time program application type containing 3272 instructions, (4) ECM contained 534 instructions and is a real-time application type program, (5) control/display containing 3663 instructions is a real-time utility program, (6) flight control, real-time application program includes 8770 instructions, (7) management containing 7838

# TABLE 9

SOFTWARE COST ESTIMATE INPUT WORKSHEET, DEFINITION OF F TERMS, AND SOFTWARE OUTPUT SHEET no tilke

LANGUAGE TYPE (HOL or MOL)

If HOL, give name

ESTIMATE NUMBER OF TOTAL INSTRUCTIONS

BREAKOUT OF TYPE OF INSTRUCTIONS:

# of control instructions
# pre-post CPU instructions
# algorithm instructions
# data management instructions
# real time instructions

DELIVERED OR OPERATING INSTRUCTIONS?

OBJECT OR SOURCE INSTRUCTIONS?

NEW OR OLD PROGRAM (% new, % old)?

RANK DIFFICULTY (between 1 and 9, 1 = easy, 9 = hard)

MANRATED OR NON-MANRATED?

IF UNFAMILIAR PROGRAM (NEW), RANK BETWEEN 1.5 and 2.0 (Subjective ranking of how unfamiliar program is)

OPERATING SYSTEM OR NOT?

REAL TIME SYSTEM OR NOT (%)?

# MAN MILES TRAVELED BY CONTRACTOR

# DOC TYPES

SYSTEM PROGRAMMER EXPERIENCE (YEARS)

# INDEPENDENT CONSOLES

# SUBROUTINES

# REUSEABLE SUBROUTINES

FUNCTION OF PROGRAM (BRIEF STATEMENT)

### TABLE 9 (Cont'd)

LANGUAGE - Self explanatory

NUMBER OF INSTRUCTIONS - Self explanatory

CONTROL INSTRUCTION - Controls execution flow and is non-time critical.

PRE-POST CPU INSTRUCTION - Pre- or post algorithm processor which manipulates data for subsequent processing or output.

ALGORITHM INSTRUCTION - Which performs logical or mathematical operations

DATA MANAGEMENT INSTRUCTIONS - Data management routine which manages data transfer within the computer.

REAL-TIME INSTRUCTIONS - Time critical processor which is highly optimized machine dependent code.

DELIVERED OR OPERATING INSTRUCTIONS - Delivered is the total of instructions received from contractor as opposed to the actual instructions you would use (operating). Contractor may have to simulate your machine (system).

OBJECT VS SOURCE INSTRUCTIONS - Object is machine language instructions after source deck has been compiled. Source  $\rightarrow$  compiler  $\rightarrow$  object

NEW OR OLD - Self explanatory

RANK DIFFICULTY - Subjective l=easy 5=median 9=difficult

MANRATED - NON-MANRATED - Self explanatory

UNFAMILIAR - For unfamiliar, multiply by 1.5 - 2.0. A judgement of how unfamiliar the program is to the programmer.

OPERATING SYSTEM - Software which controls the execution of computer programs and which may provide scheduling, debugging, I/O control, accounting, compilation, storage assignment, data management, and related services. Operating system program component, of a system, costs more per instruction, than the application or utility program components.

REAL TIME - Real time programs are those in which the time is kept as a variable, stored in memory, to be incremented or stepped under program control. It is used to describe processes in which the computer is controlling a device and must receive input signals and transmit output signals within the certain maximum time. For example, SAT. control, ship control, flight control, navigation.

# MAN-MILES TRAVELED - Miles per man traveled by the contractor to and from the customer.

# DOC TYPES - Reports, flow charts, user manuals, etc.

SYSTEM PROGRAMMER EXP. - Total years of experience with the particular system.

# SUBRCUTINES - Self explantory

# OF REUSED SUBROUTINES - Reused from previous programs.

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TABLE 9 (Concluded)

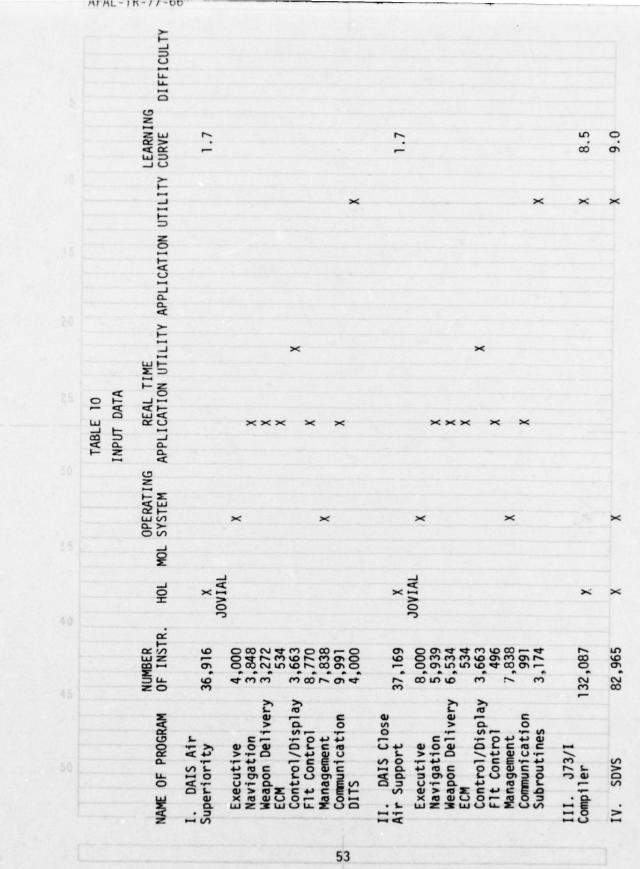
SOFTWARE OUTPUT SHEET

(Name of Software Program)

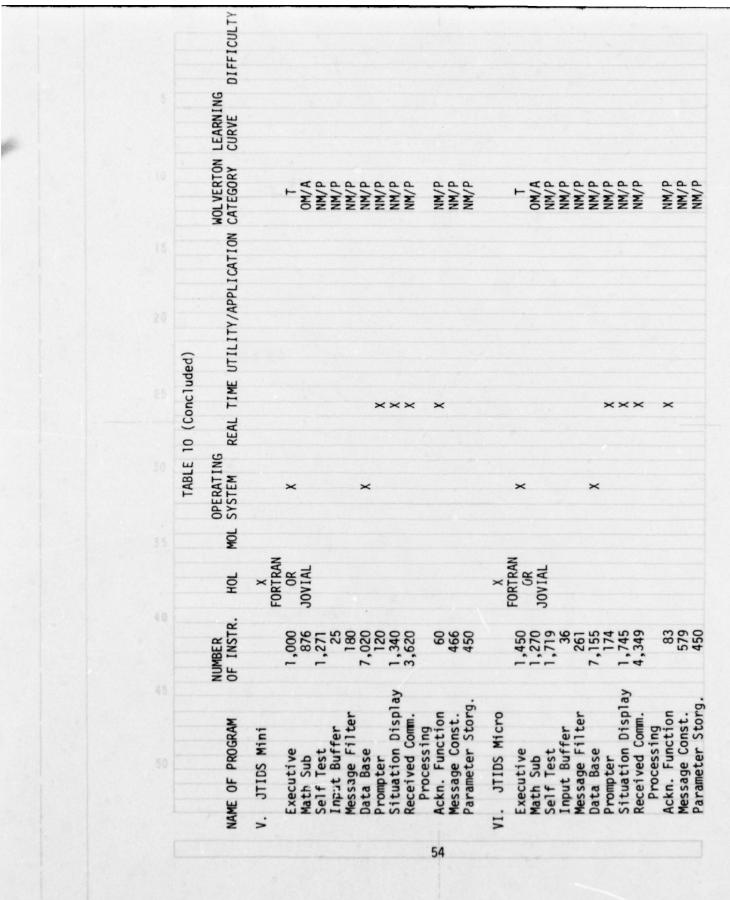
TOTAL COST TO DEVELOP PROGRAM (\$75)

COST OF ANALYSIS \$\_\_\_\_\_ DESIGN \$\_\_\_\_\_ CODE \$\_\_\_\_\_ TEST \$\_\_\_\_\_ DOCUMENTATION \$\_\_\_\_\_

TOTAL MAN MTHS (@ \$3930/MAN MTH)



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instruction is an operating system, (8) communications containing 9991 instructions is a real-time application, and (9) DITS is a utility program of 4000 instructions. The total DAIS air superiority program was man-rated.

# 2. DAIS CLOSE AIR SUPPORT

The DAIS Close Air Support program contained 37,169 statements. It was also programmed in JOVIAL (J73/I) and broken down into nine modules (Executive, Navigation, Weapon Delivery, ECM, Control/Display, Flight Control, Management, Communications, Subroutines) by number of instructions and type of program, i.e., real-time, operating system, utility, or application. The following assumptions were made pertaining to each module: (1) executive containing 8000 instructions was an operating system, (2) the navigation, weapon delivery, ECM, flight control, and communication modules are all real-time application programs with 5939, 6534, 534, 496, and 991 instructions respectively, (3) the Control/Display module is a utility real-time program of 3663 instruction, (4) management containing 7838 instruction is an operating system, and (5) Subroutines contain 3174 instructions and was a utility program.

For both the DAIS Air Superiority and Close Air Support programs, a subjective "point on the learning curve" of 1.7 was assumed. This number is based on the ESD model (Table 4) where "if unfamiliar, multiply by 1.5 to 2.0." (Reference 8)

3. F-15 JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS)

The F-15 Joint Tactical Information Distribution System (JTIDS) software program has two versions, one for minicomputers, one for microcomputers. The information about these programs was gathered from Reference 15. Both the mini- and micro-computer JTIDS software programs consisted of 12 modules. Table 11 displays the basic information about each module. More detailed information is contained in the reference.

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TAB	1 1	11	
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JTIDS PROGRAM BREAKDOWN

Name	Mini Instructions	Wolverton Cost Category	Instructions	Operating System or Real-Time
Executive	1000	т	1450	Operating
Mate Subroutine	876	OM/A	1270	Neither
Self Test	1271	NM/P	1719	Neither
Input Message Buffer	25	NM/P	36	Neither
Message Type Filter	180	NM/P	261	Neither
Data Base Management	7020	NM/P	7155	Operating
Prompter	120	NM/P	174	Real-time
Situation Display	1340	NM/P	1745	Real-time
Received Command Processing	3620	NM/P	4349	Real-time
Acknowledge Function	60	NM/P	83	Real-time
Message Construction	466	NM/P	579	Neither
Parameter Storage	450	NM/P	450	Neither

Both mini- and micro-computer JTIDS programs utilized the higher ordered languages of FORTRAN or JOVIAL.

# 4. DAIS SUPPORT SOFTWARE

The last two programs to be analyzed were the DAIS J73/I compiler and the Software Design and Verification System (SDVS). Both the J73/I compiler and the SDVS programs are good data points since we have actual costs to compare the estimates against.

The J73/I compiler consisted of 132,087 source instructions, written in HOL. It was an old program which was modified, and ranked 8.5 in difficulty (1 = easy, 10 = hard). The program was a man-rated, nonoperating system, and non-real-time program. Total man-miles traveled by contractor was 68,400. The number of document types was five, with three on-line, remote terminals, and 50 percent of the program being new instructions. The average of the programmers' experience was assumed to be three years.

The Software Design and Verification System (SDVS) was also written in J73/I and had 82,965 source instructions. SDVS was a non-man-rated, operating system program with 9.0 degree difficulty. The program was non-real-time with eight document types. An average of 21,600 miles was traveled by contractors with an average of 2.8 years software experience. The number of on-line remote terminals is five with 100 percent new instructions.

### 5. RESULTS

Table 12 is a summary chart of results obtained by applying the eight software cost estimating models. For application of those models, which were not formulated in terms of the RCA PRICE model, economic inflation rates were utilized to adjust the results to 1977 dollars. Those cases where the information obtained was insufficient to utilize a particular methodology are identified on Table 12.

	1.00			16.12			
	AEROSPACE	2,990,730	2,681,614	1,032,545	1,203,514	926,505	767,811
RESULTS OF COST MODELS	NAVAIRDEVCEN	Insufficient Data	Data Insufficient Data		Insufficient Data	1,826,507	1,744,448
	TECOLOTE	1,406,479	1,417,859	376,441	458,831	3,181,375	1,837,791
	ESD	2,126,470	2,043,376	749,975	881,012	792,522	1,866,713
	MOD WOLVERTON	1,509,493	2,243,254	855,751	601,706	Insufficient Data	Insufficient Data
	WOLVERTON	1,695,841	2,237,306	834,196	972,148	Insufficient Data	Insufficient Data
	Estimates Programs	DAIS AIR SUPERIORITY	DAIS CLOSE AIR SUPERIORITY	F-15 JTIDS MINI	F-15 JTIDS MICRO	J73/I COMPILER	SDVS

TABLE 12 S OF COST MODE

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	ACTUAL			*NOTE	*NOTE	642,039 \$5/Instruc.	1,103,000 \$13/Instruc.	Fe: McDonnell Douglas estimated between \$4.4M to \$4.7M for F-15 JTIDS MINI and \$5.1M to \$5.5M for F-15 MICRO.
TABLE 12 (Concluded)	AVERAGE	2,008,266 \$54/Instruc.	2,138,726 \$57/Instruc.	747,088 \$45/Instruc.	891,224 \$46/Instruc.	5,344,017 \$40/Instruc.	3,220,986 \$38/Instruc.	
	GRC	3,792,174	3,829,393	1,191,399	1,496,871	23,474,766	12,072,330	
	IBM	536,681	518,183	189,312	228,482	1,862,427	1,096,824	
		DAIS AIR SUPERIORITY	DAIS CLOSE AIR SUPERIORITY	F-15 JTIDS MINI	F-15 JTIDS MICRO	J73/I COMPILER	SDVS	*NOTE:

### SECTION VII

### SUPPORT/MAINTENANCE COST AREA

Once the software program has been accepted, continual support must be furnished to modify the software package to meet changing mission and performance requirements. Besides the modifications to software programs, corrections must be made to previously undetected errors which occur. Because software is the controlling and integrating agent in weapon systems today, proper support is required to insure that the program performs its intended functions properly. In avionic software programs this support is critical since errors could result in inadvertent armament release or impact with the ground in terrain following modes.

The software development process is typically oriented toward minimizing the total development time  $\gamma$ r maximizing the program's efficiency. In a study on the relative amount of time spent on software maintenance it was shown that most software facilities spent somewhere between 20 and 30 percent of their time on software maintenance, but some installations spent 90 to 100 percent of their time maintaining software. Air Force avionics software is much like the latter and "currently it costs something like \$75 per instruction to develop the software, but the maintenance of the software has cost up to \$4,000 per instruction." (Reference 20). Further noted by Judith A. Clapp (The MITRE Corp) in "A Review of Software Cost Estimation Methods" (Reference 18) was the fact that 54 percent of all errors were found after acceptance tests were conducted and of these 84 percent were design errors; also, of the total number errors found, 64 percent were attributed to mistakes in design. Throughout the development phase relatively little thought is usually given about what will happen after development is completed. According to the CCIP-85 Report (Reference 5), three things are likely to happen after development:

(1) Another organization will want to use all or part of the software for its application, (2) the user will upgrade eventually to a new machine and will wish to convert the software, and (3) users will quite frequently want the programs changed to meet new requirements, produce new reports, accommodate new inputs, clear up inconsistencies, add new options, etc.

Software transferability involves addressing the ease with which the first two points mentioned above can be accomplished. Maintainability, quite simply stated, involves the capabilities to satisfy the last point. Both the transferability and maintainability aspects involve considerable costs and inconveniences. A couple of prime examples of the costs involved with transferability and maintainability were given in the CCIP-85 Report: Strategic Air Command (SAC) estimated it would take three years for 200 programmers to convert the SAC Control System (SACCS) software to the upcoming SAC Worldwide Military Command and Control System computer. This is equivalent to three years worth of delays and roughly \$30 million in costs. It took 150 programmers one year to convert software for Electronic Intelligence (ELINT) and Minuteman application onto the IBM 360/85; currently the 360/85 has about 75 maintenance programmers. The PACER software cost \$8 million to develop and is maintained by about 50 programmers, which is an annual software maintenance cost of about 25 percent of development costs. Conversion and maintenance expenses could be reduced by such things as: machine-independent, problem-oriented programming languages; use of structured programming techniques; development of computer software maintenance and transfer aids; maintenance of an Air Force software library; and formulation of a standard for computer hardware, software, terminology and documentation. "Reduction in proliferation of different computer hardware and software styles would reduce the high cost of retraining, particularly considering Air Force officer rotation policies: The Keesler Training Center spent \$9.6 million in training computer analysts, programmers, operators, and maintenance personnel in FY69." (Reference 5)

A search of current literature results in very little in the way of predicting support and maintenance cost for computer software. Unlike hardware operation and support (O&S) models, where the cost of spares, maintenance manhours, materials, training, etc., can be estimated based on some physical characteristics of the system, software maintenance is strictly a function of manhours to perform the necessary actions. Thus far, maintenance costs for software seem to be primarily an engineering estimate by an expert, someone familiar with the changes to be made to

a program, rather than putting certain parameters into an CER or formula and calculating annual maintenance costs. The effects of the structured programming or chief programmer approaches on maintenance costs can only be subjectively estimated as of this time.

