S company ETO： Assignment Questions

1．What is cost object in ETO？What types of cost are included in cost system?

2. What are the allocation bases for burden under

a. existing cost system ?

b. the system proposed by accounting manager ?

c. the system proposed by the consultant ?

3．Calculate the reported cost of five components described in exhibit 6 under above three cost system..

S Company: Electronic Testing Operations

We put in a piece of automated equipment a year ago that only fits the requirements of one customer. This equipment reduced the direct labor required to test his components and, because of our labor-based burden allocation system, substantially reduced his costs. But putting a $40,000 machine into the general burden pool raised the costs to our other customers. It just doesn't make sense shooting yourself in the foot at the same time you are lowering the company's cost of operations.

Paul Carte, Manager

Introduction

Electronic Testing Operations (ETO), a division of S Company, provided centralized testing for electronic components such as integrated circuits. ETO was created as a result of a decision in 1979 to consolidate electronic testing from 11 different divisions of S. ETO commenced services to these divisions in 1983. It was estimated that centralization would save S in excess of $20 million in testing equipment investment over the next five years.

ETO operated as a cost center and transferred products to other divisions at full cost (direct costs plus allocated burden). Although ETO was a captive division, other divisions within S were allowed to use outside testing services if ETO could not meet their cost or service requirements. ETO was permitted to devote up to 10% of its testing capacity to outside customers but chose to work mainly with other S divisions due to limited marketing resources.

ETO employed approximately 60 hourly personnel and 40 administrative and technical staff members. Budgeted expenses were $7.9 million in 1988 (see **Exhibit 1**).

Testing Procedures

ETO expected to test between 35 and 40 million components in 1988. These components included integrated circuits (I.C.s), diodes, transistors, capacitors, resistors, transformers, relays, and crystals. Component testing was required for two reasons. First, if defective components were not caught early in the manufacturing cycle, the cost of repair could exceed the manufacturing cost of the product itself. Studies indicated that a defective resistor caught before use in the manufacturing process cost two cents. If the resistor was not caught until the end product was in the field, however, the cost of repair could run into the thousands of dollars. Second, a large proportion of S's work was defense related. Military specifications frequently required extensive testing of components utilized in aerospace and naval products. By 1988, ETO had the ability to test 6,500 different components. Typically, however, the division would test about 500 different components each month and between 3,000 and 3,500 per year. Components were received from customers in lots; in 1988, ETO would receive approximately 12,000 lots of components.

ETO performed both electrical and mechanical testing (see **Exhibit 2**). Electrical testing involved measuring the electrical characteristics of the components and comparing these measurements with the components' specifications. For example, the specifications for an amplifier may have called for a 1-volt input to be amplified into a 10-volt output. ETO would deliver a 1-volt input to the component. By measuring the amplifier's output, ETO gauged its conformance with specifications.

Mechanical testing included solderability, component burn-in, thermal shock, lead straightening, and leak detection. Solderability involved the inspection of components to see if they held solder. Burn-in was the extended powering of components at high temperature. Thermal shock involved the cycling of components between high and low temperatures. Lead straightening was the detection and correction of bent leads on components such as axial components. Leak detection examined hermetically sealed I.C.s for leaks.

Components varied significantly in the number and type of electrical and mechanical testing procedures they required. This variation resulted in about 200 different standard process flows for the division. Process flows were determined by the different combinations of tests and specifications requested by the customer. Based on these combinations, ETO planners determined the routing of components between testing equipment and the type of tests to be performed at each station. I.C.s, for example, could follow six different flows through the facility. While some I.C.s only required electrical testing at room temperature (solderability and leak detection, for instance), others also required thermal shock and burn-in.

Each type of component required separate software development, and custom tools and fixtures were often required. Software, tools, and fixtures were developed by the engineering group, which was made up of specialists in software development, equipment maintenance, calibration and repair, tooling and fixturing, and testing equipment operation. Software engineers developed programs for specific applications. The programs were then retained in a software library for future use. ETO had 6,500 different software programs on file, of which 1,300 were programs developed in the past year. ETO also had an inventory of 1,500 tools and fixtures, of which 300 had been developed in the past year. The large number of tools and fixtures allowed the testing of components with a wide variety of leads, pin combinations, and mating configurations.

The testing facility was divided into two rooms. The main testing room contained the equipment used for electrical testing. The mechanical room contained the equipment used for mechanical testing, plus incoming receiving and the stockroom. A total of 20 people worked in the two rooms on each of two main shifts, and 10 people worked on the night shift.

