

SUPPLY CHAIN MANAGEMENT AT DELLMAR, INC.

It is early March, and Ron Mason has many reasons to feel good about his career. It has been only eight short years since Ron graduated from business school, and he has just been promoted to vice president of logistics at Dellmar, Inc. In fact, Ron is one of only five vice presidents at the company, which is quite an accomplishment.

Dellmar is a major manufacturer of commercial air-conditioning systems. Dellmar introduced its cost-efficient air-conditioning system "Cushion-Air-Pro" one year ago, and this system has been very successful in the marketplace. Customers have praised the system for its design, efficiency, reliability, and price. Orders for the Cushion-Air-Pro system have been growing rapidly.

However, the success of Cushion-Air-Pro has created serious logistics problems at Dellmar. Delays in stocking of Cushion-Air-Pro at Dellmar's national and regional distribution centers have resulted in long delays in satisfying customer orders. At the same time, there is widespread concern within Dellmar that inventory and transportation costs are excessive. In February, total inventory and transportation costs amounted to over \$1.4 million. It was now up to Ron Mason to somehow figure out how to deliver Cushion-Air-Pro to customers on time, while simultaneously decreasing total inventory and transportation costs.

The Supply Chain for the Cushion-Air-Pro System

Dellmar manufactures the Cushion-Air-Pro system at its manufacturing plant in New Hampshire. The plant has the capacity to produce up to 50,000 Cushion-Air-Pro units per month. Given the success of the Cushion-Air-Pro system, Dellmar is considering increasing this capacity by an additional 10% at an additional cost of \$55,000 per month in financing and operating costs.

Dellmar divides up its national sales into three regions: the East Coast, West Coast, and Midwest areas of the United States. Each region is served by a regional sales distribution center, whose locations are Wilmington, Delaware (serving the East Coast); Salinas, California (serving the West Coast); and St. Louis, Missouri (serving the Midwest). Dellmar operates two national distribution centers, one in Ohio (that serves the Midwest and the West Coast), and one in New Jersey (that serves the Midwest and the East Coast). Completed Cushion-Air-Pro units are shipped from the plant in New Hampshire to the two national distribution centers (in Ohio and New Jersey), where they are stored for shipment to the three regional sales distribution centers. In order to take advantage of economies of scale in shipping, shipments are scheduled for once a month. Dellmar keeps inventory both at the two national distribution centers as well as at the three regional sales distribution centers.

Transportation and Inventory Costs

The unit cost of shipping of a Cushion-Air-Pro system either from the plant to a national distribution center or from a national distribution center to any of the regional sales distribution centers is \$10 per system. The fixed transportation costs of arranging for shipments are shown in Table 9.15.

The unit inventory cost per month at the national distribution centers in Ohio and New Jersey is \$5 per unit per month, while it is \$10 per unit per month at the regional sales distribution centers.

TABLE 9.15

Fixed transportation costs for the various routes at Dellmar.

<i>Route</i>		
<i>From:</i>	<i>To:</i>	<i>Fixed Transportation Cost</i>
New Hampshire	Ohio	\$5,000
New Hampshire	New Jersey	\$4,000
Ohio	West Coast	\$4,000
Ohio	Midwest	\$3,000
New Jersey	Midwest	\$5,000
New Jersey	East Coast	\$3,000

TABLE 9.16

Forecasted demand for Cushion-Air-Pro for April and May.

<i>Sales Region</i>	<i>Month</i>	<i>Forecasted Demand (units)</i>
West Coast	April	20,000
	May	20,000
Midwest	April	15,000
	May	25,000
East Coast	April	25,000
	May	30,000

TABLE 9.17

Estimated inventories of Cushion-Air-Pro at the end of March.

	<i>Distribution Center</i>	<i>Units</i>
National Distribution Centers:	Ohio	20,000
	New Jersey	10,000
Regional Sales Distribution Centers:	West Coast	2,000
	Midwest	1,000
	East Coast	2,000

The Demand for Cushion-Air-Pro Systems

Ron has asked the marketing department for a forecast of the demand for Cushion-Air-Pro systems for the next two months. The marketing department's forecast is shown in Table 9.16.

Inventories

Table 9.17 shows the estimated inventories of Cushion-Air-Pro units at each distribution center for the end of March, as prepared by Ron Mason's staff.

Ron Mason's Problem

Ron Mason would like to determine how many Cushion-Air-Pro units to manufacture each month, and how many units to ship to the distribution centers each month in order to minimize total transportation and inventory costs. Currently, there is no minimum inventory policy for inventories of Cushion-Air-Pro at any of the distribution centers. This helps to keep inventory costs down, but it does not allow for the flexibility to meet unanticipated surges in customer demand. Ron is thinking of increasing minimum inventories to 500 or possibly to 1,000 units in inventory per month at each distribution center (national as well as regional) as a hedge against such extra surges in demand for Cushion-Air-Pro. Last of all, Ron would like to make a recommendation on whether to increase production capacity at the New Hampshire plant.

Assignment:

- (a) Construct a discrete optimization model of the problem of minimizing the total transportation and inventory costs over the months of April and May.
- (b) In February, the total cost of transportation and inventory cost was \$1.4 million, and the estimated cost for March is roughly the same amount. Using the model you have developed in question (a), what is the average monthly cost in April and May if the logistics operation at Dellmar is optimized? What should be Dellmar's production and shipping schedule? How much inventory should Dellmar keep at each distribution center?
- (c) What is the effect on the total transportation and inventory cost if Dellmar decides to increase its production capacity by 10%?
- (d) In order to decrease delays in filling customer orders, Ron is considering increasing the minimum inventory at each distribution center from 0 to 500 or possibly even 1,000 Cushion-Air-Pro units per month. Is it possible to institute such a policy given the current capacity of 50,000 units per month? Is it possible to institute this policy if plant capacity were to increase by 10%? What would be the effect of such a policy change on total transportation and inventory costs?
- (e) What changes would you make in inventory policy, scheduling of shipments, and possible changes in plant capacity at Dellmar?

THE NATIONAL BASKETBALL DREAM TEAM

Rudy Dellamico has been the coach of the United States national men's basketball team for the last two years. The national men's basketball team is one of the 16 finalists for the world championship basketball tournament which is scheduled to take place in Barcelona next summer. Rudy is the chair of the player selection committee, which is responsible for selecting the 12 players that will comprise the "dream team" from among the best players in the National Basketball Association (NBA) and the National Collegiate Athletic Association (NCAA) men's basketball league. The committee has recently narrowed the field of possible dream team players to 20 players whose player statistics are shown in Table 9.18.

The players have been divided into four play positions:

- Players 1, 2, 3, 4, and 5 are designated as "playmakers," otherwise known as point-guards.
- Players 4, 5, 6, 7, 8, 9, 10, and 11 are designated as "shooting guards."
- Players 9, 10, 11, 12, 13, 14, 15, and 16 are "forwards."
- Players 16, 17, 18, 19, and 20 are "centers."

Notice that there are players that can play more than one position. For example, player 4 is both a playmaker and shooting guard. For balance purposes, the committee has decided that the team should consist of at least three playmakers, four shooting guards, four forwards, and three centers, which implies that some players who play multiple positions need to be selected.

Players 4, 8, 15, and 20 play in the NCAA, while all of the other players play in the NBA. The committee has decided that they would like at least two players from the NCAA to be included on the dream team.

After a lot of wrangling, the committee has decided that the average rebound ability among the 12 selected players should be at least 7 rebounds per game. Also, they have