

Feasibility Study:
**Boosting Processor Power with Another ARC 98 Processor
Versus Replacing Processor With A Landmark I Processor**

For
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Presented December 14, 1999

Summary of the problem

For every day the Jonesville semiconductor manufacturing facility tries to produce one day's worth of chips, it falls behind its own production schedule by over three days. This assumes the production run goes flawlessly. Unfortunately, the facility also experiences an additional 2 hours of downtime per week because the ARC 98 processor cannot handle the volume of transactions the plant's operators are trying to give it. Because the processor is now required to handle 5000 transactions per day, it processes them very slowly, which is why the plant is behind schedule and why the system tends to freeze.

We must fix this problem quickly, or Multiglomerate will eventually go out of business. Orders are already backlogged by three weeks, and more time will pass before the problem is solved. There are two options that can fix the facility's production schedule:

- We can install another ARC 98 processor into the production run
- We can replace the current processor with the Landmark I processor

Before making a decision, Jacob Arthursen, CEO of Multiglomerate Inc. created a research team of experts to analyze the issues involved with making this choice. The team collected the data, but was unable to make a recommendation because it had to handle other company problems not related to this issue. Mr. Anderson then asked me to analyze the data the team had collected and present a feasibility study on this issue. After Mr. Anderson and other company executives review this report, he will make a decision on this issue.

What's causing the Jonesville plant to drop behind schedule

Five years ago this plant handled only 1000 transactions per day. The ARC 98 processor, using the MISSION plant production program, processed each transaction in about 10 seconds. This meant the entire run was finished in less than three hours if no mishaps occurred. Because the system was running below capacity, more contracts were sold to other companies, and the number of transactions gradually increased.

Last month, management of the plant agreed with IBM to provide them with the equivalent of 2500 semiconductors per day. The plant's manufacturing load rose to 5000 transactions per day. The result was surprising: It took the MISSION program 120 seconds to complete each transaction. That means it would take 167 hours to complete work set for a 16-hour day. After careful study, the team that analyzed this problem determined the ARC 98 processor couldn't handle the additional workload. In addition, because the added load slowed down the processor, the MISSION system freezes an average of four times per week, and it takes a half-hour for the system operators to get it running again.

This report was created when we were three weeks behind schedule. IBM is greatly concerned, because our semiconductors are used in its new line of mini hard drives. To make a comparison, when Motorola was late delivering processors for Apple Computer's new line of G4 computers, its stock dropped 10 points in one day. Attempting to avoid following Apple's lead, IBM has

already sent several representatives to the plant to find out why there is a delay, and how long it will be. Our other customers have done the same. Mr. Arthursen intends to answer our customers' questions as soon as he and other company executives review this report.

Our alternatives

The hard truth is Multiglomerate Inc. is too far behind schedule to catch up. Most of our customers are probably willing to give us some time to fix the problem, but if we don't fix it quickly they will need to go to our competitors for semiconductors. The research team, made of plant operators and company personnel, investigated the problem and came up with two possible solutions: Add another ARC 98 processor to the manufacturing process, or replace the existing processor with the more-advanced Landmark I processor.

When making this choice, several factors must be considered before either choice is made:

- Time needed to modify the Jonesville facility before being able to produce semiconductors for customers
- Whether or not our customers will wait while the plant is retooled and the employees are retrained after a choice is made.
- The total costs of installing one of the two processors
- Whether or not either choice will solve any foreseeable problems in the future
- Attitudes of the employees towards any changes

Time needed to modify the facility before producing semiconductors

Several factors determine how long it will take to get the plant to make semiconductors efficiently again.

Adjustments to the physical plant

Adding an additional **ARC 98** processor requires building an adjoining facility. The time to build the facility would take approximately 8 weeks to finish.

Replacing the existing processor with the **Landmark I** would require modifying the existing facility, which is estimated to take three weeks.

File transfers and set-up time

It will take one week to set up the second **ARC 98** processor, and transfer files to the computer in the adjoining facility. The time it takes to add another ARC 98 chip was estimated by the Jonesville plant's management, who interviewed the employees who run and maintain the existing ARC 98 system.

The research team estimated it will take two weeks to set up and transfer files to the new system if the **Landmark I** processor is used, but I believe it may take as long as three weeks. When the research team examined the new processor, the manufacturer of the Landmark I

assured them the processor was compatible with the MISSION production system. This is crucial, because the Jonesville plant uses the MISSION system with the current ARC 98 processor. To prove that claim, the manufacturer gave the research team the names of three companies using MISSION with the Landmark I chip. Only one of the three recommended companies wished to divulge any information about the operating system's compatibility with the chip: Milinex Inc., our strongest competitor. The team was told that the chip was easy to install and gave the company no serious problems. However, Milinex's last quarterly report shows our competitor has made losses instead of profits because it missed several quotas for producing semiconductors. To insure any "bugs" are worked out of the system, the company should plan to spend three weeks transferring files and setting up the MISSION operating system if the Landmark I processor is chosen.