Cost Accounting System

The cost accounting system measured two components of cost: direct labor and burden. Burden was grouped into a single cost pool that included burden costs associated with each of the testing rooms as well as the engineering burden costs relating to software and tooling development and the administrative costs of the division. Total burden costs were divided by the sum of testing and engineering labor dollars to arrive at a burden rate per direct labor dollar. The division costed each lot of components. Burden was calculated for each lot by multiplying the actual direct labor dollars associated with the lot by the 145% of burden rate. The resulting burden was then added to the actual direct labor costs to determine the lot's total cost. In 1988, the facilitywide burden rate was 145% of each direct labor dollar, of which more than 40% was attributable to equipment depreciation (see **Exhibit 3**).

Signs of Obsolescence

Several trends pointed to the obsolescence of the labor-based burden allocation process. Since the founding of the division in 1983, direct labor hours per lot tested had been steadily declining (see **Exhibit 4**). This trend was aggravated by an increased dependence on vendor certification. Vendor certification was a key component of Just-in-Time (JIT) delivery. With vendor certification, S's suppliers did the primary testing of components. ETO then utilized statistical sampling to verify that the supplier's production process was still in control. Thus, whereas JIT led to an increased number of smaller lots being received by ETO, vendor certification reduced the number of tests performed. Early indications were that JIT deliveries would account for 30% of S's shipments within the next five years.

In addition to declining direct labor content and fewer test lots, the obsolescence of the labor-based allocation system was intensified by a shift from simple inspection services to broader-based test technology. On complex parts requiring screening, environmental conditioning, and testing, the division was consistently cheaper than outside services. Where only elementary testing was required, however, low-technology outside laboratories were often cheaper, especially on large lots. The advantage that the division brought customers over the outside labs was that the latter provided essentially no engineering support, whereas ETO with its resident engineering resources was able to support such service on a rapid and cost-effective basis. The shift to more technically sophisticated services prompted a shift in the labor mix from direct to indirect personnel. The division expected to see a crossover between engineering head count and hourly head count early in the 1990s.

Finally, the introduction of high-technology components created the need for more automatic testing, longer test cycles, and more data per part. Digital components, for example, were currently tested for up to 100 conditions (combinations of electrical input and output states). The new generation of digital components, on the other hand, would be much more complex and require verification of up to 10,000 conditions. These components would require very expensive highly automated equipment. This increase in automation would, in turn, lead to a smaller base of direct labor to absorb the depreciation costs of this new equipment.

There were fears that the resulting increase in burden rates would drive some customers away. ETO had already noticed an increase in the number and frequency of complaints from customers regarding the rates they were charged for testing.

The division's accounting manager proposed a new cost accounting system to alleviate the problem. Under this new system, burden would be directly traced to two cost pools. The first pool would contain burden related to the administrative and technical functions (division management, engineering, planning, and administrative personnel). This pool would be charged on a rate per direct labor dollar. The second pool would include all other burden costs and would be charged based on machine hours. **Exhibit 5** provides the proposed burden rates.

Shortly after the accounting manager submitted his proposal, a consultant hired by S's corporate management prepared an assessment of ETO's cost system. He recommended the implementation of a three-burden-pool system utilizing separate burden centers for each test room and a common technical and administrative pool. Burden would be directly traced to each of the three burden pools. Like the accounting manager's system, burden costs in the test rooms would then be allocated on a machine-hour basis. Technical and administrative costs would continue to be charged on a rate per direct labor dollar.

To examine the impact of the two alternative systems, ETO management asked that a study be conducted on a representative sample of parts. **Exhibit 6** provides a breakout of actual direct labor and machine-hour requirements per lot for the five components selected for the study.

Technological Future

In 1988, the division faced major changes in the technology of testing that required important equipment acquisition decisions. The existing testing equipment was getting old and would not be able to keep pace with developments in component technology. Existing components, for example, had between 16 and 40 input/output terminations (e.g., pins or other mating configurations), and ETO's equipment could handle up to 120 terminations. Although the 120-termination limit had only been reached a couple of times in the past few years, a new generation of components with up to 256 terminations was already being developed. Similarly, the upper limit of frequency on existing components was 20 MHz (million cycles per second), whereas the frequency on the next generation of components was expected to be 50 MHz.

The equipment required to test the next generation of components would be expensive. Each machine cost approximately $2 million. Testing on this equipment would be more automated than existing equipment, with longer test cycles and the generation of more test data per part. It was also likely that lot sizes would be larger. The new equipment would not replace the existing equipment but would merely add capabilities ETO did not currently possess. Additionally, the new equipment would only be needed to service the requirements of one or two customers in the foreseeable future. **Exhibit 7** provides a summary of the new equipment's economics and operating characteristics.