The "Aerospace Model", was discussed in Section V-7, is a total life cycle cost model. The procedure permits costs for design and development (D&D), investment, and operations and maintenance (O&M) to be determined in a series of prearranged steps. "The model first calculates hardware (CPU) costs, then applies factors for estimating the other D&D, investment, and O&M costs, and finally summarizes the total program costs." (Reference 21). Most of the factors in the model were developed based on a report entitled, "Investment Costs for Flight Area Defense Systems," also referred to as the FADS study. The primary maintenance equations for software appear as follows:

Software training costs during production phase:

Initial Civilian = number of men X 27,200

Initial Contractor = number of men X 35,598

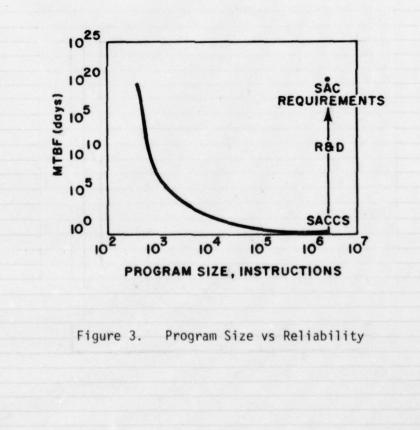
Initial Military = number of men X 17,400

b. During the depioyment phase:

Personnel contractor support cost = (number of men) X \$48,000 X (number of years 0&M or deployment)

Military support cost = (number of men) X \$18,000 X (number of years 0&M or deployment)

These equations should only be used if the estimator has no prior basis for determining costs of any of his data-processing system elements. The model, as mentioned above, calculates hardware and software costs, and is referred to as a "Data Processing System Cost Model". In the past, software support has been performed by the contractor long after transition to the user. Because of the nature of most airborne software systems, the contractor alone had the expertise and equipment to perform these follow on maintenance actions and modification. "Large operational flight programs (OFP's) usually are never absolutely debugged, and errors can remain undetected for long periods of time due to the extremely large number of logic paths." (Reference 5). Interesting to note at this time is that currently the largest program which has been mathematically proven correct has about 400 instructions; on the other hand, experience with the SAC Control System (SACCS) program, with about 2.7 million instructions, indicates that about one software error per day is discovered (Reference 5). Figure 3 summarizes current experience in software meantime between failure (MTBF) in days as a function of program size in instructions.



The Air Force has recognized the dependence upon contractors for maintenance support and has taken steps to develop in-house capabilities to support current and future OFP's. Two recent studies of software management, F-111 and A-10, show promising results of Air Force in-house capabilities.

To combat the maintenance costs in 1974 work began on an Avionics Integration and Support Facility (AISF) at the Sacramento Air Logistics Center (ALC). All ALC's software programs are to be supported by AISF. The AISF facility will provide hardware/software integration support as well as a dynamic simulation facility. The purpose of the dynamic simulator is to execute the OFP's in a bit by bit fashion to debug the software functions.

The large computer at AISF will make it easier, safer, and less expensive than flight tests to validate OFP's. Not only will the AISF facility support OFP data processing, technical data, and procedure verification, but also provide air crew familiarization and training. The AISF is costing approximately \$20 million for development and implementation. There are presently 40 contractors amd 60 Air Force military and civilian engineers working at the AISF facility. Estimated annual recurring costs for the facility are about \$3 million (Reference 15).

Since there is a lack of fully validated O&M predictive models for software programs, (Aerospace, and the forthcoming GRC "LCC software model" are the only "existing" models at the present time), this AISF facility can hopefully provide a point of contact to supply O&M cost estimates for software programs under development.

# APPENDIX A

This appendix contains the computer program listing of the Modified Wolverton model. The next two pages contain the listing with the remaining pages containing an example output listing. The following inputs are required:

NC = Number of control routine instructions

NIO = Number of input/output instructions

NP = Number of Pre- or Post- algorithm processor instructions

NA = Number of algorithm instructions

ND = Number of data management instructions

NT = Number of time critical processor instructions

The above six inputs were defined in Section V-1, and utilized the following format statement: 12 FORMAT(615)

For the example the following values were used:

NC=0 NIO=0 NP=4964 NA=5702 ND=7155 NT=1450

2 PAGE 06/10/77 10.17.59 .5X.11H DOCUMEN .34X, I5, I5X, F10 BY INSTRUCTION. 5X. 11H TOTAL -5X.11H\_TEST NEW .13X.11H ANALYSIS 5. 

