BREMEN ELECTRONICS (B)

Marlene Baer, Controller, developed the figures requested by her boss, Herman Klein, President of Bremen Electronics USA. They allowed her to see how their projected volume related to breakeven as well as the relative profitability of the two products, RC1 and RC2. (See Bremen Electronics (A) for background.) Baer thought the figures were OK as far as her analysis went, but she began to wonder about some of the assumptions built into her calculations. For example, she had used direct labor as a base for distributing indirect manufacturing overhead because that was the system traditionally used by the parent company. She recognized that the assumption on which that system was based was that the amount of direct labor used by a product was a good predictor of the amount of overhead that should be charged to it.

On reflection, she decided that direct labor was not a very good predictor. Then she considered units and decided that units worked well as a predictor of supplies usage. Supplies consisted of wire, connectors, solder, some general types of resistors, and other parts and pieces. To measure how each product actually consumed supplies would be tedious, but she thought a reasonable estimate could be made. She would deal with that later.

Though units worked well for supplies, units did not seem to make any better sense than direct labor for use as a base for distribution of the other types of overhead. Equipment maintenance, for example, had more to do with the types of equipment used than with the units produced or direct labor, though she recognized that more units would probably cause more maintenance expense.

She had heard from the controller of another division in Germany that they were considering activity-based costing (ABC). Baer decided to consider whether ABC would have any value in her situation.

In reading about ABC she learned that it was most useful where

1. there was product diversity not recognized by the existing base(s) used for overhead distribution.
2. the amount of overhead was significant.
3. the competitive situation was such that accurate product costs would be helpful to company strategy.

Baer concluded that the amount of overhead was significant and that the competitive situation could well mean accurate product costs would be important. She was not sure, however, about the product diversity requirement. Where, if at all, might use of direct labor as a base for overhead distribution introduce a distortion in product costs?

To get at that question she decided she had to examine the processes used to manufacture each product. This was actually quite easy for her since she was very familiar with plant operations. Each product went through three kinds of processes:

1. Fabrication, where equipment operators made components, such as insulated platforms for electronic parts and housings for the unit. The operation was quite highly automated with large punch presses and special molds together with belts and robots for moving and positioning parts.
2. Assembly, which was not so highly automated, but did use some small machines and moving belts.

3. Packing and shipping, in which units were packed in preprinted boxes. The RC1 unit had one configuration of packaging for its single customer. The RC2 unit was currently being shipped to four mail order companies with a total of six configurations.

Baer asked herself if these were the main activities in the manufacturing process. Not quite, she thought. There was a significant quality control/production engineering activity and a number of activities related to production such as purchasing, maintenance, payroll, and receivables/payables accounting.

She decided to use the areas she thought might have some diversity, and more important, she admitted to herself, those areas on which data would be the easiest to get. She considered her analytical approach to be a matrix, and began filling in the numbers as she obtained or estimated them. On the top she listed the four activities she decided to work on first, and down the left side she listed the budgeted expenses in the existing accounting categories. Her analysis then spread the budgeted expenses across the activities. (See Exhibit 13(B)-1.)

She had decided to treat the supplies expense differently from the other overhead expenses since it was a variable expense and was likely to vary with unit volume. For her earlier calculations she had used a flat $1.40 per unit ($21,000/15,000 units). Now she thought that number should be sharpened when it came to computing the cost of each product. Her knowledge of the process told her that the RC2 unit was a bit more complicated and would use slightly more supplies. After some more analysis she decided that a more accurate per unit figure would be $1.37 for the RC1 and $1.46 for the RC2 unit.

Along the way she realized that some budgeted overhead expenses could not be distributed to the activities using any rational connection. Or put another way, there was not a clear causal relationship between the activities and the budgeted expense. So rather than force an artificial distribution, she designated a fifth "activity" that she called "general operations." She thought that later on she might peel off some of the expenses in general operations and assign them to a newly designated activity. To make that work, however, she knew she would have to be able to relate the new activities to the products. Purchasing, for example, might be a new activity, but how to relate purchasing to products was a problem she was not ready to tackle. So the purchasing expenses were left in the general operations activity.

Baer distributed the overhead expense to the activities using the most logical method she could think of: square feet for occupancy expenses, estimates of time and parts costs for equipment maintenance expense, and equipment book values for depreciation. She filled in her spreadsheet with the resulting numbers.

Baer decided that the quality control/production engineering expense was driven more by the production activities than by any distinctive product characteristics. Therefore she decided that the $19,000 total would be distributed to the three production activities. After talking with the people involved in quality control/production engineering about what caused their work, she made the distribution to the three main production activities as shown in Exhibit 13(B)-1.

She was now ready to distribute the total activities cost to the two products. To do that she wanted to consider what linkage reflected best the way product characteristics caused the activity. She thought of three possibilities: units of product, direct labor used by the product or, as a wild card, elapsed time in the activity. She discarded the units

measure because she knew that, at least in fabrication, an RC2 unit used a lot more fabrication resources than an RC1 unit. Either direct labor or elapsed time would reflect that difference. Elapsed time, she thought, was interesting because it reflected not only the time items were worked on, but also the time they waited in a queue which had some relationship to the way their complexity used the department's resources. But in the end she chose direct labor partly because she thought it did measure the product's use of the activity's resources, and partly because the data were easily available.

