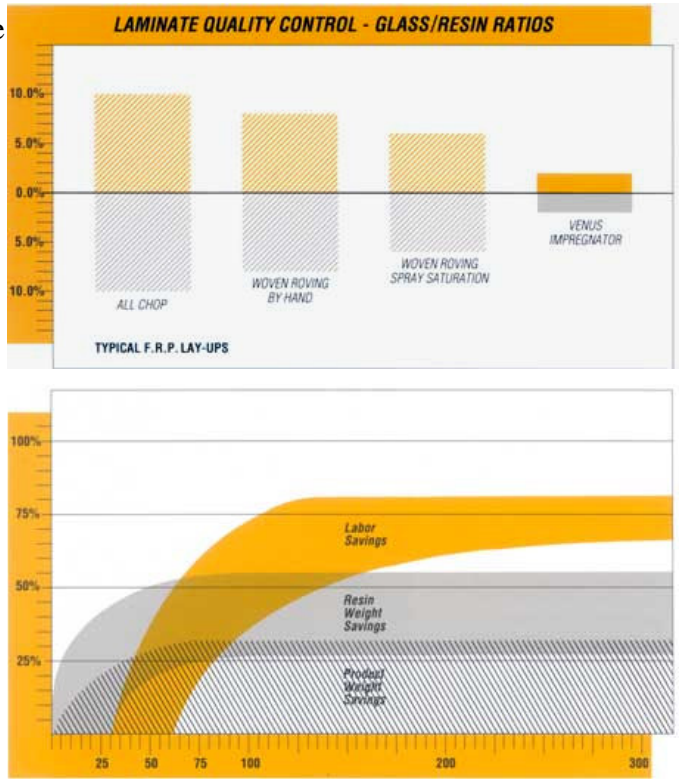
Writing Sample Introduction

Labor costs, return on investment and quality vs. quantity in production rates are all topics of the following writing sample. A brochure was published and distributed before I joined Venus/Gusmer that focused on CNC (computer numeric control) laminate resin impregnators.

An impregnator supplies and uniformly regulates the resin to fiber ratio of composite laminates.

The brochure failed to provide adequate explanations for the meanings and uses of the graphs. The follow-up document became one of my first assignments. My audience analysis showed the people asking questions were business managers and their lenders. They were interested in examples of why to invest in automation and how to use it effectively. My audience was either familiar or expert in the field of composite lay-up construction.



Two graphs were developed for the brochure.

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Analyzing Venus Impregnator Savings & Productivity

Using the Process Benefits Graph & Process Comparison Chart

Introduction:

Using the Process Benefits Graph & Process Comparison Chart

In order to give you a better idea of the kind of savings that are possible with your new Impregnator System, Venus developed the Process Benefits Graph and the Process Comparison Chart for our impregnator brochure (VI-O2). The Process Benefits Graph is based on data from the boat building industry. Because several of our customers use Venus Impregnators in boat construction, data from several sources were available for producing a meaningful graph. The Process Comparison Chart comes from material and labor monitoring information and burnout tests.

PROCESS BENEFITS GRAPH:

The graph shows potential savings in three areas: labor costs, resin weight and finished part weight. Extrapolations for the graph are based on actual glass to resin ratios that customers have reported to us over several years of operations. You will notice that the three areas of savings show a broad range of results (represented by wide shaded bands). This range is due to several variables including how well the crew is trained, how effectively the Impregnator System is matched to a manufacturing process and how thorough management's goals have been researched and appropriate methods applied. Companies have different production goals and methods for achieving those goals; therefore, varying results are to be expected.

Labor Costs

Several topics must be covered when making decisions regarding the efficient use of labor. You will notice that the labor curve of the graph does not indicate any savings until the project is 30 to 60 feet in length. This is due to size requirements for automated systems to derive any savings. The complexity of the manufacturer's product must also be factored into the minimum size calculations. To illustrate these points consider the following 2 examples.

Example 1.
Your company makes inexpensive 8-foot dinghies; furthermore, the shop space for production limits you to one mold. Because you are only making one boat at a time, you would like to increase your production rate. Installing a small impregnator seems like a good idea; after all, won't automation speed up the laminating procedure?

After a month of production, the president of the company calls you in to ask why the production rate has not gone up by even one boat per week. You report that the lamination process does indeed go faster with the impregnator; however, on an 8-foot boat, lamination is a small part of the time required to produce a hull. Consequently, the impregnator is idle while waiting for the workers to rollout the occasional void, hoist the mold out to the curing area

and set up a new mold. The total time to produce one hull has not been shortened enough to get even one more out during a shift.