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      569721.05         ONFOL       NALYOLTON       TOTAL       56972.03         ONFOL       NALYOLTON       TOTAL       56972.03         ONFOL       TEST       236709.04       5702         ATA PAREMENT       TOCUMENT       94516.33       7155         ATA PAREMENT       TOCUMENT       8364.27.72       1450         OTAL       HEY INSTRUCTION       TOTAL       8364.27.72         FGR       19271       19271       19271         SOFTWARE       SOFTWARE       FCR       1924.27.72	Re foot Code         1235.947         4964           LEGRITHM         TEST         101231.06         5702           LEGRITHM         TEST         161231.06         5702           Ed Tive         TEST         161231.06         5702           Ed Tive         TSST         161231.05         1450           Onloci         19271         INSTRUCTION         101AL         569721.05           Onloci         19271         INSTRUCTION         101AL         569721.05           Onloci         NALYSIS         167285.54         0           Onloci         NALYSIS         16709.04         5702           Onloci         NELIZOLION         1856411.99         0           Rest         185694.81         4964         1450           Rest         DOCUMENT         235709.04         1450           Rest         TIVE         1450         0           Rest         19271         INSTRUCTION         101AL           Software         19271         19271         1450	Fe fost CPU       CODE       1231.06       5702         Centifue       DEST       1655       131231.06       5702         Al The       DOCUMENT S       559721.05       1450         Al The       DOCUMENT S       569721.05       1450         Contle ev Instruction       TOTAL S       569721.05       1450         Ontal Ev Instructions       Analysis S       156411.08       0         Ontal Ev Instructions       DOCUMENT S       569721.05       0         Ontal Ev Instructions       Total S       569721.05       0         Ontal Ev Instructions       DOCUMENT S       569721.05       0         Al Panagement       DOCUMENT S       156411.08       0         Al Panagement       DOCUMENT S       235709.04       590         Al Panagement       Total S       836427.72       1450         Otal Ev Instructions       Total S       836427.72       1450         Software Cen       Total S       836427.72       1450	RE FGST CPU     CODE     123629-47     4964       RE FGST CPU     TEST     11231.06     5702       EL TIPF     DOCUMENT S     1450     1450       EL TIPF     DOCUENT S     569721.05     1450       CAL EV INSTRUCTION     TOTAL EV INSTRUCTIONS     1450     1450       FGF     19271     INSTRUCTIUNS     1450       FGF     19271     INSTRUCTIUNS     1450       FE FGST CPU     CODE     13504.81     4964       LCGTTTM     DOCUMENT S     23510.33     7155       ATA PANAGEMENT     DOCUMENT S     23510.33     7155       CAL TIPE     TEST     1450     0       CAL EV INSTRUCTIONS     TOTAL S     836427.72     1450       CAL ITAE     19271     INSTRUCTIONS     107AL S     836427.72       SoFTWRE CEH     SOFTWRE CEH     TOTAL S     569427.72	RE FGST CPU         CODE         123629-47         4964           CGRITH         1657         100CUMENT         1155           EL TIPE         00CUMENT         1657         1555           ATA MAGEWENT         050721.05         7702           CAL         EV         INSTRUCTION         101AL         569721.05           CAL         EV         INSTRUCTION         101AL         569721.05           FGA         19271         INSTRUCTION         101AL         569721.05           ONTROL         NEW         AMALYSIS.S         167785.54         0           ONTROL         NEW         AMALYSIS.S         167785.54         0           ONTROL         NEW         AMALYSIS.S         167785.54         0           ALL VOLTPUT         06516N         14541.99         0         0           RELIOUT FUL         COSE         14500.00         1450           ALL PARAGEMENT         FGR         19571.72         1450           OTAL         B36427.72         0         0           FGR         19271         INSTRUCTIONS         FERENCE         56942.772           Software         CEH         19271         19271         19271 <td>RE FGST CPU     CODE     123629.47       LEGATTHM     TEST     161231.06       LEGATTHM     TEST     161231.06       Eal TIME     DOCUMENT S     64378.48       Eal TIME     DOCUMENT S     64378.48       CIAL EY INSTRUCTION     TOTAL S     569721.05       FGR     19271     INSTRUCTION     TOTAL S       SOFTWARE     CEM     SOFTWARE     SOFTWARE</td> <td>RF FGS1 CPU       CODE       123629-47       4964         RE FGS1 CPU       CODE       12331.06       7702         RE AL TIPE       DOCUMENT S       569721.05       7155         RE I TIPE       DOCUMENT S       569721.05       7155         OTAL EY INSTRUCTION       TOTAL S       569721.05       7155         FGF       19271 INSTRUCTION       TOTAL S       569721.05       7155         FGF       19271 INSTRUCTION       TOTAL S       569721.05       7155         ONIGL NEW       ANALYSIS S       167285.54       0       0         RE FOST CPU       COSE       1550411.98       0       0         OTAL EY INSTRUCTION       TOTAL S       8364.27.72       1450         OTAL EY INSTRUCTIONS       TOTAL S       8364.27.72       1450         SOFTWRE CEH       19271 INSTRUCTIONS       107AL S       5364.27.72</td> <td>RE FGST CPU         CODE         123629.47         4964           RE FGRT CPU         EGRITH-         0000-WENT         13331.06         5702           RE AL TIPE         DECUMENT         01331.06         5702         1450           RE AL TIPE         DECUMENT         15531.06         7155           RE AL TIPE         DECUMENT         569721.05         1450           OTAL EV INSTRUCTION         TOTAL \$         569721.05         1450           OTAL EV         NALYSIS \$         167285.54         0           ONLFOLL         DESEN         1559.43         4964           LEGRITH         TEST         25570.04         5702           LEGRITH         TEST         25570.04         5702           LEGRITH         TEST         25570.04         1550           CH INSTRUCTION         TOTAL \$         836.71.72         1450           OTAL EV         NISTRUCTION         TOTAL \$         836.71.72           SOFTWRE CFM         19271         INSTRUCTIONS         1050</td> <td></td> <td>JANI 00.0</td> <td>LIVOLTPUT</td> <td>DESIGN</td> <td>106537.84</td> <td>0</td> <td>17.50</td>	RE FGST CPU     CODE     123629.47       LEGATTHM     TEST     161231.06       LEGATTHM     TEST     161231.06       Eal TIME     DOCUMENT S     64378.48       Eal TIME     DOCUMENT S     64378.48       CIAL EY INSTRUCTION     TOTAL S     569721.05       FGR     19271     INSTRUCTION     TOTAL S       SOFTWARE     CEM     SOFTWARE     SOFTWARE	RF FGS1 CPU       CODE       123629-47       4964         RE FGS1 CPU       CODE       12331.06       7702         RE AL TIPE       DOCUMENT S       569721.05       7155         RE I TIPE       DOCUMENT S       569721.05       7155         OTAL EY INSTRUCTION       TOTAL S       569721.05       7155         FGF       19271 INSTRUCTION       TOTAL S       569721.05       7155         FGF       19271 INSTRUCTION       TOTAL S       569721.05       7155         ONIGL NEW       ANALYSIS S       167285.54       0       0         RE FOST CPU       COSE       1550411.98       0       0         OTAL EY INSTRUCTION       TOTAL S       8364.27.72       1450         OTAL EY INSTRUCTIONS       TOTAL S       8364.27.72       1450         SOFTWRE CEH       19271 INSTRUCTIONS       107AL S       5364.27.72	RE FGST CPU         CODE         123629.47         4964           RE FGRT CPU         EGRITH-         0000-WENT         13331.06         5702           RE AL TIPE         DECUMENT         01331.06         5702         1450           RE AL TIPE         DECUMENT         15531.06         7155           RE AL TIPE         DECUMENT         569721.05         1450           OTAL EV INSTRUCTION         TOTAL \$         569721.05         1450           OTAL EV         NALYSIS \$         167285.54         0           ONLFOLL         DESEN         1559.43         4964           LEGRITH         TEST         25570.04         5702           LEGRITH         TEST         25570.04         5702           LEGRITH         TEST         25570.04         1550           CH INSTRUCTION         TOTAL \$         836.71.72         1450           OTAL EV         NISTRUCTION         TOTAL \$         836.71.72           SOFTWRE CFM         19271         INSTRUCTIONS         1050		JANI 00.0	LIVOLTPUT	DESIGN	106537.84	0	17.50
LGCHITHM TEST 161231.06 5702 ALT TIVE TEST 161231.06 5702 Edi TIVE DOCUMENT S 64378.48 7155 COL EV INSTRUCTION TOTAL S 569721.05 FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS AMALYSIS S 167285.54 0 DESIGN 156411.98 4964 RE FOST CPU CODE 181504.81 4964 RE FOST CPU CODE 181504.81 4964 TEST 236109.04 5702 CODE 181504.81 4964 TEST 236109.04 5702 CODE 19271 INSTRUCTION FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS	LGCHITH         TEST         TEST         64378-48         5702           ALA MAGEMENT         DOCUMENT S         64378-48         7155           Ed. TIVE         DOCUMENT S         569721.05         1450           OTAL         EXTINCTION         TOTAL S         569721.05         1450           OTAL         EV         INSTAUCTION         TOTAL S         569721.05         1450           FGR         19271         INSTAUCTIONS         TOTAL S         569721.05         1450           FGR         19271         INSTAUCTIONS         TOTAL S         569721.05         0           FGR         19271         INSTAUCTIONS         TOTAL S         564713.98         0           RE F057         CPU         CODE         19504.81         4964         0           RE F057         CPU         CODE         19504.81         4964         0           I LEST         CODE         19504.61         1450         0         0           I LIPE         DOCUMENT S         836427.72         1450         0           FGR         19271         INSTRUCTIONS         1450         1450           FGR         19271         INSTRUCTIONS         14516.33         145	LGCHITHM TEST LOLOWENT S 101231.06 5702 ALA TIVE DOCUMENT S 1155 ALA TIVE DOCUMENT S 569721.05 TISS 014L EV INSTRUCTION TOTAL S 569721.05 FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS ONTOOL NEW ANALYSIS S 1672A5.54 0 ONTOOL NEW ANALYSIS S 1672A5.54 0 Edd Total S 1856411.98 0 COEC 18566001 S 1856411.98 0 CEST CPU COEC 1856411.98 0 CEST CPU S 1856411.98 0 TAL EV INSTRUCTION TOTAL S 836427.72 OTAL EV INSTRUCTION FGR 19271 INSTRUCTIONS SOFTWARE CEM	LGCHITH       TEST       10:231.06       5702         ALL TFF       DOCUMENT S       64378.48       7155         OTAL EY INSTRUCTION       TOTAL S       569721.05       1450         OTAL EY INSTRUCTION       TOTAL S       569721.05       1555         ON FOL       MALYSIS S       167285.54       0       0         ON FOL       MALYSIS S       167285.54       0       0         RE FOST       DOCUMENT S       236709.08       4964       1556         ATA PAAGEMENT       TOTAL S       836427.72       1450       0         OTAL EY INSTRUCTION       TOTAL S       836427.72       1450       0         FGA       19271 INSTRUCTION       TOTAL S       836427.72       1450       0         FGA       19271 INSTRUCTION       TOTAL S       836427.72       1450       0       0         FGA       19271 INSTRUCTIONS       TOTAL S       836427.72       1450       0       0       0       0       0         FGA       19271 INSTRUCTIONS       TOTAL S       836427.72       1450       0       0       0       0       0       0       0       0       0       0       0       0       0       0	LGCHITH         TEST         LOCUMENT         S 5702           ALT IFF         DOCUMENT         5 5 9721.05         7155           ALT LEF         DOCUMENT         5 5 9721.05         1450           GTAL         EXTENSITY         167285.54         0           FGA         19271         INSTRUCTION         TOTAL         5 5 9721.05           FGA         19271         INSTRUCTION         TOTAL         5 5 9721.05           FGA         19271         INSTRUCTION         TOTAL         5 5 9721.05           FGA         19271         INSTRUCTIONS         5 9721.05         0           ON FOLL         NELYOUT         ODESIGN         15 4411.98         0           RE         F051         INSTRUCTIONS         2 34709.04         5 702           ALA         VARGEMENT         ODESIGN         1 950         1 1450           ALA         VARGEMENT         TOTAL         8 36427.77         1 1450           FOR         19271         INSTRUCTIONS         1 936427.77         1 1450           FOR         19271         INSTRUCTIONS         1 936427.77         1 1450	LEGHITHM LIFE TEST TEST 101231.06 5702 ALL LF NARAGEMENT 00CUMENT 5 64378.48 7155 OTAL EV INSTRUCTION TOTAL 5 569721.05 FGA 19271 INSTRUCTIONS FGA 19271 INSTRUCTIONS ON FGL NEW 00CUMENT 5 569721.05 ON FGL NEW 00CUMENT 5 94516.33 1450 RE F031 CPU 00CUMENT 5 94516.33 1450 RE F031 CPU 10TAL 5 836427.72 OTAL EV INSTRUCTION TOTAL 5 836427.72 OTAL EV INSTRUCTION TOTAL 5 836427.72 FGA 19271 INSTRUCTIONS FGA 19271 INSTRUCTIONS	LGCAITHM       TEST       TEST       161231.06         ATA MAAGEMENT       DOCUMENT S       64378.48         Eal TIME       DOCUMENT S       569721.05         OTAL EY INSTRUCTION       TOTAL S       569721.05         FGR       19271       INSTRUCTIONS       TOTAL S       569721.05         FGR       19271       INSTRUCTIONS       1956411.98         REFORT       CODE       191504.61       19564.61         LGGRITH       DOCUMENT S       94516.33         East       TEST       236709.04         TIME       DOCUMENT S       836427.72         FGR       19271       INSTRUCTION       TOTAL S         SOFTWARE       CEM       SOFTWARE       SOFTWARE	LGCHITHM ALANAGEMENT TEST ALA LEY INSTAUCTION TOTAL \$ 569721.05 GTAL EY INSTAUCTION TOTAL \$ 569721.05 GTAL EY INSTAUCTIONS FGA 19271 INSTAUCTIONS FGA 19271 INSTAUCTIONS FGA 19271 INSTAUCTIONS FGA 19271 INSTAUCTIONS FGA 19271 INSTRUCTIONS FGA 19271 FGA 1927	LEGHITH         TEST         101231.06         5702           ALA MARGEMENT         DOCUMENT         64378.48         7125           ALA LEY INSTRUCTION         TOTAL         5 569721.05         7155           OTIAL EY INSTRUCTION         TOTAL         5 569721.05         7155           FGF         19271         INSTRUCTION         TOTAL         5 569721.05           ONIFOL         NEL/OUTPUT         AMALYSIS         1656411.98         0           ONIFOL         NEL/OUTPUT         DESIGN         1566411.98         0           NEL/OUTPUT         DESIGN         1566411.98         0         0           NEL/OUTPUT         DESIGN         1566411.98         0         0           NEL/OUTPUT         DESIGN         1566411.98         0         0           ONIAL         S4516.33         1156         0         0           ALL POLICIUN         TOTAL         94516.33         1155           ALA PARGEMENT         TOTAL         8364.27.72         1450           OTAL EY INSTRUCTION         TOTAL         8364.27.72         1450           SOFTWAR         19771         19771         19771	544	BAG EO. AB	FOST CPU	CODE	123629.47	4964	17.00
ATA MAAGEMENT DOCUMENT S 64378.48 TISS Eal TIME INSTRUCTION TOTAL \$ 569721.05 TAL EY INSTRUCTIONS TOTAL \$ 569721.05 TAL EY INSTRUCTIONS 1672A5.54 0 ON FOL NEW ANALYSIS \$ 1672A5.54 0 DESIGN 156411.98 0 RECTOLTPUT 205E 181504.81 4964 TEST 290 156304 5702 ATA PANAGEMENT 235709.04 5702 ATA PANAGEMENT 294516.33 7155 COLUMENT \$ 94516.33 7155 TAL EY INSTRUCTION TOTAL \$ 836427.72 OTAL EY INSTRUCTIONS TOTAL \$ 836427.72 SOFTWARE CEM	AIA MAAGEMENT DOCUMENT S 64378.48 7155 Eal TIME DOCUMENT S 64378.48 7155 CIAL EY INSTRUCTION TOTAL S 569721.05 FGG 19271 INSTRUCTIONS FGG 19271 INSTRUCTIONS FGG 19271 INSTRUCTIONS FGG 19271 INSTRUCTION TOTAL S 54577.72 ATA PAAGEMENT FEST 235709.04 5702 ATA PAAGEMENT FEST 772 ATA PAAGEMENT FEST 772 ATA PAAGEMENT FOTAL S 8364277.72 FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS	AL PANAGEMENT DOCUMENT 5 64378.48 7155 Eal TIME DOCUMENT 5 569721.05 FGA 19271 INSTRUCTIONS FGA 19271 INSTRUCTIONS FGA 19271 INSTRUCTIONS FGA 19271 INSTRUCTIONS FGA 19271 INSTRUCTIONS FGA 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569721.05     1450       FGA     19271 INSTRUCTIONS     569721.05     0       FGA     19271 INSTRUCTIONS     569721.05     0       ONTROL NEW     ANALYSIS 5 167285.54     0       NELTOLTPUT     CODE     156411.98     0       ANALYSIS     00CUMENT     24516.33     1450       ALL PARAGEMENT     TOTAL     836427.72     1450       OTAL     19271 INSTRUCTIONS     TOTAL     836427.72       SOFTWARE CEA     SOFTWARE CEA     SOFTWARE CEA	AIL EV INSTRUCTION     DOCUMENT S 64378.48     7155       CAL TIME     DOCUMENT S 569721.05     1450       OTAL EV INSTRUCTION     TOTAL S 569721.05     1450       FGA 19271     INSTRUCTION     TOTAL S 569721.05     1450       FGA 19271     INSTRUCTION     TOTAL S 569721.05     0       FGA 19271     INSTRUCTION     TOTAL S 569721.05     0       FGA 19271     INSTRUCTION     TOTAL S 569711.98     0       RE F0517     CODE     1550411.98     0       RE F0517     CODE     1550411.98     0       ANALYSIS     ISSOF09.04     5702       ALA PAAGEMENT     DOCUMENT     236709.04     5702       ALA PAAGEMENT     DOCUMENT     236709.04     5702       ALA PAAGEMENT     TOTAL S     836427.77     1450       OTAL EV INSTRUCTION     TOTAL S     836427.77     5702       Software CEM     Software CEM     Software CEM     505	ATA MANAGEMENT DOCUMENT S 64378.48 Eal TIME ENTRUCTION TOTAL S 569721.05 FGR 19271 INSTAUCTIONS 167285.54 DATECL NEW ANALYSIS S 167285.54 DATECL NEW ANALYSIS S 167285.54 DATECL NEW ANALYSIS S 167285.54 DATECL NEW ANALYSIS S 167285.54 DATECL NEW 2000 BESTOS.04 RE FOST CPU TEST 236709.04 ACATTAM ATA PARAGEMENT DOCUMENT S 336709.04 ACATTAM ATA PARAGEMENT TOTAL S 836427.72 FOR 19271 INSTRUCTION TOTAL S 836427.72 SOFTWARE CEM	AIR WARGEMENT         DOCUMENT S         64370-40         TISS           GUL EV INSTRUCTION         TOTAL S         569721.05         1450           OTAL EV INSTRUCTION         TOTAL S         569721.05         1450           FGA 19271         INSTRUCTION         TOTAL S         569721.05         1450           ONIRGL NEW         ANALYSIS S         167285.54         0         0           NEUTOCUTPUT         CESTON         1350.041         496.4         496.4           LEGRITHM         ESTEN         236709.041         5702         1450           OLAL EV INFRUCTION         TOTAL S         836.27.72         1450         0           OLAL EV INSTRUCTION         TOTAL S         836.27.72         1450         0           FDR         19271         INSTRUCTIONS         TOTAL S         836.27.72         1450           SOFTWARE CEM         19271         INSTRUCTIONS         TOTAL S         836.27.72         1	ATA WAAGEMENT     DOCUMENT 5     64370-40     7155       ELL TIME     DOCUMENT 5     569721.05     1450       OTAL EY INSTRUCTION     TOTAL 5     569721.05     1450       FGF     19271     INSTRUCTION     TOTAL 5     569721.05       FGF     19271     INSTRUCTION     TOTAL 5     569721.05       FGF     19271     INSTRUCTIONS     105411.98     0       ONIGUL NEW     ANALYSIS 5     167285.54     0     0       RE LOCUTUT     CODE     1856411.98     0     0       RE LOCUTUT     CODE     1856411.98     0     0       RE LOCUTUT     TEST     235709.04     5702       ALL THE     DOCUMENT 5     836427.72     1450       CALTINE     OTAL 5     836427.72     1450       CALTINE     TOTAL 5     836427.72     1450       SOFTWARE CEM     10271 INSTRUCTIONS     10271     SOFTWARE CEM	BG	529.99 ALGC	CHITHM	TEST	161231.06	5702	15.00
