



## CAC and James Bradley

### Manufacturing Capacity and Inventory: New Models for Profitability

How much production capacity should a manufacturing company install? How much inventory should they hold?

#### Finding the Answer

James Bradley, former Assistant Professor at the S.C. Johnson School of Management and currently Professor of Operations & Information Technology at William & Mary, worked with the Center for Advanced Computing to reduce his production management model run times from 5 days on a PC to 3 minutes on a high-performance computing system.



Bradley worked 15 years at General Motors in manufacturing

#### Manufacturing Capacity and Inventory

The proper analysis of production capacity and inventory is vital to the profitability of manufacturing companies. These companies use three buffers – extra capacity, extra inventory, and longer delivery times – to cope with the variability in manufacturing systems. Senior managers often focus on running at full capacity, and relying on extra inventories as buffers. However, this may not be the most profitable solution.

#### Improved Research

##### Research Metrics

- Platform Flexibility: Port research application from PC platform to HPC platform
- Speed: Decrease compute time from days to minutes

##### Research Challenge

To be effective, manufacturers must be able to analyze capacity and inventory factors simultaneously rather than independently. Recognizing this, James Bradley developed a new production management model that approximates complex real-world manufacturing systems and helps managers to find the best balance between manufacturing capacity,

inventory level for finished goods, and even allows consideration of policies for subcontracting – a reflection of the trend toward the vertical disintegration of manufacturing.

### **Solution**

Bradley developed simulation algorithms in C++ to validate his manufacturing models on his Windows desktop and laptop. However, validating the model required substantial computing resources. Eager to get timely results, he took advantage of the high-performance computing systems offered by CAC for his production runs.

Bradley found the HPC system reliable and easy to use. And, with his desktop and laptop freed up from running long computations, he was able to move forward with new research projects. James Bradley's research has benefited greatly, as will the companies that use his tools to increase the profitability of their manufacturing systems. Cost-effective clusters built from industry standard components and software are introducing new classes of users to the power of scalable high-performance computing.

### **The Client**

James Bradley, former Assistant Professor of Production and Operations Management at the S.C. Johnson School of Graduate Management, Cornell University

- Currently Professor, Operations & Information Management, William & Mary
- Extensive manufacturing experience
- Research on capacity management, supply chain and life cycle management
- Industry consulting clients include 3M, Digital Equipment Corporation, and the Commonwealth of Virginia Employment Commission

### **The Collaborative Relationship**

“Scaling up from my desktop to a large-scale cluster on one operating system was a real time saver. I ported the programs I developed on my desktop to CAC systems without any modifications. Running multiple programs simultaneously saved me months.”

James Bradley

Former Assistant Professor, Manufacturing, S.C. Johnson School of Management  
Currently Professor, Operations & Information Management, William & Mary  
Mason School of Business