A possible solution to this problem is to increase production space. By adding enough area to use a second mold, the idled impregnator can be working on another hull while secondary work is done on the first. It is also likely that no additional employees would be required to accomplish the doubled output in the above example. An added note, the doubling of the production rate in this example would probably require more boat molds and a larger curing area.

Example 2.
Your company is manufacturing premium quality 16-foot fishing boats. Workers carefully fit and trim the laminate, rollout voids and install special fittings (oar locks, metal bow skid, etc.). Despite the larger project size, you now find that your impregnator is idle while waiting for the additional secondary handwork.

As in example 1, a solution would be to increase production capacity to two, or more, molds. However, the labor requirements would increase with two molds producing the premium product described above. In this case an impregnator might not make sense until you started producing larger hulls. An impregnator can stay busy placing laminate on a larger hull, thereby taking enough time in completing one pass to allow the additional secondary work to be completed. Larger projects let the workers and the impregnator operate continually because they do not get in each other's way.

To be a viable investment, an impregnator should increase the hourly output of your employees and reduce their idle time. An impregnator saves time by wetting- out material quickly and placing it directly on the mold. Idle time is reduced when the project is large enough, and/or complex enough to keep the higher output levels running at or near 100% of the shift. Employees doing the secondary work need more time between impregnator passes to accomplish their tasks when working on premium grade or complex projects. Returns on your investment in a Venus Impregnator depend on the size and complexity of your typical product.

Resin Weight

Resin savings with your Venus Impregnator are significant after the first few feet of laminate is placed. The physicals of an FRP lay-up are generally related to the amount of fiberglass, not the amount of resin. Any additional resin beyond the minimum required to saturate the fibers adds little, if any, to the strength of the laminate.

Example:
10 pounds of fiberglass wetted with 10 pounds of resin has approximately the same tensile strength of

10 pounds of fiberglass wetted with 15 pounds of resin.

It is the glass that gives the majority of the strength to the laminate; therefore, anything that can be done to increase the glass to resin ratio will save money.

A Venus Impregnator - once adjusted - will consistently provide the right amount of resin needed to wet-out your material. The only waste occurs when the machine is first adjusted to the material (or combination of materials) you have decided to use. With experience, an operator gets to know what adjustments are needed for each material. After a few feet are wet-out for adjustment and testing, the setting will maintain a constant glass to resin ratio until a different material is loaded. That is why the graph shows some savings on even the smallest projects.

As projects get larger, the percentage of material lost in adjustment and testing vs. the amount actually placed becomes mathematically insignificant. Also, as your operator gains more experience, the glass to resin ratio can be raised saving you more money as resin consumption is reduced.

Finished Part Weight

Today most products are weight sensitive and higher glass to resin ratios means you can manufacture products with lower weight. Reduced weight improves performance and lowers fuel requirements in powered vehicles. Lower weights made possible by your Venus Impregnator gives your marketing department an important sales point.

By looking at a specific example for potential resin and weight savings in the total product, we can go through a mathematical model to illustrate what occurs when better control is developed by using an impregnator to improve the glass to resin ratio.

Say you are producing a laminate using a relatively efficient spray saturation process. A common glass percentage for laminates produced by spray-up is 45%. This is equal to a glass to resin ratio of 1: 1.22. In a 10,000-pound laminate, that would yield 4,500 pounds of glass and 5,500 pounds of resin. Using a Venus Impregnator you process the same number of square feet of laminate using the same weight of glass, 4,500 pounds. Now, however, the impregnator allows your operator to raise the glass to 55% of the laminate. That means your resin amount must be reduced to 45%. Your new glass to resin ratio is 1: 0.82.

What has processing the laminate in the Venus Impregnator meant in resin and weight savings? First your resin amount went down from 5,500 pound to 3,680 pounds. That is a resin savings of about 1/3 over spray-up techniques. Also, your 10,000 pounds of laminate using a spray-up procedure would now weigh only 8,180 pounds, an 18% reduction in final product weight, using your

Venus Impregnator. Surveys from our customers commonly report this level of savings even in shops that were relatively efficient and well controlled prior to the installation of their Venus Impregnator.

Production

Increasing the glass content has both limits and trade offs. Once you have reached 60% glass content (approximately 1.5: 1 glass to resin), you are making parts as light as they can be made. Management must take several things into consideration before deciding to go to the extreme high end of possible glass to resin ratios. If your customer requires lightweight parts, you must take higher labor costs into account before submitting a bid because you will find your labor costs going up. Increased labor costs offset your resin cost savings. Relatively dryer, high glass content laminates require extra handwork to produce quality products with minimal voids. Look at the example of a 200-foot boat on the Benefits Graph. It shows a resin savings range of 25% to 60% and a labor savings range of 65% to 85%. If management decides to go for the higher resin savings of 60%, the corresponding labor savings will be at the low end, near 65%.

