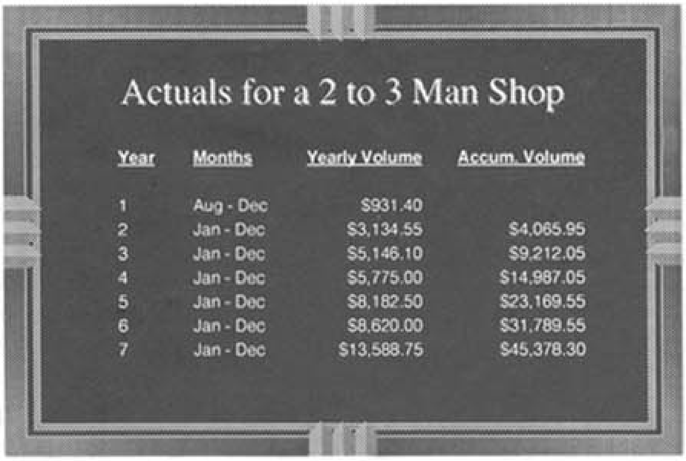

Actuals for a 2 to 3 Man Shop

Year	Months	Yearly Volume	Accum. Volume
1	Aug - Dec	$931.40	
2	Jan - Dec	$3,134.55	$4,065.95
3	Jan - Dec	$5,146.10	$9,212.05
4	Jan - Dec	$5,775.00	$14,987.05
5	Jan - Dec	$8,182.50	$23,169.55
6	Jan - Dec	$8,620.00	$31,789.55
7	Jan - Dec	$13,588.75	$45,378.30

Take a minute and study this graphic. As you can see, the machine was purchased in August of 1979, and produced $931 dollars of labor in those five months. The center column is the dollar amounts per year, and the right hand column is the running total of the years or accumulated totals. The cost to enter the balancing field is about $5,000 for a used machine to approximately $20,000 for a new state of the art machine. Another first step in entering the field could be to purchase the gram scale. This would allow you to do at least part of the job before you send the crank out for the remainder of the work. At this point, we are going to get into a little more of the technical side. Are there any questions before we proceed?

Now, let me turn it over to Gary Hildreth, thank you.

Good morning, I'd like to start off today with, "What do balancing machines read?" What is that magic reading. I will be giving you quite a bit of technical information. All of this information will be available for you to take home and review after our presentation.

What is unbalance? What are all those different tolerances for? Let's take unbalance first. Unbalance is equal to weight times distance, the distance being the radius of rotating mass from the center line and the weight being the ounces or grams. A simple example shown on the first slide shows a 1 ounce weight at a 1 inch radius, what is that equal to? Some kind of balancing magic… no, it is weight times distance. So, a 1 inch radius times a 1 ounce weight is equal to 1 ounce inch. In our next slide you will see the same 1 ounce weight but at a 10 inch radius. The same rules apply, this simple little formula on balance is equal to weight times distance, so that's a 10 inch radius times a 1 ounce weight is 10 ounce inches. You will see listed on the slide that a 1 ounce weight is equivalent to 28.35 grams. Anytime we want to convert to gram inches, we just multiply 28.35 times the ounce inch reading.

Now, my assistant here Mr. Bianchi will show us a simple demonstration of what a crankshaft feels. What we are trying to demonstrate is the very basics of what the crankshaft is going to feel or does feel from the center line as the force tries to get out. All we've done is taken the strain and put a weight on it and if I come out here to about 3-4 inches and rotate it, there's not much moving in my hand, weight times distance. If I move the weight out about a foot and do the same thing, it takes more weight and it's that force that the crankshaft is feeling as part of it rotates, just a real simple basic example.

How do we figure automotive and industrial tolerances, tolerances for racing engines, stock engines, armatures, flywheels, turbans, fans. Shown on the next slide we have a very good basic formula, tolerance in ounce inches is equal to 2.4 times the weight in ounces divided by the rpm. What we all need to know is how heavy is the part and what is it going to run in operation. The rotating part will never realize the extra work, because we have determined the proper tolerance, especially on a non-automotive job and that is what we're keying on, it is very vital that we determine both of these simple items. If a customer comes in with a fan armature or any non-automotive item, you can be prepared to figure up their tolerances and tell them what the tolerances should be.