

Analytics Exercise: An MRP Explosion— Brunswick Motors

Recently, Phil Harris, the production control manager at Brunswick, read an article on time-phased requirements planning. He was curious about how this technique might work in scheduling Brunswick's engine assembly operations and decided to prepare an example to illustrate the use of time-phased requirements planning.

Phil's first step was to prepare a master schedule for one of the engine types produced by Brunswick: the Model 1000 engine. This schedule indicates the number of units of the Model 1000 engine to be assembled each week during the last 12 weeks and is shown below. Next, Phil decided to simplify his requirements planning example by considering only two of the many components that are needed to complete the assembly of the Model 1000 engine. These two components, the gear box and the input shaft, are shown in the product structure diagram below. Phil noted that the gear box is assembled by the Subassembly Department and subsequently is sent to the main engine assembly line. The input shaft is one of several component parts manufactured by Brunswick that are needed to produce a gear box subassembly. Thus, levels 0, 1, and 2 are included in the product structure diagram to indicate the three manufacturing stages that are involved in producing an engine: the Engine Assembly Department, the Subassembly Department, and the Machine Shop.

The manufacturing lead times required to produce the gear box and input shaft components are also indicated in the product structure diagram. Note that two weeks are required to produce a batch of gear boxes and that all the gear boxes must be delivered to the assembly line parts stockroom before Monday morning of the week in which they are to be used. Likewise, it takes three weeks to produce a lot of input shafts, and all the

shafts that are needed for the production of gear boxes in a given week must be delivered to the Subassembly Department stockroom before Monday morning of that week.

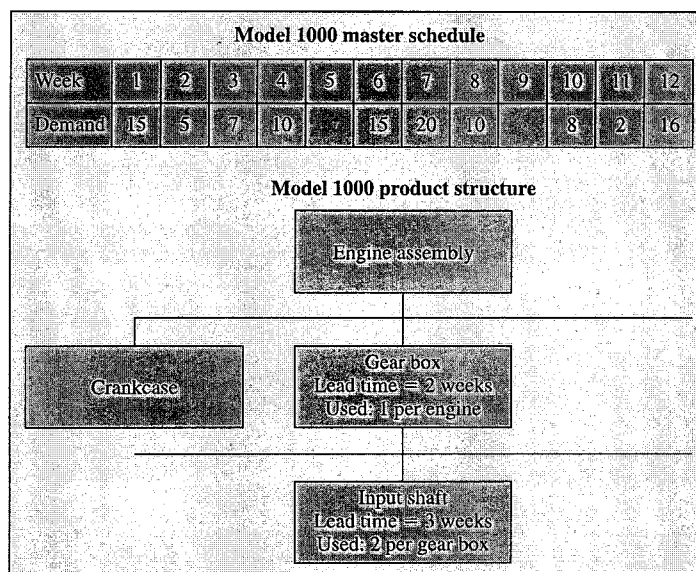
In preparing the MRP example Phil planned to use the worksheets shown on the next page and to make the following assumptions:

1. Seventeen gear boxes are on hand at the beginning of Week 1, and five gear boxes are currently on order to be delivered at the start of Week 2.
2. Forty input shafts are on hand at the start of Week 1, and 22 are scheduled for delivery at the beginning of Week 2.

Questions

1. Initially, assume that Phil wants to minimize his inventory requirements. Assume that each order will be only for what is required for a single period. Using the following forms, calculate the net requirements and planned order releases for the gear boxes and input shafts. Assume that lot sizing is done using lot-for-lot (L4L).
2. Phil would like to consider the costs that his accountants are currently using for inventory carrying and setup for the gear boxes and input shafts. These costs are as follows:

PART	COST
Gear Box	Setup = \$90/order
	Inventory carrying cost = \$2/unit/week
Input Shaft	Setup = \$45/order
	Inventory carrying cost = \$1/unit/week



Given the cost structure, evaluate the cost of the schedule from question 1. Assume inventory is valued at the end of each week.

3 Find a better schedule by reducing the number of orders and carrying some inventory. What are the savings with this new schedule?

Engine assembly master schedule												
Week	1	2	3	4	5	6	7	8	9	10	11	12
Quantity												

Gear box requirements												
Week	1	2	3	4	5	6	7	8	9	10	11	12
Gross requirements												
Scheduled receipts												
Projected available balance												
Net requirements												
Planned order release												

Input shaft requirements												
Week	1	2	3	4	5	6	7	8	9	10	11	12
Gross requirements												
Scheduled receipts												
Projected available balance												
Net requirements												
Planned order release												

Practice Exam

1. Term used for a computer system that integrates application programs for the different functions in a firm.
2. Logic used to calculate the needed parts, components, and other materials needed to produce an end item.
3. This drives the MRP calculations and is a detailed plan for how we expect to meet demand.
4. Period of time during which a customer has a specified level of opportunity to make changes.
5. This identifies the specific materials used to make each item and the correct quantities of each.
6. If an item is used in two places in a bill-of-materials, say level 3 and level 4, what low-level code would be assigned to the item?
7. One unit of Part C is used in item A and in item B. Currently, we have 10 As, 20 Bs, and 100 Cs in inventory. We want to ship 60 As and 70 Bs. How many additional Cs do we need to purchase?
8. These are orders that have already been released and are to arrive in the future.
9. This is the total amount required for a particular item.
10. This is the amount needed after considering what we currently have in inventory and what we expect to arrive in the future.
11. The planned order receipt and planned order release are offset by this amount of time.
12. These are the part quantities issued in the planned order release section of an MRP report.
13. Ordering exactly what is needed each period without regard to economic considerations.
14. None of the techniques for determining order quantity consider this important noneconomic factor that could make the order quantity infeasible.

1. Enterprise resource planning (ERP) 2. Material requirements planning (MRP) 3. Master production schedule (MPS) 4. Time fence
 5. Bill-of-materials 6. Level 4 7. Zero 8. Scheduled receipts 9. Gross requirements 10. Net requirements 11. Lead time
 12. Lot sizes 13. Lot-for-lot ordering 14. Capacity

Selected Bibliography

Jacobs, F. R., W. L. Berry, D. C. Whybark, and T. E. Vollmann. *Manufacturing Planning and Control Systems for Supply Chain Management*. 6th ed. Burr Ridge, IL: McGraw-Hill, 2011.

Orlicky, J., C. Ptak, and C. Smith. *Materials Requirements Planning*. 3rd ed. New York: McGraw-Hill, 2011. (This is the classic book on MRP).