The impact of this new equipment would be an acceleration in the decline in direct labor hours per lot of components. At the same time, burden would increase with the additional depreciation and engineering costs associated with the new equipment. This would result in a large increase in the burden rate per direct labor dollar. As Paul Carte, manager of ETO, saw it, the acquisition of the new equipment could have a disastrous effect on the division's pricing structure if the labor-based allocation system remained in use:

> *We plan on investing $2 million on a large electronic testing machine to test the chips of one or two customers. This machine will be very fast and will require little direct labor. Its acquisition will have a significant effect on our per direct labor dollar burden rate, which will result in an increase in charges to our other customers. It is clear that a number of customers will walk away if we try to pass this increase on. I am afraid that we will lose 25% of our customer base if we don't change our cost system.*

Exhibit 1 S Company.: Electronic Testing Operations

1988 BUDGETED EXPENSES		
Direct Labor		$3,260,015
Overhead		
Indirect Labor	859,242	
Salary Expense	394,211	
Supplies & Expenses	538,029	
Services[1]	245,226	
Personnel Allocations[2]	229,140	
Service Allocations[3]	2,448,134	
Total Overhead		$4,713,982
Total Budgeted Expenses		$7,973,997

[1]Includes tool repair, computer expenses, maintenance stores, and service cost transfers from other divisions.
[2]Includes indirect and salaried employee fringe benefits, personnel department, security, stores/warehousing, and holidays/vacations.
[3]Includes building occupancy, telephones, depreciation, information systems, and data control.

Exhibit 2 S Company: Electronic Testing Operations

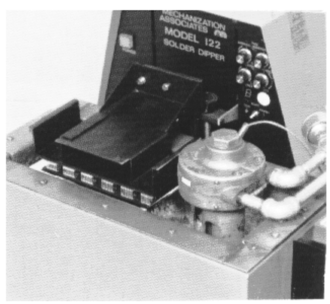
TESTING CAPABILITIES


Internal Visual


Hermeticity Check


Wire Pull


Temperature Cycling



Solderability


Burn-In

Exhibit 3 S Company: Electronic Testing Operations

CALCULATION OF BURDEN RATE **Based on 1988 Plan**		
BURDEN RATE	=	TOTAL BURDEN $[4] / DIRECT LABOR $
	=	$4,713,982 / $3,260,015
	=	144.6%
EFFECTIVE RATE	=	145%

[4]Cost Breakdown:

		Fixed		
	Variable	Depreciation	Other	Total
Total Burden	$1,426,317	$1,288,000	$1,999,665	$4,713,982