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014L     EY     INSTRUCTION     1014L     \$     569721.05       F0R     19271     INSTRUCTIONS     \$     569721.05       F0R     19271     INSTRUCTIONS     \$     569721.05       ON F0L     NEW     ANALYSIS     \$     167245.54     0       ON F0L     NEW     ANALYSIS     \$     1656411.98     0       ON F0L     DESIGN     1566411.98     \$     4964       NFLYOLTPUT     CODE     181504.81     \$     4964       ATA     PANAGEMENT     235109.34     \$     \$       ATA     PANAGEMENT     \$     35510.34     \$       ATA     PANAGEMENT     \$     35510.34     \$       OCUMENT     \$     \$     35510.34     \$       ATA     PANAGEMENT     \$     \$     \$       OTAL     \$     \$     \$     \$       FOR     19271     INSTRUCTION     \$     \$	014L     EV     INSTRUCTION     TOTAL     \$     569721.05       FGR     19271     INSTRUCTIONS     569721.05       FGR     19271     INSTRUCTIONS     569721.05       ON FACL     NEW     ANALYSIS     1672A5.54     0       ON FACL     NEW     ANALYSIS     1656411.98     0       ON FACL     DOE     1556411.98     4964       RE FORD     CODE     1556411.98     4964       LEGGRITH     CODE     23610.33     7155       AIA     PANAGEMENT     DOCLIMENT     94516.33       LEGGRITH     DOCLIMENT     94516.33     7155       OTAL     EX     RESERTER     1450       Fold     INSTRUCTION     TOTAL     836427.72       OTAL     FOR     19271     INSTRUCTIONS       SOFTWARE     CEM     SOFTWARE     SOFTWARE	014L EY INSTRUCTION TOTAL \$ 569721.05 FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS ONFPOL NEW ANALYSIS \$ 167285.54 0 ONFPOL NEW ANALYSIS \$ 167285.54 0 Design 156411.98 0 Estimated analysis \$ 156411.98 0 Design \$ 156411.98 0 FGR 19271 CODE 1556411.98 0 FGR 19271 INSTRUCTION TOTAL \$ 836427.72 OTAL EY INSTRUCTION TOTAL \$ 836427.72 FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS	OTAL     EY     INSTRUCTION     TOTAL     \$     569721.05       FG6     19271     INSTRUCTION     TOTAL     \$     569721.05       FG6     19271     INSTRUCTION     TOTAL     \$     569721.05       ONFG0L     NEW     ANALYSIS     167285.54     0     0       ONFG0L     NEW     ANALYSIS     167285.54     0     0       ONF0LUUT     DESIGN     156911.98     9564     9064       RE     FOST     TEST     236594.01     5702       AIA     VANGEMENT     DOCUMENT     235509.04     5702       AIA     FANGEMENT     DOCUMENT     9516.33     7155       OTAL     R     B36427.72     1450       FCR     19271     INSTRUCTION     TOTAL     836427.72       SOFTWARE     CEM     SOFTWARE     CEM     SOFTWARE	014L     EV     INSTRUCTION     1014L     \$ 569721.05       FGF     19271     INSTRUCTIUNS     569721.05       ONIFOL     NEW     ANALYSIS     167285.54     0       ONIFOL     NEW     ANALYSIS     167285.54     0       ONIFOL     NEW     OSSIGN     156411.98     4964       NELIZOTPUT     0     0     191594.81     4964       RE     FGSI     CODE     191594.81     7105       ANALYSIS     0     0     1450     1450       RE     FGSI     CODE     131594.81     1450       COLUMENT     TOTAL     836427.72     1450       OTAL     EV     INSTRUCTION     TOTAL     836427.72       FGR     19271     INSTRUCTIONS     1075	01+L     EV     INSTRUCTION     101AL     \$     569721.05       FGF     19271     INSTRUCTIONS     569721.05       ONIFGL     NEW     ANALYSIS     167285.54     0       ONIFGL     NEW     ANALYSIS     167285.54     0       ONIFGL     DESSIGN     181504.81     4964       NELIZOLTPUT     DESSIGN     235709.04     5702       RE     EGSI     CODE     181504.81     7352       RE     DOCUMENT     235709.04     5702       ATA     PANGEMENT     1450       CAL     INSTRUCTION     TOTAL     836427.12       OTAL     EV     INSTRUCTIONS     1450       FOR     19271     INSTRUCTIONS     50427.12	OTAL EY INSTRUCTION TOTAL \$ 569721.05 FGF 19271 INSTRUCTIONS FGF 19271 INSTRUCTIONS FFGF 19271 INSTRUCTIONS RE FOST CPU RE FOST CPU REST RE FOST CPU REST RE FOST CPU REST RE FOST CPU REST RE FOST CPU REST REST REST REST REST REST REST REST	014L     EV     INSTRUCTION     1014L     \$     569721.05       FGF     19271     INSTRUCTIONS     569721.05       FGF     19271     INSTRUCTIONS     69721.98     0       Ohlfoll     NEW     ANALYSIS     167285.54     0       NEL/JOUTPUT     DESIGN     156411.98     0       R     FGST     CODE     191504.81     4964       ATA <pargement< td="">     CODE     191504.81     4964       ATA<pargement< td="">     DOCUMENT     236709.04     5702       ATA<pargement< td="">     DOCUMENT     236427.72     1450       OTAL     FCF     19271     INSTRUCTIONS     1450       FCR     19271     INSTRUCTIONS     5074.72     1450       SOFTWARE     CEA     SOFTWARE     507     507</pargement<></pargement<></pargement<>	014L     EV     INSTRUCTION     1014L     \$     569721.05       FGF     19271     INSTRUCTIONS     569721.05       FGF     19271     INSTRUCTIONS     167285.54     0       ONIFOL     NEW     ANALYSIS     167285.54     0       NELTOLTPUT     DESIGN     156411.48     0     0       NELTOLTPUT     DESIGN     156411.48     0     0       NELTOLTPUT     DESIGN     156411.48     0     0       ALL     TEST     235709.04     5702       ALL     DOCLWENT     235709.04     5702       ALL     TEST     1450       COTAL     REST     1450       CAL     TIPE     1450       CAL     19271     INSTRUCTION       FGR     19271     INSTRUCTIONS	100		TIME .			1450	75.00
FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS ON FGU NEW ANALYSIS S 1672AS.54 0 ON FGU TEST 181594.81 964 RE FGST CPU CODE 181594.81 964 ATA PANAGEMENT 235709.04 5702 ATA PANAGEMENT 235709.04 5702 ATA PANAGEMENT 200 TEST 294516.33 11550 TAL EY INSTRUCTION TOTAL S 836427.72 OTAL EY INSTRUCTIONS FGR 19271 INSTRUCTIONS SOFTWARE CEM	FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS ONTROL NEW ANALYSIS 5 1672A5.54 0 NPLTOLTPUT DESIGN 156411.98 0 RE FOST CPU TEST 236709.04 5702 ATA PANAGEMENT 00CLIMENT 5 94516.33 1450 ATA PANAGEMENT 145 00CLIMENT 5 836427.72 OTAL EY INSTRUCTION TOTAL 5 836427.72 FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS SOFTWARE CEM	FGR 19271 INSTRUCTIONS PONFACL NEW ANALYSIS 5 1672A5.54 0 NPLIJOLTPUT DESIGN 156411.98 0 NPLIJOLTPUT DESIGN 156411.98 0 RE FOST CPU CODE 191504.81 4964 TGERTTHM TEST 236709.04 5702 ATA PANGGRENT 00CUMENT 5 94516.33 7155 ATA PANGGRENT 145 836427.72 OTAL EY INSTRUCTION TOTAL 5 836427.72 FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS SOFTWARE CEM	FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS ON FGU NEW ANALYSIS 5 1672A5.54 0 NPLIOUTPUT DESIGN 156411.98 0 RE FOST CPU DESIGN 156411.98 0 RE FOST CPU 200E 191594.81 4964 LGGTL FF 1002 000 MEMT 5 236709.04 5702 LGGTL FF INSTRUCTION TOTAL 5 836427.72 01AL EY INSTRUCTION TOTAL 5 836427.72 FOR 19271 INSTRUCTIONS FOR 19271 INSTRUCTIONS SOFTWARE CEM	FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS ON FGCL NEW ANALYSIS 5 1672A5.54 0 NEUTOUTPUT DESIGN 156411.98 0 DESIGN 156411.98 0 DESIGN 156411.98 0 LEGRITY 23109.04 5705 ATA PANAGEMENT CEN Eal TIME EST 23109.04 5705 TAL EY INSTRUCTION TOTAL 5 836427.72 OTAL EY INSTRUCTIONS FGR 19271 INSTRUCTIONS SOFTWARE CEM	FGR 19271 INSTRUCTIONS PONTROL NEW ANALYSIS 5 1672A5.54 0 NELIZOLPUT DESIGN 156411.98 0 NELIZOLPUT 28419.94 0 NELIZOLPUT 28411.98 0 DESIGN 156411.98 0 TEST 2841994.81 4964 TEST 2841994.81 4964 TIME EV INSTRUCTION TOTAL S 836427.72 OTAL EV INSTRUCTION TOTAL S 836427.72 OTAL EV INSTRUCTIONS FGR 19271 INSTRUCTIONS SOFTWARE CEM	FGA 19271 INSTRUCTIONS ON FGU NEW ANALYSIS 5 167285.54 NPLIOUTPUT DESIGN 156411.98 RE FOST CPU CODE 191504.81 RE FOST CPU CODE 191504.81 ATA PANAGEMENT CODE 191504.81 ATA PANAGEMENT CODE 191504.81 ATA PANAGEMENT CODE 894516.33 E al TIME RETURN TOTAL S 836427.72 FOR 19271 INSTRUCTIONS 836427.72 SOFTWARE CEM	FGR         19271         INSTRUCTIONS           FGR         19271         INSTRUCTIONS           ONIFOL         NEW         AMALYSIS         167285.54         0           ONIFOL         NEW         OBSIGN         156411.98         0           R         FOST         CUE         156411.98         0           R         FOST         CUE         235169.44         5964           LGGRITH         TEST         23516.33         7155           AIA         FOR         DOCUMENT         23516.33         7155           AIA         PANAGEMENT         TEST         23516.33         7155           AIA         PANAGEMENT         TOTAL         8364.27.72         1450           OTAL         TOTAL         R 364.27.72         1450         1450           FGR         19271         INSTRUCTION         TOTAL         8364.27.72	FGR 19271 INSTRUCTIONS ONIFOL NEW ANALYSIS S 167295.54 0 NELTOPU DESIGN 156411.99 0 NELTOPU DESIGN 156411.99 0 NELTOPU DESIGN 156411.99 0 NELTOPU DESIGN 156411.99 0 TEST 236709.04 5702 ATA PANGEMENT 00AL S 94516.33 1450 TAL EV INSTRUCTION TOTAL S 836427.77 FGR 19271 INSTRUCTIONS FGR 19271 INSTRUCTIONS SOFTWARE CEM	540	121.04 1014	EX		569721.05		
On FPCL         NEW         ANALYSIS         167785.54         0           NPLI/OLTPUT         DESIGN         156411.98         0           NPL/YOLTPUT         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           RE FOST CPU         CODE         181504.81         4964           LGCALTHM         TEST         235709.04         5702           ATA PANAGEMENT         DOCUMENT         94516.33         7155           Eal TIME         DOCUMENT         94516.33         7155           OTAL EY INSTRUCTION         TOTAL S         836427.72         1450           FGR         19271         INSTRUCTIONS         536427.72	On FPUL         NEW         ANALYSIS         167785.54         0           NPLI/OLTPUT         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           LGGAITHM         TEST         236709.04         5702           ATA PANAGEMENT         DOCUMENT         94516.33         7155           Eal TIME         DOCUMENT         836427.72         1450           OTAL         VINSTRUCTION         TOTAL         836427.72           OTAL         19271         INSTRUCTIONS         536427.72           FOR         19271         INSTRUCTIONS         50677.86	On FOL         NEW         ANALYSIS         167285.54         0           NFU YOU TPUT         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           LGGAITHM         TEST         235709.04         5702           ATA PANAGEMENT         00CLWENT         94516.33         7155           Eal TIME         DOCLWENT         836427.72         1450           OTAL         FOR         TOTAL         836427.72           OTAL         19271         INSTRUCTION         TOTAL           SOFTWARE         CEM         Software         Software	ONTROL NEW ANALYSIS 5 167285.54 0 NPLIVOLTPUT DE FOST CPU RE FOST CPU RE FOST CPU LGCALTHM ARE FOST CPU LGCALTHM ARE PANAGEMENT ATA PANAGEMENT E AL TIME OTAL EY INSTRUCTION FOR 19271 INSTRUCTIONS SOFTWARE CEM SOFTWARE CEM COTEC NAME COTEC NAM	Ontpol         New         Analysis         167785.54         0           NPLI/OLTPUT         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           LGCALTHM         TEST         236709.04         5702           ATA PANAGEMENT         DOCUMENT         94516.33         7155           Eal TIME         00000         1450         1450           FGR         10001         TOTAL         836427.72         1450           FGR         19271         INSTRUCTIONS         836427.72         1450           SOFTWARE CEA         SOFTWARE CEA         50         50         50	On Foll         New         Analysis         I 67295.54         D           RF LYOUTPUT         DESIGN         156411.98         0           RF FOST CPU         DESIGN         156411.98         0           RF FOST CPU         CODE         181504.81         4964           LGCATTHM         TEST         235109.04         5702           AIA PAAGEMENT         TEST         235109.04         5702           AIA PAAGEMENT         DOCLIMENT         94516.33         7155           Eal TIVE         DOCLIMENT         94516.33         7155           OTAL         R 36427.72         1450           OTAL         19271         INSTRUCTION         TOTAL           SOFTWARE         CEH         SOFTWARE         CEH	ON FOL NEW ANALYSIS 5 167285-54 NPL TOLTPUT DESIGN 156411-98 RE FOST CPU 06516N 156411-98 RE FOST CPU 060E 191504.01 LGCRITHM TEST 236709.04 ATA PAAGEMENT 00CUMENT 5 94516.33 Eal TIVE 00CUMENT 5 836427.72 FOR 19271 INSTRUCTION TOTAL 5 836427.72 SOFTWARE CEM	Onifold         New Tyoit pit         Operation         Design         Operation         Operation <th< td=""><td>Ohied         Neu Ysis         I67285.54         O           NFUTOUTPUT         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           LGCHITHM         DESIGN         181504.81         4964           LGCHITHM         TEST         235109.04         5702           AIA PAAGEMENT         TOCLWENT S         94516.33         1450           OTAL         FGR         1071L         S64.27.72         1450           FGR         19271         INSTRUCTION         TOTAL         8364.27.72         1450           SOFTWARE         CEM         S064.27.72         194.27.72         1450</td><td>u.</td><td>69721.05 FOF</td><td></td><td>s</td><td></td><td></td><td></td></th<>	Ohied         Neu Ysis         I67285.54         O           NFUTOUTPUT         DESIGN         156411.98         0           RE FOST CPU         DESIGN         156411.98         0           LGCHITHM         DESIGN         181504.81         4964           LGCHITHM         TEST         235109.04         5702           AIA PAAGEMENT         TOCLWENT S         94516.33         1450           OTAL         FGR         1071L         S64.27.72         1450           FGR         19271         INSTRUCTION         TOTAL         8364.27.72         1450           SOFTWARE         CEM         S064.27.72         194.27.72         1450	u.	69721.05 FOF		s			
NFLI/OLTPUT         DESIGN         IS6411.98         0           RE FOST CPU         CODE         IA1504.81         4964           ATA PANAGEMENT         TEST         235709.04         5702           ATA PANAGEMENT         DOCUMENT         24516.33         7155           ATA PANAGEMENT         DOCUMENT         94516.33         7155           OTAL         FOR         1450         1450           FCA         INSTRUCTION         TOTAL         8364.27.72           OTAL         FUNCTION         TOTAL         8364.27.72           SOFTWARE CEM         SOFTWARE CEM         SOFTWARE CEM         SOFTWARE CEM	NFLI/OLTPUT         DESIGN         IS6411.98         0           RE FOST CPU         CODE         191504.81         4964           LIGATHAM         TEST         235709.04         5702           LIA PANGGMENT         DOCUMENT         94516.33         7155           LIA PANGGMENT         DOCUMENT         94516.33         7155           COL         BOCUMENT         94516.33         1450           COL         FOR         TOTAL         S36427.72         1450           FOR         19271         INSTRUCTION         TOTAL         S36427.72           SOFTWARE CEM         SOFTWARE CEM         SOFTWARE CEM         SOFTWARE CEM	NFLI/OLTPUT         DESIGN         I56411.98         0           RE FOST CPU         CODE         191504.81         4964           LIGATHAM         TEST         235709.04         5702           LIA PANAGEMENT         DOCUMENT \$ 24516.33         1450           COTAL         NSTRUCTION         TOTAL \$ 836427.72         1450           COTAL         NSTRUCTION         TOTAL \$ 836427.72         1450           FOR         19271         INSTRUCTIONS         S06427.72         S0677.82	NFLI/OLTPUT         DESIGN         IS6411.98         0           RE FOST CPU         CODE         181504.81         4964           ATA FANAGEMENT         TEST         235709.04         5702           ATA FANAGEMENT         DOCUMENT         235709.04         5702           ATA FANAGEMENT         DOCUMENT         24516.33         7155           OTAL EY INSTRUCTION         TOTAL         836427.72         1450           FOR         19271         INSTRUCTIONS         636427.72         1450           FOR         19271         INSTRUCTIONS         50677.72         1450	NFLI/OLTPUT         DESIGN         IS6411.98         0           RE FOST CPU         CODE         181504.81         4964           ATA PANAGEMENT         TEST         235109.04         5702           ATA PANAGEMENT         DOCLWENT         24516.33         7155           ATA PANAGEMENT         DOCLWENT         94516.33         7155           OTAL         R 336+27.72         1450           OTAL         R 336+27.72         1450           FCR         19271         INSTRUCTION         TOTAL           SOFTWARE         CEM         S36+27.72         1450	NFLIOLTPUT         DESIGN         IS6411.98         0           RE FOST CPU         CODE         181504.81         4964           ATA FARME         TEST         235109.04         5702           ATA FARME         DOCUMENT         94516.33         1155           ATA FARME         DOCUMENT         94516.33         1155           OTAL EY INSTRUCTION         TOTAL S         836427.72         1450           FOR         19271         INSTRUCTIONS         536427.72           FOR         19271         INSTRUCTIONS         50677.72	NPLIJOLTPUT DESIGN IS6411-98 RE FOST CPU CODE 181504-81 ATA PANAGEMENT 236709-04 ATA PANAGEMENT DOCUMENT \$ 345709-04 Eal TIME 836427.72 FOR 19271 INSTRUCTIONS 636427.72 SOFTWARE CEM	NFLIOLTPUT         DESIGN         IS6411.98         0           RE FOST CPU         CODE         181504.81         4964           ATA FANAGEMENT         TEST         235709.04         5702           ATA FANAGEMENT         DOCUMENT \$ 235709.04         5702           ATA FANAGEMENT         DOCUMENT \$ 235709.04         5702           ATA FANAGEMENT         DOCUMENT \$ 235709.04         5702           ATA FANAGEMENT         TOTAL \$ 335600.04         5702           OTAL EY INSTRUCTION         TOTAL \$ 836427.72         1450           FGR         19271         INSTRUCTIONS         50677.72           Software Cen         Software Cen         50677.72         50677.72	NFLI/OLTPUT         DESIGN         IS6411.98         0           RE FOST CPU         CODE         181504.81         4964           ATA PANAGEMENT         TEST         235109.04         5702           ATA PANAGEMENT         DOCLWENT         235109.04         5702           ATA PANAGEMENT         DOCLWENT         24516.33         7152           ATA PANAGEMENT         DOCLWENT         8354.27.72         1450           OTAL EY INSTRUCTION         TOTAL S         8354.27.72         1450           FOR         19271         INSTRUCTIONS         5354.27.72         1450           SOFTWARE CEM         SOFTWARE CEM         50577.72         1450         1450		0.00 CONT		ANALYSIS 5	167285.54	0	33.00
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Eal TIME 1450 DIAL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	EaL TIME 1450 DIAL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	EaL TIKE 1450 DTAL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	Eal TIME 1450 OTAL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	Eal TIME 1450 01AL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	Eal TIME 1450 01AL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	EaL TIME ESTIME EAL TIME ESTIME ESTIMES ESTIME ESTIME ESTIME ESTIME ESTIME ESTIME ESTI	Eal TIKE 1450 01AL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	Eal TIKE 1450 DIAL EY INSTRUCTION TOTAL S 836427.72 FOR 19271 INSTRUCTIONS SOFTWARE CEM	26	A312.50 DATA	A MANAGEMENT	DOCUMENT S	94516.33	7155	37.50
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0.00     INPLI/OLTPUT     DESIGN     IISIS7.22     0       88.33.77     PRE FOST CPU     CODE     II33631.64     496.4       96.933.37     PRE FOST CPU     EEST     ITAZ75.37     5702       190.833.31     DATA MANAGEMENT     DOCUMENT \$     69566.94     7155       190.845.18     DATA MANAGEMENT     DOCUMENT \$     69566.94     7155       108750.00     HEAL TIME     DOCUMENT \$     615814.02     1450       615814.02     FOL     R     INSTRUCTION     TOTAL \$     615814.02       615814.02     O     0     O     FOL     R       615814.02     INSTRUCTION     TOTAL \$     615814.02     0       615814.02     INSTRUCTION     TOTAL \$     171326.32     0       0     0     INSTRUCTIONS     INSTRUCTIONS     177326.32     0       147756.29     PRE FOST CPU     CODE     192399.06	115157.22 133631.64 174275.37	0 4964	20.04