With a little work extracting existing data on direct labor use in the activities, Baer constructed the table shown in Exhibit 13(B)-2 and prepared to carry out the final step to compute the revised manufacturing cost of the two products. Each of the three overhead amounts for activities would be distributed in proportion to direct labor in that activity. The general operations overhead of $39,000 would be distributed in proportion to total direct labor for all three activities.

EXHIBIT 13(B)-1

BREMEN ELECTRONICS (B)

Distribution of Direct Labor and Overhead to Activities
(In Dollars)

Expense	*Total*	*Qual.Control*	*Fabrication*	*Assembly*	*Pack & Ship*	*General Operations*
Direct Labor	56,000		18,500	30,000	7,500	
Overhead:						
Occupancy	15,000	1,000	3,000	5,000	4,000	2,000
Equip. Maint.	17,000	1,000	10,000	4,000	1,000	1,000
Equip. Dep'n.	8,000	2,000	4,000	1,000	1,000	
Qual. Contr.	15,000	15,000				
Mfg. Admin.	36,000					36,000
Total	91,000	19,000	17,000	10,000	6,000	39,000
Qual. Contr.		(19,000)	11,000	7,000	1,000	
Total	91,000	0	28,000	17,000	7,000	39,000
Supplies	21,000					
Total Overhead	112,000					

EXHIBIT 13(B)-2

BREMEN ELECTRONICS (B)

Estimated Direct Labor Per Month by Activity and by Product
(In Dollars)

	Total	*RC1* 10,000 Units	*RC2* 5,000 Units
Fabrication	18,500	10,000	8,500
Assembly	30,000	21,000	9,000
Pack and Ship	7,500	4,000	3,500
Total	56,000	35,000	21,000

BREMEN ELECTRONICS (C)

Early in 1995 Herman Klein, President, and Marlene Baer, Controller, of Bremen Electronics USA were reviewing results for 1994. (See Bremen Electronics (A) and (B) for background.) Sales of the RC1 unit had just reached the minimum guarantee of 100,000 units, or 20,000 units below their target for the year. Offsetting their disappointment with those results was a high level of satisfaction with the mail order sales of the RC2 unit which reached 80,000 units. During the year the item had been picked up and featured by five new mail order customers. It was included, but not featured, in thirteen other catalogues.

Klein was proud of the way his organization had responded to the mail order companies, particularly during the months leading up to Christmas. Their requirements had not been easy to meet. Two of the largest had ordered once a week from September through the second week in December, and twice in several weeks of November and December. Others ordered every two or three weeks. Most of the mail order companies required shipment within five days and occasionally asked for shorter lead times.

Packaging also became a problem. With more customers, the variety of packaging increased. Packaging included printed display boxes, directions, and sometimes guarantee and repair information. Whereas the garage timers were simple to package with just one customer, the mail order timers seemed to involve endless problems.

Klein had been determined to provide satisfactory service and believed they had come through the holiday season with relatively few events that upset customers. He had added a full time expediter to see that the special needs of customers for delivery and packaging were met. Another person in packaging and shipping was also added. In addition to the temporary help used in purchasing and billing he knew there were probably other expenses incurred to keep customers satisfied.

To get a quick picture of the level of unexpected expenses, he asked Baer to develop a rough listing of what she thought they had been. Table 1 shows her list.

TABLE 1
List of Estimated Extra Expenses for 1994

Expediter (6 months)	$ 12,000
Added person in packaging and shipping (8 months)	12,000
Temporary help	12,000
Cost of expediting purchased components	8,000
Overtime	18,000
Depreciation on additional packaging equipment	8,000
Total extra expenses	$ 70,000

With this information Baer decided to make a rough estimate of how they came out at the end of the year. (See Exhibit 13(C)-1.)

Though her figures were only approximate they carried a message: Bremen had been much less profitable than they had hoped it would be, and much of the problem seemed to be in those extra expenses which were mainly caused by the RC2 business. As she thought about how to get a better understanding of what went on, she began to think that they were actually running two factories: one made the two kinds of signalling devices and the other serviced customers. The first factory produced two products with no variations on each up to the point where they were labeled, packaged, and shipped. The second factory handled all the matters relating to packaging, shipping, and customer relations. There were many "products" of the second factory. The service of each customer was certainly a distinct product, and sometimes there were even several types of service (e.g., different packaging or shipment directions) for a given customer. Many activities were involved and she realized there was wide diversity in the demands put on those activities. It was intuitively clear that not only was the RC2 less profitable than they expected, but some customers were also less profitable than others.

Though she did not want to make her analysis excessively complicated, she pressed on to get a clearer picture of what had happened. First she listed the activities that went on in her second factory:

- order processing, from receipt of an order to scheduling production
- setting up of the packaging line with matching boxes, directions, guarantees, etc.
- running the packing line
- assembling the shipment with delivery instructions
- billing
- collections
- cost of capital tied up in accounts receivable.