Exhibit 4 S Company: Electronic Testing Operations

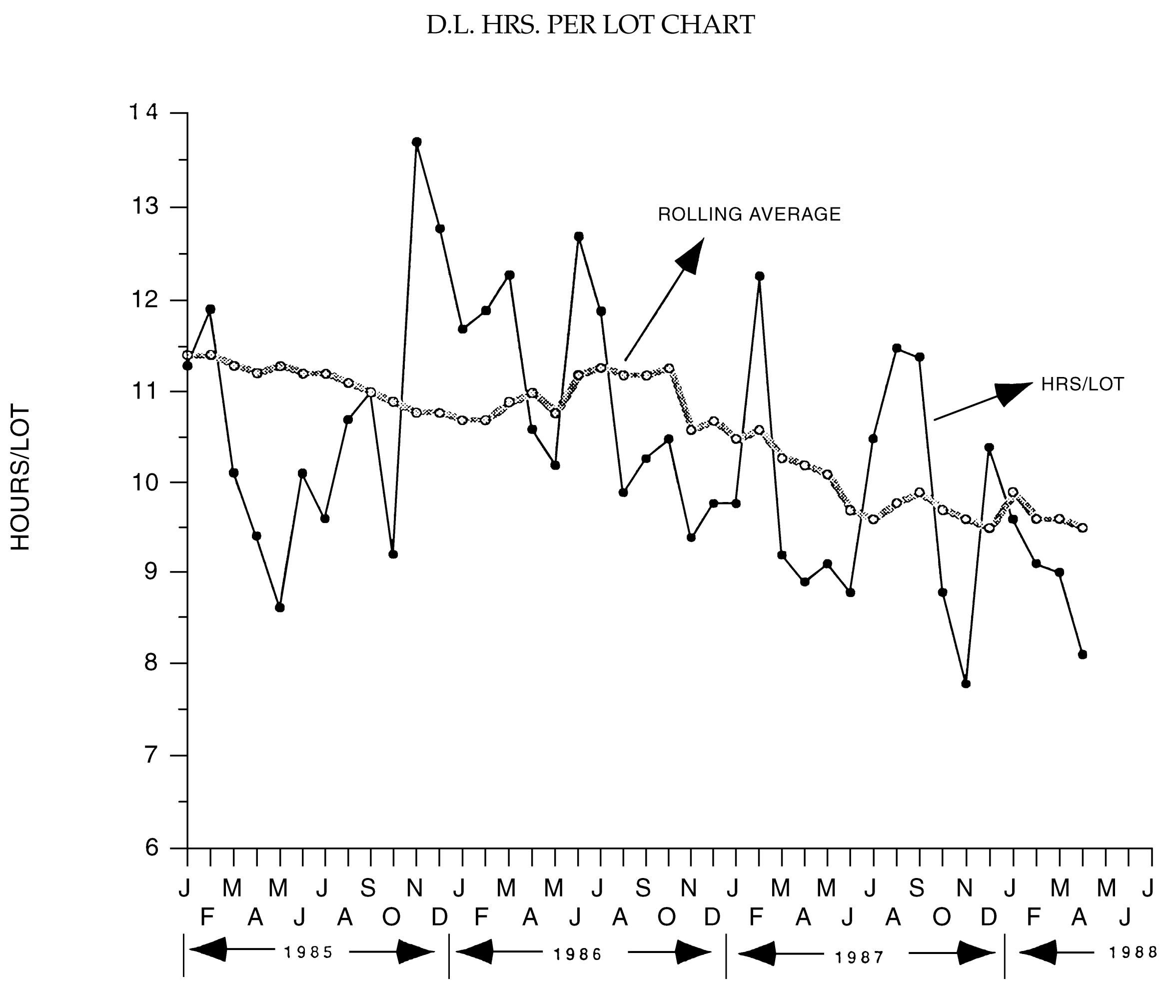


Exhibit 5 S Company: Electronic Testing Operations

PROPOSED BURDEN RATES
Based on 1988 Plan

Machine-Hour Rate

	MACHINE HRS.	BURDEN $[5]
Main Test Room	33,201	$2,103,116
Mechanical Test Room	17,103	1,926,263
Total	50,304	$4,029,379

Machine-Hour Rate $= \dfrac{\text{Test Room Burden \$}}{\text{Machine Hrs.}} = \dfrac{\$4{,}029{,}379}{50{,}304} = \$80.10$

Effective Machine-Hour Rate = $80.00

Direct Labor Hour Rate

Total Engineering & Administrative Burden $ = $684,603

Total Direct Labor Dollars = $3,260,015[6]

Burden Rate = $\dfrac{\text{Engr. \& Admin. Burden \$}}{\text{Direct Lbr \$}} = \dfrac{\$684{,}603}{\$3{,}260{,}015} = 21\%$

Effective Burden Rate Per Direct Labor $ = 20%

[5]Cost Breakdown

		FIXED		
	VARIABLE	DEPRECIATION	OTHER	TOTAL
Main Test Room	$ 887,379	$ 88,779	$1,126,958	$2,103,116
Mechanical Test Room	443,833	808,103	674,327	1,926,263
Test Room Burden	$1,331,212	$ 896,882	$1,801,285	$4,029,379
Engineering & Admn.	$ 95,105	$ 391,118	$ 198,380	$ 684,603
Total Burden	$1,426,317	$1,288,000	$1,999,665	$4,713,982

[6]Includes all direct labor costs, including direct labor costs incurred in both test rooms as well as in engineering.

Exhibit 6 S Company: Electronic Testing Operations

Direct Labor and Machine-Hour Requirements
Actuals For One Lot

		----------------MACHINE HOURS----------------		
PRODUCT	DIRECT LABOR $	MAIN ROOM	MECH.ROOM	TOTAL
ICA	$ 917	8.5	10.0	18.5
ICB	2051	14.0	26.0	40.0
CAPACITOR	1094	3.0	4.5	7.5
AMPLIFIER	525	4.0	1.0	5.0
DIODE	519	7.0	5.0	12.0

Exhibit 7 S Company: Electronic Testing Operations

New Testing Equipment Economics and Operating Characteristics	
Cost:	$2 Million
Useful Life:	8 Years
Depreciation Method:	Double Declining Balance (First Year Depreciation Costs of $500,000)
Location:	Main Test Room
Utilization:	10% first year, rising to 60% by third year and in all subsequent years, based on 4,000 hours per year availability (2 shifts x 2,000-hour year)
Direct Labor Requirements:	Approximately five minutes per hour of operation; average labor rate of $30 per hour
Engineering Requirements:	$75,000 in installation and programming costs in first year
Estimated overhead (nonengineering depreciation)	$250,000 ($100,000 variable, $150,000 fixed)