RB323.77     PRE     FOST     FU     CODE     133631.64     4964       1908750.00     HEAL     TIFST     IT4275.37     5702       1908750.00     HEAL     TIFF     DOCUMENT \$     69566.94     7155       1908750.00     HEAL     TIFF     DOCUMENT \$     69566.94     7155       108750.00     HEAL     TIFF     DOCUMENT \$     615814.02     7155       108750.00     HEAL     TIFF     DOCUMENT \$     615814.02     7155       114702     TOTAL     BY     INSTRUCTION     TOTAL \$     817326.32     0       615814.02     FGF     19271     INSTRUCTION     TOTAL \$     8177326.32     0       615814.02     FGF     19271     INSTRUCTION     TOTAL \$     1755     0       615814.02     FGF     FGF     177326.32     0     0       0     0     FGF     FGF     192399.06     4964       147755.00     F	133631.64	4964	
56933.9A     ALGGAITHM     TEST     174.275.37     5702       100.8750.00     KEAL TIMF     DOCUMENT \$ 69566.9B     7155       101.750.00     KEAL TIMF     NETRUCTION     TOTAL     87155       \$15814.02     FGA     19271     INSTRUCTION     TOTAL \$ 177326.32     90       \$15814.02     FGA     19271     INSTRUCTION     TOTAL \$ 177326.32     0       \$15814.02     FGA     19271     INSTRUCTION     TOTAL \$ 177326.32     0       \$147856.29     FE     FCS1     CONE     1923990.01     0       \$147856.29     FE     FCS1     CONE     1923999.05     4964       \$147856.29     FE     FCS1     CONE     1923990.05     5702       \$2590916.75     S177326.32     0     0     0     5702       \$143966.29     FE     FCS1     CONE     1923990.05     5702       \$2590916.75     S177326.32     FCS1     7155     7155       \$291566.00     FA     TOTAL     FOCUMENT     5702       \$255000     FC     FC     FC     7155       \$291666.00     FC     FC     FC     7155       \$255000     FC     FC     FC     7155       \$1086631.67     FC     <	174275.37		17.79
IGGRAS.IR DATA WANGEMENT DOCUMENT \$ 69566.98 7155 IGR750.00 HEAL TIPF SISEILATE TOTAL BY INSTRUCTION TOTAL \$ 615814.02 615814.02 FGA 19271 INSTRUCTIONS 615814.02 FGA 19271 INSTRUCTIONS 0.00 INPLITOL NEW ANALYSIS \$ 177326.32 0 0.00 INPLITOL TOTT DESIGN \$ 177326.32 0 147856.29 PRE FCS1 CPU CONE 192399.06 4964 147856.29 PRE FCS1 CPU CONE 192399.05 5702 249662.00 ALCHIME DOCUMENT \$ 100189.37 7155 1456431.67 TOTAL BY INSTRUCTION TOTAL \$ 888631.62 AR66431.67 TOTAL BY INSTRUCTION TOTAL \$ 888631.62		5702	17.00
108750.00 HEAL TIME       1450         #15814.02 FOR INSTRUCTION       TOTAL \$ 615814.02         615814.02 FOR 19271 INSTRUCTIONS       #177326.32       0         0.00 CONTECL NEW       ANALYSIS \$ 177326.32       0         0.01 INFLYOLTPUT       DESIGN 17.5       177326.32       0         147755.29 PRE FCS1 CPU       CONE       192399.05       4964         147965.29 PRE FCS1 CPU       TEST       250916.75       5702         291566.26 Data Management       DOCUMENT \$ 100189.37       7155         108750.00 REAL TIME       MASTRUCTION       TOTAL \$ 886631.62       1450	69586.98	7155	26.68
615#14.02 TOTAL &Y INSTRUCTION TOTAL \$ 615814.02 615#14.02 FGA 19271 INSTRUCTIONS 615#14.02 FGA 19271 INSTRUCTIONS 0.00 CONTFCL NEW ANALYSIS \$ 177326.32 0 0.00 INPLT/0LTPUT 0FSIGN 192399.05 4964 147956.29 PRE FCS1 CPU CONE 192399.05 4964 147956.29 PRE FCS1 CPU TEST 250916.75 5702 291566.25 DA12 WANAGEWENT DOCUMENT \$ 100189.37 7155 108750.00 FEAL TIME #F6A31.62 TOTAL BY INSTRUCTION TOTAL \$ #86631.62		1450	15.00
615814.02       FGA       19271       INSTRUCTIONS         0.00       CONTACL       NEW       ANALYSIS       177326.32       0         0.00       INPLIFOLTPUT       DESIGN       155800.11       0       0         147856.29       PRE <fcs1< td="">       CPU       CONE       192399.06       4964         147856.29       PRE<fcs1< td="">       CPU       CONE       192399.06       4964         149965.40       ALGEATITH       CONE       192399.06       4964         149965.60       PAIL FILE       DOCUMENT       250916.75       5702         291566.27       DAIL MAAGEMENT       DOCUMENT       100189.37       7155         108750.00       REAL TIME       DOCUMENT       100189.37       7155         #PR6A31.67       TOTAL       B866331.62       1450</fcs1<></fcs1<>	615814.02		
CONTACL         NEW         ANALYSIS         177326.32         0           INALIVOLTOUT         DESIGN         155800.11         0         0           PRE         FCSI         CPU         DESIGN         155800.11         0           PRE         FCSI         CPU         DESIGN         1923999.06         4964           ALGGENTHM         TESI         250916.75         5702           ALGGENTHM         DOCUMENT         100189.37         7155           REAL         TIFF         1450         1450           ALAL         TITE         DOCUMENT         100189.37         7155           REAL         TIFF         B866511.62         1450         1450			
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PRE         FCST         CPU         CONE         192399.06         4964           ALGCALTHM         TEST         250016.75         5702           DATA         MAAAGEMENT         DOCUMENT         250016.75         5702           DATA         MAAAGEMENT         DOCUMENT         8         100189.37         7155           REAL         TIFF         MACUMENT         8         100189.37         7155           TOTAL         Emerstand         2502.06         1450         1450	145800.11		29.86
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0.00     INPLIFUCTPUT     DESIGN     122616.37     0       92460.44     PRE FOST CPU     CODE     142287.44     4964       10.0750.00     RELTIME     DESIGN     17201     5702       204453.43     DATA PANEWENT     DOCUMENT S     7404.38     5702       204453.43     DATA PANEWENT     DOCUMENT S     7404.38     7502       204453.43     DATA PANEWENT     DOCUMENT S     7404.38     7502       204453.43     DATA PANEWENT     DOCUMENT S     7404.38     7502       455702.50     TOTCL EY INSTRUCTION     TOTAL S     655702.50     1450       455702.50     FGE     19271 INSTRUCTIONS     27150     1450       455702.50     FGE     19271 INSTRUCTIONS     0     0       455702.50     FGE     19271 INSTRUCTIONS     27150     1450       455702.50     FGE     19271 INSTRUCTIONS     1758330     0       455702.50     FGE     19271 INSTRUCTIONS     265100.40     0       455702.50     FGE     19271 INSTRUCTIONS     265100.93     5702       455702.50     FGE     19271 INSTRUCTIONS     265130.93     0       455702.50     FGE     FGE     19070.44     0       455702.50     FGE     FGE	.0.0	CONTROL			0	00.07
92460.44         PRE         FCST         CDDE         142287.44         4964           108437.32         ALGGATINM         TEST         14506.3.81         5702           2014437.32         ALGGATINM         DOCUMENT         14506.3.81         5702           20144750.00         REAL TIPE         DOCUMENT         1450         1450           655702.50         TOTCL         EV         INSTRUCTION         TOTAL         555702.50           655702.50         FGF         19271         INSTRUCTION         TOTAL         655702.50           655702.50         FGF         19271         INSTRUCTION         TOTAL         655702.50           655702.50         FGF         19271         INSTRUCTION         TOTAL         655702.50           157775         FGF         19271         INSTR	• 0.0	INPLT/OLTP	DESIGN	122616.37	0	22.20
106437.32     ALGCATLM     TEST     18563.81     5702       108450.00     REAL TIME     DOCUMENT     74094.38     7155       108450.00     REAL TIME     DOCUMENT     74094.38     7155       108450.00     REAL TIME     DOCUMENT     74094.38     7155       108450.00     REAL TIME     DOCUMENT     655702.50     1450       455702.50     TOTLL     EV     INSTRUCTIONS     20000       455702.50     FCF     19271     INSTRUCTIONS     20000       456702.50     FCF     19271     INSTRUCTIONS     20000       456702.50     FCF     19271     INSTRUCTIONS     20000       456702.50     FCF     19271     INSTRUCTIONS     0       456702.50     FCF     19271     INSTRUCTIONS     0       157702.50     FCF     19271     INSTRUCTIONS     0       157702.50     FCF     19271     19503.40     0       157702.50     FCF     19271     17555     17555       157702.50     FCF     FCF     17555     14500       157702.50     FCF     FCF     17555     1450       157702.50     FCF     FCF     16564.30     1456       157702.50     FCF     FCF<	\$ 92460.4		CODE	142287.44	4964	18.63
204453.43       Data MANGFMENT       DOCUMENT \$       74094.38       7155         108750.00       REAL TIPE       Extension       Item       1450         655702.50       TOTCL EY INSTRUCTION       TOTAL \$       655702.50       1450         655702.50       FCF       19271       INSTRUCTIONS       555702.50       1450         655702.50       FCF       19271       INSTRUCTIONS       555702.50       0         655702.50       FCF       19271       INSTRUCTIONS       555702.50       0         655702.50       FCF       19271       INSTRUCTIONS       0       0         655702.50       FCF       19271       INSTRUCTIONS       0       0         65550       FCF       19271       INSTRUCTIONS       0       0         15777       FEST       266130.93       5702       0       0         1584515       ALCHEN       DOCUMENT       106264.30       1456       0         1584515       ALCHEN       FEST       266130.93       5702       0       0         1584515       ALCHEN       DOCUMENT       FEST       266130.93       7155       0       0         11087500       FELTHE       FEST<	\$ 106437.3		TEST	185563.81	5702	18.67
108750.00 REAL TIPE       1450         655702.50 TOTCL EY INSTRUCTION       TOTAL S       655702.50         458702.50 FGR 19271 INSTRUCTIONS       655702.50       1450         458702.50 FGR 19271 INSTRUCTIONS       655702.50       1450         458702.50 FGR 19271 INSTRUCTIONS       655702.50       655702.50         458702.50 FGR 19271 INSTRUCTIONS       655702.50       0         659702.50 FGR 19271 INSTRUCTIONS       0       0         1577950 FGR 19271 FULL       06516N       175853.30       0         1577950 FGR 17PL       06216N       175853.30       0       0         1577950 FGR 17PL       06216N       175853.30       0       0         1577950 FGR 17PL       06216N       175853.30       0       0         1585150 FGR 17PL       062046.30       14964       0       0         1585150 FGR 17PL       062046NT       106264.30       1450         1585150 FGR 17PL       0702       1450       0         1585150 FGR 18PL       070392.00       1450	\$ 209453.4		DOCUMENT S	74094.38	7155	29.16
655702.50     TOTL EY INSTRUCTION     TOTAL S     655702.50       655702.50     FGF     19271     INSTRUCTIONS     655702.50       656702.50     FGF     19271     INSTRUCTIONS     655702.50       656702.50     FGF     19271     INSTRUCTIONS     655702.50       656702.50     FGF     19271     INSTRUCTIONS     0       157755     600     205653.30     0     0       157755     ALGCATIFY     75653.30     0     0       157755     ALGCATIFY     75653.30     0     0       15855     ALGCATIFY     75653.30     0     0       15855     ALGCATIFY     7555     7755     7755       1587500     FEAL     700     7155     7155       10875000     FEAL     FY INSTRUCTION     707L     840392.00	\$ 108750.0				1450	75.00
655702.50 TOTCL EY INSTRUCTION       TOTAL S       655702.50         65702.50 FGF       19271 INSTRUCTIONS       655702.50         65000000000000000000000000000000000000				**********		
***702.50 FCR         19271         INSTRUCTIONS           ***02.50 FCR         19271         INSTRUCTIONS           ***00         CONFACL         NEW           ***00         CONFACL         NEW           ***00         INSTRUCTIONS         INSTRUCTIONS           ****00         INSTRUCTIONS         INSTRUCTIONS           ************************************	\$ 655702.5	TOTEL EY		655702.50		
5       0.00 CONTACL NEW       ANALYSIS \$ 18076.40       0         5       15774.40       0       0         5       15774.40       0 ESIGN       175853.30       0         5       15774.40       0       0       0         5       15774.40       0       0       0         5       15615.40       0       0       0         5       156515.40       0       0       0         5       156515.40       1666.130.93       5702       5702         5       156515.40       1666.130.93       5702       7155         5       108750.40       64.130       7155       7155         5       940392.00       64.11FE       0       0       0         5       940392.00       64.11FE       0       0       0			s			
Fight         Design         175853.30         0           5         15774.00         PHE FCST CPU         DESIGN         175853.30         0           5         158754.00         PHE FCST CPU         CODE         204065.06         4964           5         315415.00         A4661174         TEST         266130.93         5702           5         315415.00         A464         106264.30         7155           5         108750.00         Fall TIME         DOCUMENT S         106264.30         1450           5         940392.00         Fall TIME         FINSTRUCTION         TOTAL S         940392.00	s. 5.6	CONTROL	ANALYSIS 5	188078.40	0	34.62
\$ 1577***         Pue ECSI CPU         CODE         Z04065.06         4964           \$ 16851***         ALCCAITH*         TEST         266130.93         5702           \$ 15851***         BALCAITH*         TEST         266130.93         5702           \$ 108750***         BALATH*         DOCUMENT         106264.30         7155           \$ 108750****         TIME         DOCUMENT         106264.30         7155           \$ 108750****         TIME         MARCANT         1450         1450           \$ 940392.00         TIME         \$ 940392.00         1450         1450	5 6.0		DESIGN	175853.30	0	32.36
\$ 158515         ALGCAITH: A AAAAGAA         TEST         266130.93         5702           \$ 315416         Data #AAAAGAA         DOCUMENT         DOCUMENT         7155           \$ 108750         Fall         TIME         DOCUMENT         106264.30         7155           \$ 108750         Fall         TIME         DOCUMENT         106264.30         7155           \$ 940392.00         Fall         Fall         1450         1450	\$ 157794 .P		CODE	204065.06	4964	31.79
S 315416. DATA FAAAFEMENT DOCUMENT S 106264.30 7155 S 108750.00 Fall TIVE S 940392.00 Total BY INSTRUCTION TOTAL S 940392.00			TEST	266130.93	5702	27.80
\$ 108750.00 Fal TIME 1450 ====================================			DOCUMENT S	106264.30	7155	44.08
5 940392.00 1014L BY INSTRUCTION TOTAL 5	\$ 108750.0	NEAL			1450	75.00
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1459546.67 4964 195096.38 5702 77900.68 7155 ========= 689386.51 1450 1450 1450 216502.82 4964 216502.82 4964 216502.82 4964 112741.10 1450 112741.10 1450 =========	CODE         149595.67         4964           TEST         195096.38         5702           DOCUMENT \$         77900.68         1450           TOTAL \$         195041.77         0           AMALYSIS \$         199541.77         0           DESIGN         216502.82         4964           CODE         216502.82         4964           CODE         216502.82         4964           TEST         112741.10         1450           TOTAL \$         29551.60         7155           DOCUMENT \$         112741.10         1450           TOTAL \$         997708.83         1450	TODE         14996.87         4704           VT         T000         1450         5702           STRUCTION         T01AL         \$ 77900.68         7155           STRUCTION         T01AL         \$ 77900.68         7155           INSTRUCTION         T01AL         \$ 5005.38         7155           INSTRUCTION         T01AL         \$ 5102         7155           INSTRUCTION         T01AL         \$ 569386.51         1450           INSTRUCTION         T01AL         \$ 5105.65         \$ 7155           INSTRUCTION         T01AL         \$ 199541.77         0           DESIGN         186571.55         0         7502           VT         D000MENT         \$ 112741.10         7155           VT         D000MENT         \$ 112741.10         7155           STRUCTION         T01AL         \$ 997708.83         1450           INSTRUCTION         T01AL         \$ 997708.83         1450
137877.30 129595.58 149596.38 77960.68 77960.68 ====================================	ANALYSIS \$ DESIGN CODE TEST DOCUMENT \$ TOTAL \$ ANALYSIS \$ DESIGN CODE TOTAL \$ TOTAL \$	CL OLD ANALYSIS 5 CUTPUT CST CPU ESIGN CST CPU TEST TITM WANAGEMENT DOCUMENT 5 TIM BY INSTRUCTION TOTAL 5 BY INSTRUCTIONS TOTAL 5 BY INSTRUCTIONS TOTAL 5 BY INSTRUCTIONS TOTAL 5 BY INSTRUCTIONS TOTAL 5 BY INSTRUCTION TOTAL 5 BY I
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00     CONTACL     0L0     ANALYSIS \$ 143373.21     0     28.92       00     INTYOUTPUT     DESTION     1140533.95     0     28.43       00     NALYSIS \$ 143373.09     5702     25.43       00     ALGGRITH     CONTACL     205516N     114053.09     5702     20.041       00     REAL TIME     COCUMENT \$ 202873.09     5702     21.00     23.79       00     REAL TIME     DOCUMENT \$ 202873.09     5702     21.00       00     REAL TIME     DOCUMENT \$ 716866.05     7155     21.00       00     REAL TIME     TOTAL \$ 716866.05     75.00       00     FOR     19271 INSTRUCTION     TOTAL \$ 716866.05     35.73       00     CONTACL NEW     TOTAL \$ 716866.05     35.73       00     CONTACL NEW     TOTAL \$ 716866.05     35.73       00     CONTACL NEW     TOTAL \$ 71516.42     0       00     NALVOLTOUT     DOCUMENT \$ 199619.74     7155       00     NALVOLTOUT     DOCUMENT \$ 199619.74     71550       00     NALMAL	CL         OLD         ANALYSIS         143373.21         0           TOLTPUT         05516N         134053.95         0         0           TOLTPUT         05516N         134053.95         0         0           TOLTPUT         05516N         134053.95         0         0           TIPE         0         058559.93         4964         0           TIPE         0         0         1450         1450           TIPE         0         0         1450         1450           TIPE         0         0         0         0           TIPE         0         0         0         0           TOL         0         0         0         0           TIPE         0         0         0         0           TIPE         0         0         0         0           CL         NEM         0         0         0           GCL         NEW         0         0         0           FCL         0         0         0         0           FCL         0         0         0         0           FCL         0         0         0	CL         OLD         ANALYSIS         I43373.21         O           COLTPUT         DESSIGN         134053.45         9         4964           COST CPU         COCE         134053.45         9         4964           ATTH         COCWENT         134053.45         9         4964           ATTH         COCWENT         B1005.86         7155         4964           VANAGEMENT         DOCUMENT         R1005.86         7155         4966           VANAGEMENT         TOTAL         T16866.05         1450         1450           J9271         INSTRUCTION         T0TAL         T16866.05         5702           L         EY         INSTRUCTION         T0TAL         T16866.05         5702           J9271         INSTRUCTION         T0TAL         T16865.05         4964         60           ACL         NEW         ANALYSIS         271716.42         0         0           ACL         NEW         ANALYSIS         27176.32         4964           ACL         NEW         2729712.32         4964         1450           ATHU         DOCUMENT         299582.12         1450         1450           ILPE         INSTRUCTION	CL       OLD       ANALYSIS       143373.21       0         CALTPUT       DESTION       15555.45       95702         CALTPUT       DESTION       15555.45       95702         CALTPUT       DESTION       15555.45       95702         TIPE       DOCUMENT       202873.09       5702         TIPE       DOCUMENT       202873.09       5702         TIPE       DOCUMENT       202873.09       5702         TIPE       DOCUMENT       211716.42       0         TOOLTPUT       DOCUMENT       219795.466       0         GCL       NEW       ANALYSIS       211716.42       0         TOOLTPUT       DOCUMENT       219719.42       0       0         TOOLTPUT       CODE       229512.32       496.4       7155         MAALYSIS       119619.78       119619.78       7155         LeY       INSTRUCTION       TOTAL       299578.74       5702         JIPPE       