

Cray Operations' 16 Week Vision

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ABSTRACT: *The decision by our customers to purchase computer solutions has changed from accepting a lead-time of up to a year to a time frame much shorter in duration. We have recognized this requirement and have re-engineered our Operations Division to reduce our order-to-delivery time to meet the delivery dates our customers expect and deserve. This paper will familiarize you with the new process we refer to as the **16 Week Vision**. It will cover issues such as parts procurement, module/chassis assembly and test, and final integration test of the system.*

Introduction

The Operations Mission is stated as follows:

“The Operations Division will build products that meet customer expectations for quality, cost and delivery.”

The achievement of this mission ultimately has no clearly defined beginning or end. It is a continuous process of change to meet dynamic customer requirements. As a part of this continuous improvement process, the time required to go from initial forecast to final configuration became a major focus.

The Operations Division began a systematic examination of work processes that covered forecasting, purchasing, inventory management, assembly, test and final configuration/shipping. This examination was done within a clearly defined timeline and required input from all levels of Cray employees. The focus of the examination was process problem identification and resolution. This examination caused us to ask why we do things this way - is there another way to accomplish this task and will it add value? As a result, solutions to problems, alternative processes and the **16 Week Vision** were developed.

Past 36 Week Reality

In the past, the forecast was for systems only, with very little information about other parts that made up the final configuration (i.e. disk drives, etc.). The forecast was issued quarterly and the numerous modifications to the forecast, between issuances, came at inconsistent time frames, from a variety of sources and through a variety of channels. Translating the forecast into the build schedule took from six to eight weeks. Parts were ordered to arrive 36 weeks prior to the shipment that

generated the demand. Production was scheduled to begin 18 weeks prior to shipment, and the machine would be configured to the best guess as soon as initial testing of the components was complete. The final configuration often would arrive one week prior to the ship date and changes would be made.

Opportunities within the Past 36 Week Reality

Although this process was successful for many years and would have been viable for many more, certain results of this process were unacceptable to Cray. The lack of detail in the forecast and the inconsistent methods used to communicate demand resulted in frequent schedule changes and conflicting schedules. Communications to purchasing and the manufacturing floor, when the schedule changed, took too long. These factors contributed to long build cycles and excessive amounts of piece parts inventory (greater than eight weeks). Test cycles were long and a lot of rework resulted from incomplete and slow communication of information. The net result, to compensate for the problems within the process, was a 36-week Operations inventory cycle and a 52-week CRI inventory cycle.

16 Week Vision

As a solution to the problems identified with the old way of doing things, the **16 Week Vision** was developed by Cray Operations Management. Under the **16 Week Vision** the forecast is reissued every two weeks and includes sub-assemblies and peripherals. The forecast is translated into a production schedule within seven days. Piece parts are ordered to arrive 16 weeks prior to shipment of the system. Sub-Assembly production (Modules, Chassis, etc.) is scheduled to start 12 weeks prior to shipment. Sub-Assembly testing is completed and parts are stocked in the integration crib four weeks prior to shipment. Also four weeks prior to shipment, the subassemblies are pulled from the crib and the system is put into its final configuration.

16 Week Vision Benefits

The benefits of changing the process to the *16 Week Vision* are:

- A forecast that provides more detailed information on a more frequent basis
- Better control over demand placed on Operations by sources other than the marketing forecast

This is accomplished through a clearly defined channel for communication of this demand that insures it is put into the schedule.

- More timely and accurate schedule information to purchasing and the production floor
- Ultimately a more stable schedule
- Reduced cycle time
- Less inventory required
- Reduced rework

Forecasting Specifics

Marketing will supply a 52-week rolling forecast, biweekly, to the Operations Division, for systems and upgrades at the major component level. The final 16 weeks of the forecast will be frozen. At the point that the forecasted equipment enters the frozen window (week 16), and prior to operations committing to build the equipment, the equipment will be confirmed to the contract line item level. At week 12 when the forecasted equipment enters the assembly stage, the delivery date of the equipment will be confirmed.

A checklist was developed to insure all the required information is available and in place prior to pulling sub-assemblies out of the integration crib for final configuration. Operations and Marketing will review, on a scheduled basis, the forecasted versus actual shipments and associated inventory levels. As variances occur, Cray management will determine and implement the appropriate adjustments in the build schedule to maintain an effective inventory and meet the requirements of our customers.

Planning and Procurement Specifics

The forecast is loaded into the Business Planning Module. This tool allows planning to simulate the production schedule and identify/resolve capacity issues prior to the schedule being released to the floor. The schedule is then loaded into the Material Requirements Planning System. Action notices are issued from the system to tell Procurement to order parts. This process is completed within one week to insure prompt communication to suppliers. Purchasing parameters are aligned with a four week piece part inventory. Parts are scheduled to arrive no greater than four weeks prior to the assembly start date.

Individual work center schedules were developed and are available to supervisors for on the floor implementation and

follow-up. Resource planning tools were refined and are used to insure the appropriate resources are available to complete the scheduled production within customer requirements.