Training employees for the new system

An additional **ARC 98** processor will require no training time, because the operators are familiar with it. This does not include training time for the non-operator employees, and it is not certain how much time it will take to train these employees. The plant's management has said the most reasonable assumption is if we build a new facility for the additional ARC 98 processor, it will take one week to train all of the non-operator employees to handle the changes. We also may need to hire new warehouse employees as well (which is discussed later in this document).

It will take 80 hours, or one week of working our operators in 8-hour shifts, to learn how to use the MISSION system with the **Landmark I** processor. Again, training time for non-operator employees will probably take a week. The company may be able to train the non-operator employees during that time. The plant's management was not completely certain the other non-operator employees could be trained while the MISSION operators are being retrained, but they thought it was likely. If it is not possible, it will take two weeks to train all plant employees to adjust to the Landmark I.

Summary

It will take about 9-10 weeks to install the ARC 98 processor, and 7-8 weeks to install the Landmark I processor. However, because the Landmark I processor is new to our company, it is possible these estimates may be too short. Our time estimate with the ARC 98 processor is more reliable because the plant operators are more familiar with the chip. This factor should be considered when deciding whether or not to use the Landmark I processor.

Will our customers wait during the retooling and retraining period?

Multiglomerate's newest and biggest customer is IBM. While our other customers are important, the bulk of our decision lies with how Big Blue will react to restructuring the Jonesville plant; and the element of time will probably be the biggest factor in their decision.

IBM

IBM purchased a two-year contract for semiconductors from our company. According to our contract, if we cannot fill semiconductors orders for the first six months of the contract, it is legal for IBM to break our contract and go elsewhere. Currently there are three more months left for us to make our quotas to IBM. In a sense, it doesn't matter which processor the

company chooses because we will not be able to fulfill our contract with IBM no matter what choice is made.

However, the contract states that IBM has the *choice* to leave the contract if we miss our quotas. They may stay aboard with us if we demonstrate that our company is taking the most efficient route to get back on schedule and get caught up with our quotas.

If we decide to use the **ARC 98** processor it will take 9-10 weeks for us to produce semiconductors again. If we use the **Landmark I**, it will take 7-8 weeks. However, since the Landmark chip is a new technology, if we choose it as our processor and then unexpected problems occur, we will have to tell IBM we will be late with our quotas *a second time*. That could make IBM decide to go elsewhere with its business.

Old customers

Our old customers are more likely to hang on with us because we have served them well in the past. This means that either choice is probably acceptable. However, the plant's management has said that many of our older customers cannot wait longer than three months for the changes. Using the **ARC 98** processor will cut us close to that time, but we are likely to beat the three month deadline; using the **Landmark I** processor could be faster, but because it is new technology it may take longer than the estimated 7-8 weeks to set it up. And if it takes longer than three months, we will lose many of our older customers.

New Customers

Multiglomerate is currently talking with Gateway, one of the biggest made-to-order computer companies, to be one of the three suppliers of semiconductors for their computers. Gateway approached Multiglomerate's executives after IBM announced it purchased a two-year contract for semiconductors with us. We can assume similar opportunities will come to us if IBM continues to buy semiconductors from us.

But our future progress also depends on choosing a processor that will serve the company well in the future. Using the **ARC 98** processor means we could lose IBM, and with them new opportunities like Gateway. If we choose the **Landmark I** processor we may retain IBM and attract more companies to us – but if the Landmark processor takes longer than it is estimated, we will lose IBM and any new business opportunities.

Summary

If we choose the **ARC 98** processor, IBM is more likely to leave us, and we will see fewer new business opportunities. However, our old customers will probably stick it out with us. On the other hand, if we go with the **Landmark I** processor, we may keep our old business, keep IBM, and gain Gateway and other new business opportunities. The risk is if we do not meet our timeline for installing the Landmark I, we will lose most of our customers and probably go out of business.

Total costs of installing one of the two processors

The costs for installing either option are close, and because they are so similar, one option is not significantly better than the other.

General cost breakdowns

The table below illustrates the cost of both options. The fixed costs include the purchase price of each processor, energy cost increases, facility adjustments, file transfer and set up time costs, and operator training time (which only applies to the Landmark I processor). Variable costs include all the employee time wasted when the system is being repaired, and the wages it will cost to implement each decision.