ISTRUCTION       TOTAL       1958582.12       202         VOLTPUT       DOCUMENT       205862.12       202       202         VOLTPUT       DOCUMENT       1058582.12       202       202         VOLTPUT <th>CL     0L0     AMALYSIS \$ 143373.21     0       COLTOUT     COST COU     COST COU     5002       CST CPU     COST COU     5002       CST CPU     COST COU     5002       FATHAM     TSS     202873.09     5702       FATHAM     TSS     202873.09     5702       FATHAM     TSS     202873.09     5702       FATHAM     TSS     205855.95     5702       FATHAM     TOTAL \$ 716866.05     114500       TIFE     AMALYSIS \$ 716866.05     11550       FATHAM     TOTAL \$ 716866.05     0       CL     NEW     AMALYSIS \$ 211716.42     0       CL     DAMALYSIS \$ 211716.42     0     0       COLOTPUT     COSE     299578.74     5702       COLOTPUT     TOTAL     1195099.78     11550       COLOTPUT     TOTAL     10595682.112     1550</th> <th>CCL         OLD         AMLYSIS         143333.21         O           FIGL FULT         EESI         134055.45         143333.21         0           FIGL FULT         EESI         134055.45         143333.21         0           AITHM         TESI         202873.09         5702           ANALYSIS         81005.46         1155           L         EY         INSTRUCTION         TOTAL           19271         INSTRUCTION         TOTAL         21716666.05           L         EY         INSTRUCTION         TOTAL           19271         INSTRUCTION         TOTAL         21716.42         0           CCL         NEW         ANALYSIS         211716.42         0           FCL         NSTRUCTION         TOTAL         239516.32         5702           TOUTPUT         ESTENDER         239516.32         5702         2702           FILM         TESI         299576.32         5702         2702           TIME         ESTENDER         10058586.12         1450         1450           L         EY         1058586.12         1450         1450           LIPE         INSTRUCTIONS         1058586.12         1450         1</th> <th>CCL         OLD         AMALYSIS         143333.21         0           FILTH         DESIGN         134553.95         0         0           FILTH         DESIGN         134553.95         4564         0           FALM         DESIGN         134553.95         4564         0           FALM         DECUMENTS         B1005.66         1155         1555           FAMAGEMENT         DOCUMENTS         B1005.66         1450         1555           L         EY         INSTAUCTION         TOTAL         5         716666.05           L         EY         INSTAUCTION         TOTAL         5         7155           19271         INSTAUCTION         TOTAL         5         7155         1450           19271         INSTAUCTION         TOTAL         5         239772.32         4964           FUL         DESIGN         2299772.32         5702         1450           L         EY         INSTAUCTION         TOTAL         1959           LIFE         DESIGN         229772.32         5702           LIFE         DESIGN         10569582.12         1450           LIFE         DESIGN         TOTAL         1959.78</th> <th>0.00</th> <th></th> <th></th> <th></th> <th></th> <th></th>	CL     0L0     AMALYSIS \$ 143373.21     0       COLTOUT     COST COU     COST COU     5002       CST CPU     COST COU     5002       CST CPU     COST COU     5002       FATHAM     TSS     202873.09     5702       FATHAM     TSS     202873.09     5702       FATHAM     TSS     202873.09     5702       FATHAM     TSS     205855.95     5702       FATHAM     TOTAL \$ 716866.05     114500       TIFE     AMALYSIS \$ 716866.05     11550       FATHAM     TOTAL \$ 716866.05     0       CL     NEW     AMALYSIS \$ 211716.42     0       CL     DAMALYSIS \$ 211716.42     0     0       COLOTPUT     COSE     299578.74     5702       COLOTPUT     TOTAL     1195099.78     11550       COLOTPUT     TOTAL     10595682.112     1550	CCL         OLD         AMLYSIS         143333.21         O           FIGL FULT         EESI         134055.45         143333.21         0           FIGL FULT         EESI         134055.45         143333.21         0           AITHM         TESI         202873.09         5702           ANALYSIS         81005.46         1155           L         EY         INSTRUCTION         TOTAL           19271         INSTRUCTION         TOTAL         21716666.05           L         EY         INSTRUCTION         TOTAL           19271         INSTRUCTION         TOTAL         21716.42         0           CCL         NEW         ANALYSIS         211716.42         0           FCL         NSTRUCTION         TOTAL         239516.32         5702           TOUTPUT         ESTENDER         239516.32         5702         2702           FILM         TESI         299576.32         5702         2702           TIME         ESTENDER         10058586.12         1450         1450           L         EY         1058586.12         1450         1450           LIPE         INSTRUCTIONS         1058586.12         1450         1	CCL         OLD         AMALYSIS         143333.21         0           FILTH         DESIGN         134553.95         0         0           FILTH         DESIGN         134553.95         4564         0           FALM         DESIGN         134553.95         4564         0           FALM         DECUMENTS         B1005.66         1155         1555           FAMAGEMENT         DOCUMENTS         B1005.66         1450         1555           L         EY         INSTAUCTION         TOTAL         5         716666.05           L         EY         INSTAUCTION         TOTAL         5         7155           19271         INSTAUCTION         TOTAL         5         7155         1450           19271         INSTAUCTION         TOTAL         5         239772.32         4964           FUL         DESIGN         2299772.32         5702         1450           L         EY         INSTAUCTION         TOTAL         1959           LIFE         DESIGN         229772.32         5702           LIFE         DESIGN         10569582.12         1450           LIFE         DESIGN         TOTAL         1959.78	0.00					
TOLTPUT         DESIGN         134053.95         0           CC1 CPU         TC0LTPUT         CODE         155559.93         4964           CC51 CPU         TESE         205553.09         5702           R11H         TESE         20559.309         5702           FALAGEMENT         DOCUMENT S         215559.309         5702           TIPE         2050.466         7155         1450           TIPE         2105.66         1450         1450           TIPE         716866.05         7155         0           J9271         INSTRUCTION         7074L         511716.42         0           J9271         INSTRUCTION         7074L         229712.32         4964           GCL         NEW         ANALYSIS         211716.42         0           GCL         NEW         ANALYSIS         211716.42         0           GCL         NEW         0         0         0           GCL         NEW         ANALYSIS         211716.42         0           GCL         NEW         0         0         0           FCS1         0         229712.32         4964         7155           TIME         0	TOLTPUT         DESIGN         134053.95         0           CC1 CPU         CODE         155559.93         4964           CC51 CPU         TEST         2155559.93         5702           R11M         TEST         2155559.93         5702           R11M         DOCUMENT         R1005.86         7155           VANAGEMENT         DOCUMENT         R1005.86         7155           VANAGEMENT         DOCUMENT         R10666.05         1450           L         EY         INSTRUCTION         TOTAL         \$716866.05           L         EY         INSTRUCTION         TOTAL         \$716866.05           L         EY         INSTRUCTION         TOTAL         \$711716.42         0           GCL         NEW         ANALYSIS         \$211716.42         0         0           GCL         NEW         ANALYSIS         \$211716.42         0         0           GCL         NEW         ANALYSIS         \$211716.42         0         0           GCL         NEW         DOCUMENT         229978.74         7702           MARE         EST         299958.71         7150         702           ILME         DOCUMENT <t< th=""><th>TOLTPUT     DESIGN     134053.455     0       COLE     155559.93     4964       FINE     COLE     155559.93     4964       TINE     TEST     2050586     7155       MAAGEMENT     TEST     2050586     7155       VANAGEMENT     TEST     2050586     7155       VANAGEMENT     TEST     20505866.05     5702       VANAGEMENT     TOTAL     57116666.05     1450       19271     INSTRUCTION     TOTAL     716866.05       GL     NEW     ANALYSIS     211716.42     0       FOL     NEW     ANALYSIS     211716.42     0       FOL     TOUTPUT     CESIGN     197954.865     0       FOL     TOUTPUT     CESIGN     197954.865     0       FOL     TEST     2395712.32     4964       TIPE     TEST     2395712.32     4964       TIPE     TISE     195019.78     7155       VANAGEMENT     TOTAL     1058582.12     1450       IP271     INSTRUCTIONS     1058582.12     1450       IP271     INSTRUCTIONS     1058582.12     1450       SOFTWARE     TOTAL     1058582.12     1450</th><th>NOLTPUT         DESIGN         1340595         0           CCST         CPU         TEST         15555.93         4964           GCST         CPU         TEST         25553.09         5702           VAAAGEMENT         TEST         205873.09         5702           VAAAGEMENT         TISS         265873.09         5702           VAAAGEMENT         TIGST         205873.09         5702           VAAAGEMENT         TOTAL         STISS         2702           VAAAGEMENT         TOTAL         T16866.05         1450           19271         INSTRUCTION         TOTAL         21710.42         0           0         OCUMENT         2197954.86         4964         0           0         OCUMENT         219710.42         0         0           0         CODE         229712.32         4964         0           0         <t< th=""><th>TOUTPUT         DESIGN         13405.95         0           CEST CPU         CODE         1555559.93         4644           CEST CPU         CODE         155559.93         4644           CEST CPU         CODE         155559.93         4664           VANAGEMENT         DOCUMENT S         81005.86         7155           VANAGEMENT         DOCUMENT S         716866.05         7155           VANAGEMENT         TOTAL S         716866.05         7155           L EY INSTRUCTION         TOTAL S         716866.05         7155           L EY INSTRUCTION         TOTAL S         21776.42         0           GGL         NEM         ANALYSIS S         211716.42         0           GGL         DESIGN         19619.78         7155         4964           TIPE         TS9977.74         5905         1450         0           L EY INSTRUCTION         TOTAL S         19619.78         7155         0           LIPE         NSTRUCTION         TOTAL S         1058582.12         0           LIPE         INSTRUCTIONS         TOTAL S         1058582.12         0           LIPE         INSTRUCTIONS         TOTAL S         1058582.12         0</th><th>TOTION         TOTAL         Stors         Stors         Stors           ATH-WT         CDEE         134653-95         96.4         97.02           ATH-WT         CDE         1555599         5702         5702           MAAGEMENT         TOTAL         \$ 716866.05         5702         5702           MAAGEMENT         TOTAL         \$ 716866.05         5702         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTIONS         107954.86         7155         1450           L         ESIGN         197954.86         7155         502         1450           L         ESIGN         107954.86         11950.78         1450         1450           L         ESIGN         1059587.74         5062         1456         1456           L         ESIGN         1059587.74         5062         1450           L         EY         INSTRUCTION         10784.74         <td< th=""><th>TOUTPUT         DESIGN         134053.95         0           COST         DESIGN         155539.03         564           RTHM         DECUMENTS         B1005.86         7155           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         203772.32         5404           TOUTPUT         DESIGN         137954.86         0           CODE         2395772.32         5404         7155           MALTSIS         2395772.32         5404         7155           MALTSIS         119619.78         7155         5702           MALTSIS         10585822.12         1450         1450           TIME         MALTSIS         10585822.12         1450           TIME         MALTSIS         10585822.12         5702           TIME         TOTAL         10585822.12         1450           TANT         TOTAL         10585822.12         5702           SOFTWARE         CEM         10585822.</th><th></th><th>CONTHCL</th><th>ANALYSIS S</th><th>143373.21</th><th>00</th><th>28.92</th></td<></th></t<></th></t<>	TOLTPUT     DESIGN     134053.455     0       COLE     155559.93     4964       FINE     COLE     155559.93     4964       TINE     TEST     2050586     7155       MAAGEMENT     TEST     2050586     7155       VANAGEMENT     TEST     2050586     7155       VANAGEMENT     TEST     20505866.05     5702       VANAGEMENT     TOTAL     57116666.05     1450       19271     INSTRUCTION     TOTAL     716866.05       GL     NEW     ANALYSIS     211716.42     0       FOL     NEW     ANALYSIS     211716.42     0       FOL     TOUTPUT     CESIGN     197954.865     0       FOL     TOUTPUT     CESIGN     197954.865     0       FOL     TEST     2395712.32     4964       TIPE     TEST     2395712.32     4964       TIPE     TISE     195019.78     7155       VANAGEMENT     TOTAL     1058582.12     1450       IP271     INSTRUCTIONS     1058582.12     1450       IP271     INSTRUCTIONS     1058582.12     1450       SOFTWARE     TOTAL     1058582.12     1450	NOLTPUT         DESIGN         1340595         0           CCST         CPU         TEST         15555.93         4964           GCST         CPU         TEST         25553.09         5702           VAAAGEMENT         TEST         205873.09         5702           VAAAGEMENT         TISS         265873.09         5702           VAAAGEMENT         TIGST         205873.09         5702           VAAAGEMENT         TOTAL         STISS         2702           VAAAGEMENT         TOTAL         T16866.05         1450           19271         INSTRUCTION         TOTAL         21710.42         0           0         OCUMENT         2197954.86         4964         0           0         OCUMENT         219710.42         0         0           0         CODE         229712.32         4964         0           0 <t< th=""><th>TOUTPUT         DESIGN         13405.95         0           CEST CPU         CODE         1555559.93         4644           CEST CPU         CODE         155559.93         4644           CEST CPU         CODE         155559.93         4664           VANAGEMENT         DOCUMENT S         81005.86         7155           VANAGEMENT         DOCUMENT S         716866.05         7155           VANAGEMENT         TOTAL S         716866.05         7155           L EY INSTRUCTION         TOTAL S         716866.05         7155           L EY INSTRUCTION         TOTAL S         21776.42         0           GGL         NEM         ANALYSIS S         211716.42         0           GGL         DESIGN         19619.78         7155         4964           TIPE         TS9977.74         5905         1450         0           L EY INSTRUCTION         TOTAL S         19619.78         7155         0           LIPE         NSTRUCTION         TOTAL S         1058582.12         0           LIPE         INSTRUCTIONS         TOTAL S         1058582.12         0           LIPE         INSTRUCTIONS         TOTAL S         1058582.12         0</th><th>TOTION         TOTAL         Stors         Stors         Stors           ATH-WT         CDEE         134653-95         96.4         97.02           ATH-WT         CDE         1555599         5702         5702           MAAGEMENT         TOTAL         \$ 716866.05         5702         5702           MAAGEMENT         TOTAL         \$ 716866.05         5702         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTIONS         107954.86         7155         1450           L         ESIGN         197954.86         7155         502         1450           L         ESIGN         107954.86         11950.78         1450         1450           L         ESIGN         1059587.74         5062         1456         1456           L         ESIGN         1059587.74         5062         1450           L         EY         INSTRUCTION         10784.74         <td< th=""><th>TOUTPUT         DESIGN         134053.95         0           COST         DESIGN         155539.03         564           RTHM         DECUMENTS         B1005.86         7155           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         203772.32         5404           TOUTPUT         DESIGN         137954.86         0           CODE         2395772.32         5404         7155           MALTSIS         2395772.32         5404         7155           MALTSIS         119619.78         7155         5702           MALTSIS         10585822.12         1450         1450           TIME         MALTSIS         10585822.12         1450           TIME         MALTSIS         10585822.12         5702           TIME         TOTAL         10585822.12         1450           TANT         TOTAL         10585822.12         5702           SOFTWARE         CEM         10585822.</th><th></th><th>CONTHCL</th><th>ANALYSIS S</th><th>143373.21</th><th>00</th><th>28.92</th></td<></th></t<>	TOUTPUT         DESIGN         13405.95         0           CEST CPU         CODE         1555559.93         4644           CEST CPU         CODE         155559.93         4644           CEST CPU         CODE         155559.93         4664           VANAGEMENT         DOCUMENT S         81005.86         7155           VANAGEMENT         DOCUMENT S         716866.05         7155           VANAGEMENT         TOTAL S         716866.05         7155           L EY INSTRUCTION         TOTAL S         716866.05         7155           L EY INSTRUCTION         TOTAL S         21776.42         0           GGL         NEM         ANALYSIS S         211716.42         0           GGL         DESIGN         19619.78         7155         4964           TIPE         TS9977.74         5905         1450         0           L EY INSTRUCTION         TOTAL S         19619.78         7155         0           LIPE         NSTRUCTION         TOTAL S         1058582.12         0           LIPE         INSTRUCTIONS         TOTAL S         1058582.12         0           LIPE         INSTRUCTIONS         TOTAL S         1058582.12         0	TOTION         TOTAL         Stors         Stors         Stors           ATH-WT         CDEE         134653-95         96.4         97.02           ATH-WT         CDE         1555599         5702         5702           MAAGEMENT         TOTAL         \$ 716866.05         5702         5702           MAAGEMENT         TOTAL         \$ 716866.05         5702         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTION         TOTAL         \$ 716866.05         5702           L         EY         INSTRUCTIONS         107954.86         7155         1450           L         ESIGN         197954.86         7155         502         1450           L         ESIGN         107954.86         11950.78         1450         1450           L         ESIGN         1059587.74         5062         1456         1456           L         ESIGN         1059587.74         5062         1450           L         EY         INSTRUCTION         10784.74 <td< th=""><th>TOUTPUT         DESIGN         134053.95         0           COST         DESIGN         155539.03         564           RTHM         DECUMENTS         B1005.86         7155           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         203772.32         5404           TOUTPUT         DESIGN         137954.86         0           CODE         2395772.32         5404         7155           MALTSIS         2395772.32         5404         7155           MALTSIS         119619.78         7155         5702           MALTSIS         10585822.12         1450         1450           TIME         MALTSIS         10585822.12         1450           TIME         MALTSIS         10585822.12         5702           TIME         TOTAL         10585822.12         1450           TANT         TOTAL         10585822.12         5702           SOFTWARE         CEM         10585822.</th><th></th><th>CONTHCL</th><th>ANALYSIS S</th><th>143373.21</th><th>00</th><th>28.92</th></td<>	TOUTPUT         DESIGN         134053.95         0           COST         DESIGN         155539.03         564           RTHM         DECUMENTS         B1005.86         7155           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         202873.03         5702           TIME         DOCUMENTS         203772.32         5404           TOUTPUT         DESIGN         137954.86         0           CODE         2395772.32         5404         7155           MALTSIS         2395772.32         5404         7155           MALTSIS         119619.78         7155         5702           MALTSIS         10585822.12         1450         1450           TIME         MALTSIS         10585822.12         1450           TIME         MALTSIS         10585822.12         5702           TIME         TOTAL         10585822.12         1450           TANT         TOTAL         10585822.12         5702           SOFTWARE         CEM         10585822.		CONTHCL	ANALYSIS S	143373.21	00	28.92