Build and Test Specifics

Subassemblies (modules, chassis, etc.) are released to the production floor 12 weeks prior to the date they are scheduled to ship. Lead-times and operations on the subassembly routings are structured in the Material Requirements Planning System such that they will be completed within eight weeks. As a general rule, the assembly process is scheduled to be completed within four weeks.

At this point the subassemblies are ready to undergo a rigorous series of tests. These tests are scheduled to be completed within four weeks. Upon completion of the tests, the subassemblies are placed in a logical inventory called the integration crib. This inventory is monitored by Operations and Marketing to insure it contains the appropriate quantities and mix to meet customer requirements. It is from this crib that subassemblies will be pulled to assemble the system in its final configuration.

Final Configuration

Four weeks prior to the scheduled ship date for a system, the subassemblies are pulled and assembled into the final system configuration. At this time, all documentation and detail required to configure and ship the system to customer specifications will be available. This will include:

- Signed contract by both parties
- Export license (if required)
- Letter of credit (if required)
- Software license
- Final configuration including diagram of module locations and cable/channel connections.
- Color definition (if required)
- Confirmed site readiness by local site planner
- Confirmed date to start installation
- Satisfaction of third party hardware issues
- Specifications of factory trial requirement

When the system is configured it is run through the final series of tests. These tests are intensive and insure the reliability of the system and its components in the final configuration. Upon completion, the system is disassembled and packaged for shipment. This activity begins three to five days prior to the scheduled ship date.

Summary - Results/Further Improvement Plans

Implementation of the *16 Week Vision* has improved the utilization of Cray's Operations' Resources with the goal of

meeting 100% of our customers requirements. Cray inventories were reduced \$112,000,000 in 1994. This represented a substantial cash flow improvement and carrying cost savings of \$6,000,000 to \$7,000,000, to invest in further improving our business.

As stated earlier, this is a continuous process of change to meet dynamic customer requirements. While all areas have not yet fully implemented the new processes, we are on target to complete implementation by mid-year.

16 Week Manufacturing Vision



Change

"...the hallmark of the truly successful company is a willingness to abandon what has long been successful.

...A truly great company willingly abandons practices that have long worked well, in the hope and expectation of coming up with something better."

Author: Andrew



Planned improvements to close out 1995 are:

- Further reduce the cycle time to 12 weeks.
- Reduce inventory an additional \$30M.
- Improve forecasting process.
- Reduce lead time with suppliers.
- Improve the quality of our products.

Previous Manufacturing Model

- Sales & Marketing provided a one-year machine forecast.
- Chippewa built machines to the configuration specified in the forecast.
 - Via the DAL process, machines were assigned to the eventual customer.



This Model Doesn't Work Anymore

- We no longer have anything like one year viability.
- We can't easily tell if we are building too many or too few components.
- We can't respond to the numerous configuration changes that are today's reality.
- We can't load-level the factory.
- We end up with too much inventory.
 - It was greater than \$300M on January 1, 1994.
 - We can only achieve about *one* inventory turn per year.
- The bottom line is that manufacturing costs (and therefore product costs) are just too high.



The New Manufacturing Model

- **Delays final configuration to the last 'minute'.**
 - Last 'minute' means 4 weeks for mainline system and 3 weeks for agile systems.
 - Allows for maximum configuration flexibility
- **Delays starting build until 12 weeks before expected delivery.**
 - Minimizes parts inventory and scrap
- **Does not allow changes inside the 16 week envelope.**
 - Allows efficient plant load leveling
 - Permits much greater visibility into build, versus actual demand, and makes it possible to increase or decrease module build rates incrementally

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16 Week Manufacturing Vision



Delivery Checklist

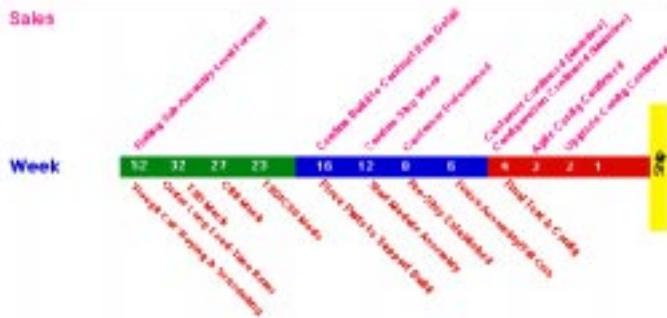
1. Signed contract by both parties w/o contingencies
2. Export license (if required)
3. Letter of credit (if required)
4. Software license
5. Final configuration including diagram of module locations and cable/channel connection
6. Color definition (if required)
7. Confirmed site readiness by local site planner
8. Confirmed date to start installation
9. Satisfaction of third party hardware issues
10. Specification of factory trial requirement (if required)

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16 Week Manufacturing Vision



16 Week Vision



Operations

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16 Week Manufacturing Vision



Summary - Overall Benefits

- Greatly reduced parts inventory and scrap
- Greater flexibility in meeting final configurations
- Greater ability to load-level the factory
- Fewer customer 'surprises'; i.e. deliveries will be much more predictable

The bottom line is that by implementing this new model, we can:

- reduce product cost
- improve margins
- reduce cost-of-ownership to our customers

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