Description	ARC 98 Processor	Landmark I Processor
Total Fixed Costs (year one)	\$93,100	\$199,500
Total Fixed Costs (following years)	\$43,100	\$93,300
Total Variable Costs For All Years	\$7,630,896	\$5,707,520
<i>Total Costs For Year One</i>	<i>\$7,723,996</i>	<i>\$5,907,020</i>
<i>Total Costs For Following Years</i>	<i>\$7,673,996</i>	<i>\$5,800,820</i>

Summary

The total cost for installing another **ARC 98** processor will be slightly over \$7.7 million in year one. Each following year the cost for the additional processor will be about \$7.6 million per year. For the **Landmark I processor**, the cost will be a little more than \$5.9 million in year one, and the cost will drop to about \$5.8 million for the following years.

Whether either choice will solve any foreseeable future problems

Both chips have pros and cons when their future performance is measured. One important factor is whether our choice of processor will be wisest course for Multiglomerate's future growth.

Questions about upgrading

The **ARC 98** processor uses technology that is still reliable, but swiftly becoming out-of-date. A comparison to the problem would be choosing to upgrade your personal computer from a Pentium II 300 MHz chip to either a Pentium III 500 MHz chip, or to install another Pentium II processor to work in tandem with your original processor. Though initially the two older processors will do a better job than the Pentium III, the technology from the newer processor will eventually beat the two processors, and will be able to do things neither Pentium II processor can do. The ARC 98 processor choice is the same: Two ARC 98 chips can do more work than a Landmark, but they will soon be out of date and need replacing in the near future.

Landmark I processors will let us to process 10,000 transactions per second, and give us the ability to process orders from our old customers, IBM, and many new customers in the future. Again, the big risk for this decision is making our deadlines for installing the Landmark chip and making the Jonesville plant operational by the deadline. If we do not make the deadline, Multiglomerate Inc. may go broke. Also, the Landmark I processor is not the final answer for future technology. Other new and innovative chips may come into the market that are superior to the Landmark I. However, it is impossible to predict what technology will come up in the future.

Summary

Buying another **ARC 98** processor may be a short-term solution, but its technology is swiftly becoming out of date. The **Landmark I** processor uses more current technology, and may be the best option in the long term.

Attitudes of the employees towards any changes

Our employees prospective on this issue must be considered. If we are not careful, we could alienate our employees, and cause productivity to suffer even if the company chooses the best processor for this problem.

Warehouse workers

After being polled, most of the warehouse workers opted for the additional **ARC 98** processor. They made this choice for two reasons: First, because it guaranteed job security because Multiglomerate would have to hire 30 more warehouse workers to handle the new building the new ARC 98 processor would be stored in. Second, they do not want to have to learn the new **Landmark I** system. Even though the warehouse workers know they would still have to adjust to a new building, the warehouse workers supported the ARC 98.

MISSION operators

The majority of the MISSION operators wanted the **Landmark I** processor because they felt the **ARC 98** processor was making their work cumbersome. Some disagreed, because two operators may be no longer needed if the Landmark I chip is used. However, most operators are not worried about this because one of the operators is up for retirement this year.

Management

Management of the Jonesville plant isn't as concerned about training time as much as it is concerned about friction between two sets of workers. Choosing the **ARC 98** processor means pleasing the Warehouse workers, but disappointing the MISSION operators; choosing the **Landmark I** chip means the opposite. The management feels this could lead to friction between the two types of workers, and could interfere with supplying semiconductors no matter what choice is made. John Jones, the head manager for the plant, suggests increasing the number of human resource personnel to handle any potential conflicts between the employees. How many HR personnel would be needed and for how long is not known.

Summary

If we choose an additional ARC 98 processor, we will have to hire an additional 30 warehouse employees. If we choose the Landmark I, we may need to cut two MISSION operators from the staff. The management of the plant is concerned that friction between both groups of employees could hurt production quotas either way. We may not be able to choose a solution without alienating one side or the other, but hiring more HR personnel may help reduce the friction.

Conclusion

Whether we choose the ARC 98 processor or the Landmark I processor, Multiglomerate's biggest enemy is time. The choice must be made as soon as possible, and then the company must quickly explain the decision to our customers tactfully. While the additional ARC 98 processor may be a good solution for the long term, it could certainly hurt future business. The Landmark I processor may ensure future business, there is also a chance Multiglomerate Inc. could go broke. In any event, a choice must be made soon, or the company will certainly be out of business within three months.