In other words, your Venus Impregnator will not give you simultaneous maximum labor savings and resin savings shown in the Process Benefits Graph. Actual results will depend upon the goals management chooses and the methods used to pursue those goals. If labor costs are an overriding consideration, then management must forgo the maximum resin savings of extremely high glass percentage laminates.

PROCESS COMPARISON CHART:

You can see the comparisons of several lay-up methods in the second graph. What is evident is the lack of precision or quality control in the less mechanized and non-automated processes. Achieving adequate wetting often leads to excessive resin being used in the hand operated procedures. Spray gun operation is also highly dependent on the experience and skill of the operator. Glass to resin ratios are easier to maintain using the mechanical systems found in the Venus Impregnator.

Venus has tested the output of various lay-up methods. We generally find that hand lay-up (bucket and brush) techniques vary widely in glass content, mostly in the 40% range. External-mix spray saturation gives slightly better results with glass amounts in the 40% to 45% area. The Venus low-pressure airless gun results in mid- to high 40% glass content. An inexperienced crew with a new Venus Impregnator starts out processing laminates with 45% to 50% glass content. After some experience, maximum glass percentages of 60% can be achieved.

If you compare the average glass percentages of the methods listed on the lower chart, you will discover increasing average glass contents as you move from the labor-intensive techniques to the

more automated systems. This is not surprising. If the control of the glass to resin ratio is poor, attempts at reducing resin amounts risk leaving some cloth dry; therefore, the tendency is to add more resin to ensure adequate fiber wetting. With Venus automation, you are able to control the wetting process, both in amount of resin used and uniformity of wetting. Lowering the resin with automation is not as risky as manual techniques.

Management Decisions

As reflected in the Process Benefits Graph, the range of actual shop results vary a great deal more than both Venus engineers and our customer's management had anticipated. Often control of the new equipment is placed in the hands of a relatively unskilled worker in a shop with little monitoring other than production rates. Sometimes the shop is not set up to take full advantage of the new equipment and unnecessary slowdowns take place in production. Finally, if management's study, or lack thereof, has not considered the applicability of a machine to the product being manufactured, costly investments might have disappointing returns.

Savings with your Venus Impregnator are not going to be at their highest levels at the start. It takes a well-trained crew some time to gain the experience needed to achieve the Venus Impregnator's potential production rates and material savings. It is important that workers who will actually operate the equipment be trained so that efficient operation can start producing a return on your investment in the shortest time. To effectively monitor your investment, some members of management should also be trained on the equipment. Without material consumption monitoring, little is known other than the production rate. Venus Products can provide equipment to monitor and record resin consumption on your impregnator. Managers will be able to measure improvements in production efficiency, provide accurate glass to resin information to clients and be quickly alerted to potentially costly problems. Your material consumption information will also allow timely ordering of stock so that production is not interrupted by a shortage of supplies. You can also avoid overstocking of supplies that waste warehouse space and working capital.

Other items are also affected by the addition of an impregnator to the shop. If you are upgrading from a spray-up system to a Venus Impregnator, the ventilation requirements should be reduced. This is due to the way catalyzed resin is handled. The resin and catalyst are internally mixed then gently poured into the wetting reservoir. At no time is the resin aspirated or atomized, therefore, there is lower resin fuming compared to other wetout procedures such as spray-up. Lower fuming means less ventilating with cool air from the outside that needs to be heated. It is also worth noting that many areas of the country are considering legislation restricting Volatile Organic Compound (V.O.C.) emissions at FRP plants. Much of the legislation will severely restrict use of air-aspirated equipment.

Not all products fall into the same efficiency ranges as the boat hulls studied in the Process Benefits Graph. Some products lend themselves well to impregnator process and have higher labor savings, while other products yield little or no benefits from an impregnator system. Management must determine the applicability of a piece of process equipment to the production methods required.

The Next Step

To determine the cost effectiveness of your investment in a Venus Impregnator, management must establish a base point for present operations. Unfortunately most FRP plants have little idea what their present material efficiency is. Material waste needs to be monitored and glass to resin ratios should be established by testing actual output. Once this information is in hand, decisions about investments in new equipment can be made. If potential increases in profits are significant, then there is justification for spending money on new equipment.

Tests have found that laminates produced in a shop often lack consistency from one shift to the next or between different workers. To get an accurate picture of the situation, testing from several areas of many parts must be done over a period of time. The more tests run, the more accurate the results. Testing parts that will have pieces cut out of them are easiest. All you need do is keep records of what part the sample is from and where it was located on the part. A simple burnout test will give the glass to resin ratio. After a number of tests, assumptions can be made as to the average glass to resin ratio for each type of part manufactured. This information can then be used in determining the potential material and weight savings realized by improving your control over the laminate process with a Venus Impregnator.