Except for running the line and the cost of tied up capital, she thought that each of the other activities was driven by orders, not by numbers of items. Beyond just orders as a driver she recognized that some orders were harder than others to handle (those with short delivery, for example). She thought that at a later stage she might use an index of difficulty (e.g., 1.2 for difficult, .8 for easy) but as a start she decided to simply compute an average cost per order and to use that to develop a rough figure for customer profitability.

To carry on her analysis she needed three kinds of information:

Numbers of orders
Cost of order processing activities
Number of orders for each customer

The first was easy because each order had a number. She could simply subtract the year's starting number from the last number. She came up with 420 orders, 20 for the RC1 unit and 400 for the RC2 unit.

The next two steps were harder. It took her several days to develop approximate figures. The activities driven by receipt of an order, producing, and shipping it together with billing and occasional follow-up took place in a number of departments. Her plan was to segregate those costs and treat them as a single cost pool, and to treat the remaining costs as they had been before. She worked with budgeted figures (except for the $70,000 extra expenses) because those figures were readily available. She thought the $70,000 in

extra expenses should all be attributed to order handling since the total number of units sold was the same as had been budgeted. The following table is the result of her study.

TABLE 2
Separation of Order-Driven Cost Per Year

	Total	*Driven by Orders*	*Remaining*
Direct labor-pack & ship RC1	$40,000	$5,000	$35,000
Direct labor-pack & ship RC2	56,000	15,000	41,000
Overhead-pack & ship	84,000	16,000	68,000
General operations	468,000	38,000	430,000
Selling and Admin.	480,000	24,000	456,000
Total		$98,000	
Extra Expenses		70,000	
Total order handling cost		$168,000	
Number of orders	420		
Cost per order	$400		

Next she examined the sales records to find out how many orders and how many units each customer ordered. There were one customer for the RC1 unit and 18 customers for the RC2 unit.

TABLE 3
Customer Orders

	Orders	*Total Units Ordered*
RC1 Customer	20 Orders	100,000 Units
RC2 Customers:		
1	50	15,000
2	40	5,000
3	36	7,200
4	30	2,400
5-14	200	40,000
15	12	4,800
16	12	2,400
17	12	1,200
18	8	2,000
Total RC2	400 orders	80,000 units

Finally she began to reconstruct the cost sheets for the two products, first as originally budgeted and then recognizing actual volumes and order handling costs. (See Exhibit 13(C)-2.)

When she took a break, she had four things left to do:

1. Complete her cost sheets for the "two factory" approach.
2. Using those figures, compute the profitability of the RC1 and the RC2 sales to the eight customers shown in Table 3.
3. Compute RC2 profitability for orders of 100 units, 200 units, and 400 units.
4. Figure out how 1995 could be more profitable than 1994.

EXHIBIT 13(C)-1

BREMEN ELECTRONICS (C)

Revised Profit Estimates for 1994

	RC1		*RC2*	
Selling price				
Variable cost-original	$10.40	$ 20.00	$12.00	$ 23.00
Adjustment in supplies	(.03)		.06	
		(10.37)		(12.06)
Variable contribution		$ 9.63		$ 10.94
Sales in units	100,000		80,000	
Total contribution each product		$ 963,000		$ 875,200
				963,000
Total contribution (RC1 & RC2)				$1,838,200
Normal fixed manufacturing cost	$ 91,000 x 12			1,092,000
Normal selling admin. cost	$ 40,000 x 12			480,000
Total cost				$1,572,000
Profit before extra expense				$266,200
Less extra expenses				70,000
Projected profit				$196,200

EXHIBIT 13(C)-2

BREMEN ELECTRONICS (C)

Per Unit Product Costs

	ABC #1 Budgeted Volume		*"Two Factory" Cost Actual Volume*	
Driven by units	*RC1*	*RC2*	*RC1*	*RC2*
Parts	$ 5.50	$ 6.40	$ 5.50	$ 6.40
Supplies	1.37	1.46	1.37	1.46
Fabric. labor	1.00	1.70	1.00	1.70
Fabric. ohd	1.514	2.573	1.514	2.573
Assembly labor	2.10	1.80	2.10	1.80
Assembly ohd	1.191	1.020	1.191	1.020
Subtotal (unchanged)	12.675	14.953	12.675	14.953
Pack & Ship labor	.40	.70	.35	.512
Pack & Ship ohd	.373	.653	.313	.458
General Operations	2.436	2.923	2.227	2.592
Total Mfg. Cost	$15.884	$19.229	$15.565	$18.514
Driven by orders				
Total: $168,000	-0-	-0-		
Selling & Admin				
$480k/180k units $456k/180k units	2.667	2.667	2.533	2.533
Total cost	$18.551	$21.896		
Unit price	$20.00	$23.00	$20.00	$23.00
Profit	$ 1.45	$ 1.104		