CCT CPU       CODE       155559.93       4964         ATTH       TEST       202873.09       5702         VANAGEMENT       DOCUMENT \$       81005.86       7155         VANAGEMENT       DOCUMENT \$       7155       1450         TIPE       DOCUMENT \$       7155       1450         L EY INSTRUCTION       TOTAL \$       716866.05       1450         19271 INSTRUCTION       TOTAL \$       716866.05       0         GCL       NEW       ANALYSIS \$       211716.42       0         FCL       DUC       2095.74       5702       4964         ATHM       TEST       299578.74       5702       1450         TIME       DOCUMENT \$       1058582.12       1450       1450         TIME       TIME       1058582.12       1450       1450         19271 INSTRUCTION       TOTAL \$       1058582.12       1450 <th>CGT CPU       CODE       155559.93       4964         FITH       TEST       202873.09       5702         FANAGEMENT       DOCUMENT S       202873.09       5702         FANAGEMENT       DOCUMENT S       202873.09       5702         FANAGEMENT       DOCUMENT S       202873.09       5702         FANAGEMENT       DOTAL S       7155       1450         I9271       INSTRUCTION       70744       5702         GCL       NEM       ANALYSIS S       211716.42       0         GCL       NEM       ANALYSIS S       211716.42       0         GCL       NEM       ANALYSIS S       211716.42       0         GCL       NEM       ANALYSIS S       217116.42       0         GCL       NEM       ANALYSIS S       21716.42       0         GCL       NEM       ANALYSIS S       21716.42       0         GCL       NEM       ANALYSIS S       21716.42       0         GLU       NEM       TEST       299573.74       5702         MAAGEMENT       DOCUMENT S       1056582.12       1450         TIPE       INSTRUCTION       TOTAL S       10565882.12         19271</th> <td>CCST CPU     CODE     155559.93     4964       RITH     TEST     202873.09     5702       RITH     TEST     202873.09     5702       RITH     DOCUMENT \$     81005.86     7155       L EY INSTRUCTION     TOTAL \$     716866.05     1450       19271     INSTRUCTION     TOTAL \$     716866.05     1450       19271     INSTRUCTION     TOTAL \$     716866.05     1450       CdL     NEW     ANALYSIS \$     211716.42     0       CdL     NEW     ANALYSIS \$     211716.42     0       CdL     NEW     ANALYSIS \$     219712.32     496.4       FCST     CDU     CODE     229712.32     496.4       FCST     CDU     CODE     229712.32     496.4       FCST     TISE     19619.7B     7155       FCM     TOTAL \$     1058582.12     1450       TIME     INSTRUCTION     TOTAL \$     19588582.12       19271     INSTRUCTIONS     TOTAL \$     19588582.12       SOFTWARE     CEH     SOFTWARE     505</td> <td>COL COLE 15555.93 4964 AITH COLMENT 5 15555.93 5702 AITH BEST 202873.09 5702 ILE NOTRUCTION TOTAL 5 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS COL NEW ANALYSIS 5 211716.42 0 COL NEW TOTAL 5 195954.86 0 COL NEW TOTAL 5 1950582.12 MAAGEMENT TOTAL 5 1050582.12 1450 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS COT COLE 200582.12 1450 1</td> <td>CODE       155555.93       4964         CEST CPU       CODE       15555.93       4964         TIPE       DEST       202873.09       5702         NAMAGEMENT       DECUMENT       202873.09       5702         TIPE       DEST       202873.09       5702         NAMAGEMENT       DECUMENT       202873.09       5702         IPPT       TIPE       20000.66       1450         IPPT       TISTUCTION       TOTAL       5       716866.05         IPPT       TISTUCTIONS       TISTUCTIONS       229712.32       4964         CCL       NEW       ANALYSIS       21710.42       0         COLTOUT       DESIGN       197954.86       90       0         CODE       229712.32       4964       7125         TIPE       DECUMENT       2299518.74       5702         MAAAGEMENT       DECUMENT       209582.12       1450         LEY       INSTRUCTIONS       TOTAL       1959582.12         19271       INSTRUCTIONS       TOTAL       1959582.12         19271       INSTRUCTIONS       TOS       5702         SOFTWARE       TOTAL       1059582.12       1450         S</td> <td>Contend to the second s</td> <td>Cost CPU COLE 155559.93 4964 RITH COLMENT \$ 20273.09 5702 TIPE DOCUMENT \$ 20273.09 5702 TIPE 1155 1450 19271 INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19795.85 COLMEN 000000 COLMEN 5 209576.74 5702 TIPE 209576.74 5702 TIPE 10570 TOTAL \$ 1058582.12 TIPE 10570 TOTAL \$ 1058582.12 TIPE 10570 TOTAL \$ 1058582.12 COPE 100 TOTAL \$ 10586582.12 COPE 100 TOTAL \$ 1058682.12 COPE 100 TOTAL \$ 10586882.12 COPE 100 TOTAL</td> <td></td> <td>INPLT/OLTPUT</td> <td>DESIGN</td> <td>134053.95</td> <td>0</td> <td>25.43</td>	CGT CPU       CODE       155559.93       4964         FITH       TEST       202873.09       5702         FANAGEMENT       DOCUMENT S       202873.09       5702         FANAGEMENT       DOCUMENT S       202873.09       5702         FANAGEMENT       DOCUMENT S       202873.09       5702         FANAGEMENT       DOTAL S       7155       1450         I9271       INSTRUCTION       70744       5702         GCL       NEM       ANALYSIS S       211716.42       0         GCL       NEM       ANALYSIS S       211716.42       0         GCL       NEM       ANALYSIS S       211716.42       0         GCL       NEM       ANALYSIS S       217116.42       0         GCL       NEM       ANALYSIS S       21716.42       0         GCL       NEM       ANALYSIS S       21716.42       0         GCL       NEM       ANALYSIS S       21716.42       0         GLU       NEM       TEST       299573.74       5702         MAAGEMENT       DOCUMENT S       1056582.12       1450         TIPE       INSTRUCTION       TOTAL S       10565882.12         19271	CCST CPU     CODE     155559.93     4964       RITH     TEST     202873.09     5702       RITH     TEST     202873.09     5702       RITH     DOCUMENT \$     81005.86     7155       L EY INSTRUCTION     TOTAL \$     716866.05     1450       19271     INSTRUCTION     TOTAL \$     716866.05     1450       19271     INSTRUCTION     TOTAL \$     716866.05     1450       CdL     NEW     ANALYSIS \$     211716.42     0       CdL     NEW     ANALYSIS \$     211716.42     0       CdL     NEW     ANALYSIS \$     219712.32     496.4       FCST     CDU     CODE     229712.32     496.4       FCST     CDU     CODE     229712.32     496.4       FCST     TISE     19619.7B     7155       FCM     TOTAL \$     1058582.12     1450       TIME     INSTRUCTION     TOTAL \$     19588582.12       19271     INSTRUCTIONS     TOTAL \$     19588582.12       SOFTWARE     CEH     SOFTWARE     505	COL COLE 15555.93 4964 AITH COLMENT 5 15555.93 5702 AITH BEST 202873.09 5702 ILE NOTRUCTION TOTAL 5 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS COL NEW ANALYSIS 5 211716.42 0 COL NEW TOTAL 5 195954.86 0 COL NEW TOTAL 5 1950582.12 MAAGEMENT TOTAL 5 1050582.12 1450 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS COT COLE 200582.12 1450 1	CODE       155555.93       4964         CEST CPU       CODE       15555.93       4964         TIPE       DEST       202873.09       5702         NAMAGEMENT       DECUMENT       202873.09       5702         TIPE       DEST       202873.09       5702         NAMAGEMENT       DECUMENT       202873.09       5702         IPPT       TIPE       20000.66       1450         IPPT       TISTUCTION       TOTAL       5       716866.05         IPPT       TISTUCTIONS       TISTUCTIONS       229712.32       4964         CCL       NEW       ANALYSIS       21710.42       0         COLTOUT       DESIGN       197954.86       90       0         CODE       229712.32       4964       7125         TIPE       DECUMENT       2299518.74       5702         MAAAGEMENT       DECUMENT       209582.12       1450         LEY       INSTRUCTIONS       TOTAL       1959582.12         19271       INSTRUCTIONS       TOTAL       1959582.12         19271       INSTRUCTIONS       TOS       5702         SOFTWARE       TOTAL       1059582.12       1450         S	Contend to the second s	Cost CPU COLE 155559.93 4964 RITH COLMENT \$ 20273.09 5702 TIPE DOCUMENT \$ 20273.09 5702 TIPE 1155 1450 19271 INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19795.85 COLMEN 000000 COLMEN 5 209576.74 5702 TIPE 209576.74 5702 TIPE 10570 TOTAL \$ 1058582.12 TIPE 10570 TOTAL \$ 1058582.12 TIPE 10570 TOTAL \$ 1058582.12 COPE 100 TOTAL \$ 10586582.12 COPE 100 TOTAL \$ 1058682.12 COPE 100 TOTAL \$ 10586882.12 COPE 100 TOTAL		INPLT/OLTPUT	DESIGN	134053.95	0	25.43
RITH     TEST     202873.09     5702       MAAGEMENT     DOCUMENT \$     81005.86     7155       FIME     DOCUMENT \$     81005.86     7155       L BY INSTRUCTION     TOTAL \$     716866.05     1450       19271 INSTRUCTION     TOTAL \$     716866.05     1450       19271 INSTRUCTION     TOTAL \$     716866.05     0       19271 INSTRUCTION     TOTAL \$     715866.05     0       GCL     NEW     ANALYSIS \$     211716.42     0       FGL     NEW     ANALYSIS \$     211716.42     0       FGL CUT     CODE     197954.86     0       FGT CPU     CODE     197954.86     7155       ATITH     TEST     299578.74     5702       MITH     TEST     299578.74     5702       MAAN     TOTAL \$     10568582.12     1450       MANDIA     TOTAL \$     1058582.12     1450       TIME     TOSE     1058582.12     1450       TIME     TOSE     1058582.12     1450	NT         TEST         202873.09         5702           NTIDE         DOCUMENT         81005.86         7155           VSTRUCTION         TOTAL         \$         716866.05         1450           VSTRUCTION         TOTAL         \$         716866.05         5702           I INSTRUCTION         TOTAL         \$         716866.05         5702           Montrain         Solutions         TOTAL         \$         7156         0           MT         DESIGN         21716.42         0         0         0         0           MT         DESIGN         19619.78         7155         4964         7155         1650           MT         TOTAL         SogeSec.12         1650         1650         1650         1650           MSTRUCTION         TOTAL         SogeSec.12         1650         1650         1650         1650           Software CeH         TOTAL         Software CeH         TOTAL         Software         1650         1650	RITH     TEST     202873.09     5702       FAMAGEMENT     DOCUMENT \$     81005.86     7155       FINE     DOCUMENT \$     81005.86     7155       FE     INSTRUCTION     TOTAL \$     716866.05       19271     INSTRUCTION     TOTAL \$     716866.05       19271     INSTRUCTION     TOTAL \$     716866.05       19271     INSTRUCTION     TOTAL \$     716866.05       GGL     NEW     ANALYSIS \$     211716.42     0       GGL     NEW     ANALYSIS \$     217716.42     0       GGL     NEW     ANALYSIS \$     217716.42     0       FGT     CODE     229754.38     4964       FGT     CODE     239754.38     4964       FGT     CODE     119619.78     7155       MANAGEMENT     TOTAL \$     1058582.12       MANAGEMENT     TOTAL \$     1058582.12       J19271     INSTRUCTIONS     1450       J9271     INSTRUCTIONS     TOTAL \$	RITHM       TEST       202873.09       5702         TIRE       DOCUMENT       B1005.66       7155         L EY INSTRUCTION       TOTAL \$ 716866.05       1450         19271       INSTRUCTION       TOTAL \$ 716866.05         ACL       NEW       ANALYSIS \$ 211716.42       0         ACL       NEW       ANALYSIS \$ 211716.42       0         ACL       DESSION       229712.32       4964         ATOUTPUT       DESSION       229518.74       5702         ATTHE       DOCUMENT \$ 1098582.12       1450         ATTHE       EST       209582.12         ATTHE       INSTRUCTION       TOTAL \$ 1058582.12         19271       INSTRUCTION       TOTAL \$ 1058582.12         SOFTWARE CEM       SOFTWARE CEM <td>RITHM       TEST       202873.09       5702         L EY       NAAGEMENT       DOCUMENT \$       202873.09       5702         L EY       INSTRUCTION       TOTAL \$       7155       1450         J9271       INSTRUCTION       TOTAL \$       716866.05       5702         J9271       INSTRUCTION       TOTAL \$       716866.05       5702         J9271       INSTRUCTIONS       TOTAL \$       7156       60         CL       NEW       ANALYSIS \$       211716.42       0         GCL       NEW       TEST       299578.44       7155         VAAGEMENT       TOTAL \$       1058582.12       1450         TIFE       INSTRUCTION       TOTAL \$       1058582.12         L EY       INSTRUCTIONS       TOTAL \$       1058582.12         J9271       INSTRUCTIONS       TOTAL \$       1058582.12         SOFTWARE CEM       SOFTWARE CEM       TOTAL       TOSS   </td> <td>TITH     TEST     202873.09     5702       FIFE     DOCUMENT     81005.86     7155       FIFE     DOCUMENT     81005.86     7155       I BY INSTRUCTION     TOTAL     716866.05     7155       19271     INSTRUCTION     TOTAL     20795.86     0       19271     INSTRUCTION     TOTAL     201716.42     0       Cold     NEW     AMALYSIS     211716.42     0       Cold     DESIGN     20975.32     496.4       Cold     DESIGN     109515.73     155       VANAGEMENT     TEST     209578.74     5702       AMALYSIS     119619.78     1550     1450       L     EY     INSTRUCTION     TOTAL     1058582.12       L     EY     INSTRUCTION     TOTAL     1058582.12       L     EY     INSTRUCTION     TOTAL     1058582.12       J19271     INSTRUCTION     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1550</td> <td>RITH     TEST     202873.09     5702       FIFE     DOCUMENT     81005.86     7155       FIFE     DOCUMENT     716866.05     1450       19271     INSTRUCTION     TOTAL     \$ 716866.05       19271     INSTRUCTION     TOTAL     \$ 716866.05       19271     INSTRUCTION     TOTAL     \$ 716866.05       19271     INSTRUCTION     TOTAL     \$ 715666.05       19271     INSTRUCTION     TOTAL     \$ 71566.05       CLL     NEW     209578.74     5702       PANAGEWAT     209578.74     5702       ANALYSIS     119619.78     1450       EST     209578.74     5702       ATTAC     TOTAL     209578.74     5702       TIFE     19619.78     119619.78     1450       L     EY     INSTRUCTION     TOTAL     5058582.12       11FE     19231     INSTRUCTION     1058582.12       19231     INSTRUCTION     TOTAL     5058582.12       19231     INSTRUCTION     TOTAL     5058582.12       SOFTWARE     ER     105858282.12</td> <td>2.05</td> <td>PHE FCST CPU</td> <td>CODE</td> <td>155559.93</td> <td>4964</td> <td>20.41</td>	RITHM       TEST       202873.09       5702         L EY       NAAGEMENT       DOCUMENT \$       202873.09       5702         L EY       INSTRUCTION       TOTAL \$       7155       1450         J9271       INSTRUCTION       TOTAL \$       716866.05       5702         J9271       INSTRUCTION       TOTAL \$       716866.05       5702         J9271       INSTRUCTIONS       TOTAL \$       7156       60         CL       NEW       ANALYSIS \$       211716.42       0         GCL       NEW       TEST       299578.44       7155         VAAGEMENT       TOTAL \$       1058582.12       1450         TIFE       INSTRUCTION       TOTAL \$       1058582.12         L EY       INSTRUCTIONS       TOTAL \$       1058582.12         J9271       INSTRUCTIONS       TOTAL \$       1058582.12         SOFTWARE CEM       SOFTWARE CEM       TOTAL       TOSS	TITH     TEST     202873.09     5702       FIFE     DOCUMENT     81005.86     7155       FIFE     DOCUMENT     81005.86     7155       I BY INSTRUCTION     TOTAL     716866.05     7155       19271     INSTRUCTION     TOTAL     20795.86     0       19271     INSTRUCTION     TOTAL     201716.42     0       Cold     NEW     AMALYSIS     211716.42     0       Cold     DESIGN     20975.32     496.4       Cold     DESIGN     109515.73     155       VANAGEMENT     TEST     209578.74     5702       AMALYSIS     119619.78     1550     1450       L     EY     INSTRUCTION     TOTAL     1058582.12       L     EY     INSTRUCTION     TOTAL     1058582.12       L     EY     INSTRUCTION     TOTAL     1058582.12       J19271     INSTRUCTION     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1058582.12       J19271     INSTRUCTIONS     TOTAL     1550	RITH     TEST     202873.09     5702       FIFE     DOCUMENT     81005.86     7155       FIFE     DOCUMENT     716866.05     1450       19271     INSTRUCTION     TOTAL     \$ 716866.05       19271     INSTRUCTION     TOTAL     \$ 716866.05       19271     INSTRUCTION     TOTAL     \$ 716866.05       19271     INSTRUCTION     TOTAL     \$ 715666.05       19271     INSTRUCTION     TOTAL     \$ 71566.05       CLL     NEW     209578.74     5702       PANAGEWAT     209578.74     5702       ANALYSIS     119619.78     1450       EST     209578.74     5702       ATTAC     TOTAL     209578.74     5702       TIFE     19619.78     119619.78     1450       L     EY     INSTRUCTION     TOTAL     5058582.12       11FE     19231     INSTRUCTION     1058582.12       19231     INSTRUCTION     TOTAL     5058582.12       19231     INSTRUCTION     TOTAL     5058582.12       SOFTWARE     ER     105858282.12	2.05	PHE FCST CPU	CODE	155559.93	4964	20.41
MAAGEMENT         DOCUMENT S         BIDDS.86         TISS           TIME         BIDDS.86         TISS           L EY INSTRUCTION         TOTAL S         TIBB666.05           19271 INSTRUCTION         TOTAL S         TIBB666.05           19271 INSTRUCTION         TOTAL S         TIBB666.05           19271 INSTRUCTION         TOTAL S         ZINT16.42         0           AGL NEW         ANALYSIS S         ZINT16.42         0           AGL NEW         DESIGN         Z29712.32         4964           ATINM         TEST         Z39712.32         4964           ATINM         TEST         Z39578.74         5702           ATINM         TEST         Z99578.74         5702           ATINM         TEST         Z9958.74         7155           ATINE         DOCUMENT S         1196J9.78         1450           ATINE         TEST         Z058582.12         1450           ATINE         TOTAL S         10585882.12         1450           ATINE         TOTAL S         10585882.12         1450	MAAGEMENT     DOCUMENT S     BIDDS:86     TISS       TIME     DOCUMENT S     BIDDS:86     TISS       L     EY     INSTRUCTION     TOTAL S     TIBB666.05       19271     INSTRUCTION     TOTAL S     TIBB666.05       19271     INSTRUCTION     TOTAL S     TIBB666.05       19271     INSTRUCTION     TOTAL S     ZINT16.42     0       6GL     NEW     ANALYSIS S     ZINT16.42     0       1000 ESIGN     197954.86     0     0       1000 ESIGN     239712.32     4964     7105       1000 ESIGN     239958.18     74     5702       MAAAGEMENT     DOCUMENT S     299578.74     7105       MAAAGEMENT     DOCUMENT S     299578.74     7702       MAAAAGEMENT     DOCUMENT S     19609.74     7105       MAAAAGEMENT     TOTAL S     10505882.12     1450       19271     INSTRUCTION     TOTAL S     1058582.12       19271     INSTRUCTIONS     TOTAL S     1058582.12       19271     INSTRUCTIONS     TOTAL S     1058582.12	MAAGEMENT     DOCUMENT S     BIDDS:86     TISS       TIME     DOCUMENT S     BIDDS:86     TISS       L     EY     INSTRUCTION     TOTAL S     TIBB666.05       19271     INSTRUCTIONS     ZITT16.42     0       FCL     NEM     ANALYSIS S     ZITT16.42     0       FCL     DOCUMENT S     Z29712.32     4964       FCST     CODE     Z29712.32     4964       FITH     FCST     FCUMENT     FCUMENT       IME     INSTRUCTION     TOTAL     I0596582.1	MAGEMENT         DOCUMENT S         BI005:66         TISS           TIME         DOCUMENT S         BI005:66         TISS           TIME         DOCUMENT S         BI005:66         TISS           IP271         INSTRUCTION         TOTAL S         TI6866:05           IP271         INSTRUCTION         TOTAL S         TISS           IP271         INSTRUCTION         TOTAL S         211716:42           GCL         NEW         ANALYSIS S         211716:42         0           GCL         NEW         ANALYSIS S         211716:42         0           GCL         NEW         ANALYSIS S         211716:42         0           GCL         NEW         ZOSTIS 2:32         496.4         0           TIME         TEST         ZOSTIS 2:32         496.4         0           ATH         TEST         ZOSTIS 2:12         1450         0           TIME         TISS         ISSBSR2:12         1450         0           TIME         TOSTI INSTRUCTIONS         TOSBSR2:12         1450         0           IP271         INSTRUCTIONS         TOSBSR2:12         1450         0         0           SOFTWARE CEM         SOFTWARE CEM         TOS	FANAGEMENT     DOGUMENT S     BIDDS: BE     TISS       TIPE     11450     11450       19271     INSTRUCTION     TOTAL S     716866.05       19271     INSTRUCTIONS     716866.05     1450       19271     INSTRUCTIONS     716866.05     7155       1020LTPUT     ANALYSIS S     211716.42     0       0     ANALYSIS S     211716.42     0       0     19271     INSTRUCTIONS     192712.32       0     19271     1920     19519.78       0     1920     19519.78     1450       0     119619.78     1450       0     11959.78     1450       10     1195852.12     1450       10271     INSTRUCTION     107AL       10271     INSTRUCTIONS     1058582.12       10271     INSTRUCTIONS     1450	FAMAGEMENT     DOCUMENT S     BI005:86     TISS       TIFF     DOCUMENT S     TISS     TISS       TIFF     TOTAL S     TISS     TISS       19271 INSTRUCTION     TOTAL S     TISS     TISS       19271 INSTRUCTION     TOTAL S     TISS     PAAA       19271 INSTRUCTIONS     AMALYSIS S     Z11716.42     0       CLL NEW     AMALYSIS S     Z11715.32     406.4       TOUTPUT     DESIGN     Z29717.32     406.4       TIST     TISS     Z3957.74     5102       ATTAC     DOCUMENT S     TI9619.78     7155       VANAGEMENT     TOTAL S     1058582.12     1450       TIFE     TOTAL S     1058582.12     1450       TIPE     TOTAL S     1058582.12     1450       TIPE     TOTAL S     1058582.12     1450       TATTI INSTRUCTIONS     TOTAL S     1058582.12     1450       TAT     TOTAL S     1058582.12     1450       TIPE     SOFTWARE CEH     SOFTWARE CEH     TOTAL S	AAAGEMENT     DOCUMENT S     BIOGS 86     TISS       TIPE     DOCUMENT S     BIOGS 86     TISS       19271     INSTRUCTION     TOTAL S     T16866.05       19271     INSTRUCTION     TOTAL S     T16866.05       19271     INSTRUCTION     TOTAL S     T16866.05       19271     INSTRUCTION     TOTAL S     211716.42     0       Cold NEW     ANALYSIS S     211716.42     0       COLUNA     COSE     19795.28     7125       COST CUU     COSE     23975.28     702       TIPE     DOCUMENT S     1958652.12     1450       L EY INSTRUCTION     TOTAL S     1058652.12     1450       19271     INSTRUCTIONS     TOTAL S     1058652.12       SOFTWARE CEH     SOFTWARE CEH     SOFTWARE CEH		AI CGITHM	TEST	202873.09	5702	21.00
TIME       1450         I EY INSTRUCTION       TOTAL \$ 716866.05         19271 INSTRUCTIONS       7168666.05         19271 INSTRUCTIONS       221716.42         GCL NEW       ANALYSIS \$ 211716.42       0         FCL NEW       ANALYSIS \$ 217716.42       0         FCL NEW       ANALYSIS \$ 217716.42       0         FCL NEW       ANALYSIS \$ 217716.42       0         FCL NEW       CODE       229712.32       4964         FCST CPU       CODE       229712.32       4964         FCST CPU       CODE       299578.74       5702         HITH       TEST       299578.74       5702         MARMENT       DOCUMENT \$ 119619.78       1450         L EY INSTRUCTION       TOTAL \$ 1058582.12       1450         19271 INSTRUCTIONS       TOTAL \$ 1058582.12       1450	L EY INSTRUCTION TOTAL \$ 7168666.05 I9271 INSTRUCTIONS TOTAL \$ 7168666.05 I9271 INSTRUCTIONS \$ 211716.42 0 GGL NEW ANALYSIS \$ 211716.42 0 FOULTON CODE 29754.86 0 FOULTON TEST 29954.74 5702 ATINH CODE 29954.74 5702 ATINH TEST 299578.74 5702 ATINH TEST 299578.74 5702 ATINH TOTAL \$ 1058582.12 INSTRUCTION TOTAL \$ 1058582.12 INSTRUCTIONS SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS AMALYSIS \$ 211716.42 CL NEW AMALYSIS \$ 211716.42 CODE 229712.32 4964 CODE 229712.32 4964 19271 INSTRUCTION TOTAL \$ 1058582.12 L EY INSTRUCTION 19271 INSTRUCTION SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS CCL NEW ANALYSIS \$ 211716.42 0 CCL NEW ANALYSIS \$ 21716.42 0 CODE 229712.32 4964 CODE 229712.32 4964 TISS PANAGEMENT DOCUMENT \$ 19619.78 7105 TIME ====================================	TIME     1450       19271     INSTRUCTION     TOTAL       19271     INSTRUCTIONS     19271       19271     INSTRUCTIONS     19271       19271     INSTRUCTIONS     211716.42       CL     NEW     ANALYSIS     211716.42       CL     NEW     ANALYSIS     211716.42       CL     NEW     ANALYSIS     211716.42       CL     DESIGN     12953.43     49.4       TIME     2953712.32     49.4       ATTH     EST     295378.74     5702       ATTH     TOTAL     19619.78     7155       MAAAGEMENT     TOTAL     1058582.12     1450       TIME     ISTRUCTION     TOTAL     1058582.12       LeY     INSTRUCTIONS     1058582.12       SOFTWARE     CEM	L EY INSTRUCTION TOTAL \$ 716666.05 19271 INSTRUCTION TOTAL \$ 716666.05 19271 INSTRUCTIONS TOULTPUT CESSION 197954.86 CODE 299712.32 MANLYST 299578.74 TOULTPUT CODE TOULTPUT CODE TOULTPUT CODE TOULTPUT CODE TOULTPUT CODE TOULTPUT CODE TOULTPUT TOTAL \$ 1058582.12 THE STRUCTION TOTAL \$ 1058582.12 THE SOFTWARE CEH SOFTWARE CEH	TIPE       1150         19271       INSTRUCTION       TOTAL \$ 716866.05         19271       INSTRUCTION       TOTAL \$ 716866.05         19271       INSTRUCTION       TOTAL \$ 716866.05         19271       INSTRUCTIONS       19794.86         19271       INSTRUCTIONS       19794.86         1020L       NEW       ANALYSIS \$ 211716.42       0         1010L       DESIGN       229712.32       4964         111P       TEST       299517.34       5102         ANARGEMENT       TOTAL \$ 19619.78       1450       1450         ECST       CODE       229517.23       4964         ANARGEMENT       TOTAL \$ 1058582.12       1450       1450         LEY       INSTRUCTION       TOTAL \$ 1058582.12       1450         SOFTWARE CEH       SOFTWARE CEH       SOFTWARE CEH       505778	200		DOCIMENT &	AL DUCE AK	7155	32 79
L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS CLL NEW ANALYSIS \$ 211716.42 CLL NEW ANALYSIS \$ 211716.42 CODE 297954.86 CODE 29978.74 19272 CPU FOR MANAGEMENT FEST 299578.74 TIME 7155 MANAGEMENT FEST 299578.74 TIME 7155 MANAGEMENT FEST 74 TIME 7155 MANAGEMENT FEST 74 196096.05 19608582.12 19271 INSTRUCTION	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS AGL NEW ANALYSIS \$ 211716.42 AGL NEW ANALYSIS \$ 211716.42 COESIGN 197954.86 19271 COUNT COESIGN 197954.86 COESIGN 197954.86 COESIGN 197954.86 19271 INSTRUCTION TOTAL \$ 119619.78 19271 INSTRUCTIONS SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS CLL NEW ANALYSIS \$ 211716.42 CLL NEW ANALYSIS \$ 211716.42 0 19271 PUT DESIGN 299548.74 19271 INSTRUCTION TOTAL \$ 1058582.12 L EY INSTRUCTIONS 19271 INSTRUCTIONS SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS CCL NEW ANALYSIS \$ 211716.42 CODE 229712.32 CODE 229712.32 ANAGEMENT CODE 229712.32 ANAGEMENT CODE 229712.32 ANAGEMENT TEST 299578.74 TIME 1960 TIME 1960 19271 INSTRUCTION TOTAL \$ 1058582.12 19271 INSTRUCTIONS SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS ACL NEW ANALYSIS \$ 211716.42 0 CODE 229712.32 49795.86 209578.74 19619.78 19619.78 19619.78 19619.78 19619.78 1450 1450 1450 1450 1450 1450 19271 INSTRUCTION 19271 INSTRUCTIONS 19271 INSTRUCTIONS SOFTWARE CEH	L EY INSTRUCTION TOTAL \$ TIEREFEE 10271 INSTRUCTIONS 10271 INSTRUCTIONS GCL NEW ANALYSIS \$ 211710.42 0 GCL NEW ANALYSIS \$ 211710.42 0 GCL NEW 2005E 29753.32 496.4 TEST CPU 2005E 299713.32 496.4 TEST CPU 155 TIPE 299713.32 496.4 TEST 299713.32 195513.73 195513 TEST 299713.32 195513.73 195513 TEST 299713.73 195513.73 195513.73 195513 TEST 299713.73 195513.73 195513.73 195513 TEST 299713.73 195513.73 195513.73 195513.73 195513 TEST 299713.73 195513.73 195513.73 195513 TEST 299713.73 195513.73 195513.73 195513.73 195513.73 195513 TEST 299713.73 195513.73 195513.73 195513.73 195513.73 195513.74 1	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS Content and total \$ 21716.42 Content 2095.634 19271 INSTRUCTION TOTAL \$ 1058582.12 MARGEMENT TOTAL \$ 1058582.12 19271 INSTRUCTIONS SOFTWARE CEH	0.0				1450	15.00
L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS AGL NEW ANALYSIS \$ 211716.42 0 AGL NEW ANALYSIS \$ 211716.42 0 FCST CPU 229712.32 4966 0 ECST CPU 229712.32 4966 0 ECST CPU 229712.32 4966 0 ECST CPU 229712.32 4966 0 ECST CPU 229712.32 4966 0 TIME 19596 229712.32 4966 0 TIME 19596 200 1 TIME 1450 1450 1450 1450 1450 1450 1450 1450	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS ACL NEW ANALYSIS \$ 211716.42 0 TOUTPUT DESIGN 197954.86 0 TOUTPUT CODE 229712.32 4964 CODE 229712.32 4964 TODE 229712.32 4964 TODE 229712.32 4964 TODE 229712.32 19619.78 702 TIME 19505 MARAGEMENT TOTAL \$ 1058582.12 19271 INSTRUCTION 19271 INSTRUCTION SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS GGL NEW ANALYSIS \$ 211716.42 0 GGL NEW ANALYSIS \$ 211716.42 0 0 0 0 0 0 0 0 0 0 0 0 0	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS CLL NEW ANALYSIS \$ 211716.42 CODE 229712.32 CODE 229712.32 4964 7105 CODE 229712.32 4964 7105 19619.18 19619.18 1450 TIME TIME TIME TIME TIME 19271 INSTRUCTION 19271 INSTRUCTIONS SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS AGL NEW ANALYSIS \$ 211716.42 0 AGL NEW ANALYSIS \$ 211716.42 0 AGL NEW ANALYSIS \$ 211716.42 0 AGL NEW ANALYSIS \$ 211716.42 0 AGC NEW ANALYSIS \$ 1058582.12 0 AGC NEW ANALYSIS \$ 1059782 0 AGC NEW ANALYSIS \$	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS CCL NEW ANALYSIS \$ 211710.42 0 CCL NEW ANALYSIS \$ 211710.42 0 TOUTOUT 0 ESSIGN 229713.32 4964 CCDE 229713.32 4964 CCDE 229713.32 4964 TEST 299578.74 7155 TIPE 119619.78 119619.78 1450 TEST 299582.12 1450 19271 INSTRUCTION TOTAL \$ 1058582.12 19271 INSTRUCTION TOTAL \$ 1058582.12 19271 INSTRUCTION SOFTWARE CEM	L EY INSTRUCTION TOTAL \$ 716866.05 19271 INSTRUCTIONS 19271 INSTRUCTIONS 19271 INSTRUCTIONS AAALYSIS \$ 211716.42 AAALYSIS \$ 211716.42 0 0 0 0 0 0 0 0 0 0 0 0 0						
19271 INSTRUCTIONS           GCL NEW         ANALYSIS \$ 211716.42         0           GCL NEW         ANALYSIS \$ 211716.42         0           T/OLTPUT         ANALYSIS \$ 211716.42         0           T/OLTPUT         ANALYSIS \$ 211716.42         0           FGST         239724.86         0           FGST CPU         CODE         229712.32         496.4           FITH         TEST         299578.74         5702           MAAGEMENT         DOCUMENT \$ 119619.78         7155           MAAGEMENT         TOTAL \$ 1058582.12         1450           L         FY INSTRUCTION         TOTAL \$ 1058582.12         1450	19271 INSTRUCTIONS GGL NEW ANALYSIS \$ 211716.42 0 FGCL NEW ANALYSIS \$ 211716.42 0 FGCL TPUT COFE FCST CPU 1995.486 0 FCST COFE FCST 299578.74 5702 MITH MANAGEMENT DOCUMENT \$ 119619.78 7155 MANAGEMENT DOCUMENT \$ 1058582.12 ILE F INSTRUCTION TOTAL \$ 1058582.12 19271 INŠTRUCTIONS SOFTWARE CEM	19271 INSTRUCTIONS     0       GCL     NEW     ANALYSIS \$ 211716.42     0       GCL     NEW     ANALYSIS \$ 21716.42     0       TOUTPUT     DESIGN     197954.86     0       TOUTPUT     DESIGN     229712.32     4964       FEST     299578.74     5702       HITH     TEST     299578.74     5702       MALYEN     DOCUMENT \$ 119619.78     1450       L     EY     INSTRUCTION     TOTAL       19271     INŠTRUCTIONS     TOTAL     \$ 1058582.12       SOFTWARE CEH     SOFTWARE CEH     SOFTWARE CEH	19271 INSTRUCTIONS     0       GCL     NEW     ANALYSIS \$ 211716.42     0       GCL     NEW     ANALYSIS \$ 211716.42     0       GCL     NEW     ANALYSIS \$ 211716.42     0       GCL     NEW     ANALYSIS \$ 21716.42     0       GCL     DESIGN     197954.86     0       GCST     CODE     229712.32     4964       GCST     TEST     299518.74     5702       ATITH     TEST     19619.78     1450       FY     INSTRUCTION     TOTAL     1058582.12       19271     INŠTRUCTIONS     TOTAL     1058582.12       SOFTWARE     CEH     SOFTWARE     SOFTWARE	19271 INSTRUCTIONS     0       GCL NEW     ANALYSIS \$ 211716.42     0       GCL NEW     ANALYSIS \$ 217716.42     0       GCL NEW     ANALYSIS \$ 217716.42     0       FCST CPU     DESIGN     197954.86     0       FCST CPU     CODE     229712.32     4964       FCST CPU     CODE     229712.32     4964       FCST CPU     CODE     299578.74     5702       ATTHE     TEST     299578.74     5702       ATTHE     TEST     19619.78     1450       ATTHE     TEST     19619.78     1450       ATTHE     TIPE     1058582.12     1450       INSTRUCTION     TOTAL     1058582.12     1450       SOFTWARE CEH     SOFTWARE CEH     SOFTWARE CEH     1958582.12	19271 INSTRUCTIONS     19771 INSTRUCTIONS       FGL NEW     ANALYSIS \$ 211716.42     0       FGL NEW     DESIGN     197954.86     0       FGT CPU     CODE     229716.32     4964       FGT CPU     CODE     229518.74     7102       ATHM     DOCUMENT     19619.78     1450       ATHM     TOTAL     SOFTWARE CEM     1058582.12       SOFTWARE CEM     SOFTWARE CEM     1058582.12	19271 INSTRUCTIONS     0       AGL NEW     ANALYSIS \$ 211716.42     0       AGL NEW     DESIGN     19795.486     0       TOUTPUT     DESIGN     19795.486     0       CODE     229712.32     4964       CODE     229712.32     4964       ATTAUCTION     DESI     229712.32     4964       ATTAUCTION     DOCUMENT     229712.32     4964       ATTAUCTION     TOTAL     239578.74     5702       MANAGEMENT     DESI     299518.74     5702       MATTAUCTION     TOTAL     19619.78     1450       J1271     INSTRUCTIONS     1058582.12     1450       SOFTWARE CEM     SOFTWARE CEM     505882.12     505882.12	.0.	10141		716866.05		
GCL         NEW         ANALYSIS         211716.42         0           1/OLTPUT         DESIGN         197954.62         0           1/OLTPUT         DESIGN         197954.64         0           651         CDDE         229712.32         4964           651         CDDE         229713.47         5702           ATTH         TEST         299578.74         5702           MAAGEMENT         DOCUMENT         119619.78         7155           MAAGEMENT         DOCUMENT         119619.78         7155           L         EY         INSTRUCTION         TOTAL         1058582.12           19271         INSTRUCTIONS         1058582.12         1450	GCL         NEW         ANALYSIS         211716.42         0           FOLTPUT         DESIGN         197954.466         0           FGST         CDDE         229712.32         4964           FGST         CODE         299578.32         4964           FGST         CODE         299578.32         4964           FGST         CODE         299578.34         5702           MITH         TEST         299578.74         5702           MAAGEMENT         DOCUMENT         119619.78         7155           MAAGEMENT         DOCUMENT         119619.78         7155           TIME         ISBS82.12         1450         1450           MAAGEMENT         TOTAL         S05882.12         1450           SOFTWARE CEM         SOFTWARE CEM         SOFTWARE CEM         SOFTWARE CEM	GCL         NEW         ANALYSIS         \$ 211716.42         0           1/OLTPUT         DESIGN         197954.62         0           1/OLTPUT         DESIGN         197954.32         4964           EGST CPU         CODE         229712.32         4964           EGST CPU         TEST         299578.74         5702           ATTHM         TEST         29958.74         5702           ATTHF         19619.78         1450         1450           ATTHF         1058582.12         1450         1450           ATTHF         1958582.12         1450         5057           ATTHF         1958582.12         5058582.12         5057           ATTHF         ATTHF         1958582.12         5057           ATTHF         ATTHF         1958582.12         1450	GCL         NEW         ANALYSIS         \$ 211716.42         0           T/OLTPUT         DESIGN         197954.82         0         0           FEST         DESIGN         197954.82         0         0           FEST         CODE         229712.32         4964         0           FEST         CODE         229712.32         4964         0           FEST         CODE         299578.74         5702         7155           ATITHE         TEST         299578.74         5702         7155           PADAGEMENT         DOCUMENT         J19619.78         7155         7150           PADAGEMENT         TOTAL         J19619.78         7155         1450           F V         INSTRUCTION         TOTAL         J058582.12         1450           19271         INŠTRUCTIONS         TOTAL         J058582.12         5677448           SOFTWARE         CEM         SOFTWARE         CEM         50582.12	GCL         NEW         ANALYSIS         \$ 211716.42         0           T/OLTPUT         DESIGN         197954.86         0           FCST         CODE         229712.32         4964           FCST         CODE         239712.32         4964           FCST         CODE         299578.74         5702           ATTHM         TEST         299582.12         1450           ATTHE         1058582.12         1450         1450           ATTHE         1058582.12         1450         1450           ATTHE         19271         INSTRUCTION         TOTAL         5058582.12           ASOFTWARE CEM         SOFTWARE CEM         SOFTWARE CEM         ATTHE	GCL         NEW         ANALYSIS         S         211716.42         0           FOLTPUT         DESIGN         19795456         0         0           FCST         CODE         229715456         0         0           FCST         CODE         229715456         0         0           FCST         CODE         299578.74         5702           ATTH         TEST         299578.74         5702           ATTH         TEST         299578.74         5702           ATTH         TEST         299578.74         5702           MARAUCTION         TOTAL         J058582.12         1450           SOFTWARE CEH         TOTAL         SOFTWARE CEH         SOFTWARE CEH	GCL         NEW         ANALYSIS         211716.42         0           FCGL PUT         DESIGN         19795.486         0           FCGT CPU         DESIGN         19795.486         0           FCGT CPU         DESIGN         229712.32         4964           FCGT CPU         CODE         229712.32         4964           FCGT         TEST         299578.74         5702           FILH         TEST         19619.78         7155           FAAAGEMENT         DOCUMENT S         19619.78         7155           FILHE         ISTRUCTION         TOTAL S         1058582.12         1450           19271         INSTRUCTION         TOTAL S         1058582.12  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