A Short Introduction

Presented by Carol Ptak and Chad Smith, co-authors
Orlicky’s Material Requirements Planning, Third Revised Edition
What is the Problem we are Solving?

Today’s formal planning systems are fundamentally broken!
Old Rules, Old Tools, New Pressures

- Forecast error is on the rise
- Volatility in supply and demand is increasing
- Legacy planning tactics and tools are breaking down
  - Inside most modern ERP systems is MRP
  - 79% of ERP Buyers implement MRP
  - Conceived in the 1950’s
  - Codified in the 1960’s
  - Commercialized in the 1970’s and…
  - …it hasn’t changed
  - What has changed?
The “New Normal”

- Global sourcing and demand
- Shorter product life cycles
- Shorter customer tolerance times
- More product complexity and/or customization

- Pressure for leaner inventories
- Inaccurate forecasts
- More product variety
- Long lead time parts/components

Worldwide there are more complex planning and supply scenarios than ever – the past is NOT an predictor for the future
The First Law of Manufacturing

All benefits will be directly related to the speed of **FLOW** of materials and information.

Corollary:
Materials and Information must be RELEVANT!!!
Effective Materials and Inventory Mgmt – What Should we Strive For?

Too Little = stock-outs, back orders, expedites & missed sales

Too much = cash, capacity and space tied up in inventory

Effective

Ineffective

Amount of inventory
Unacceptable Inventory Performance
Unacceptable Service Level Performance
High Expedite Related Wastes

Too Little = stock-outs, back orders, expedites & missed sales

Too much = cash, capacity and space tied up in inventory

Effective

Ineffective

Oscillation
Supply Chains = Islands of MRP

Should we abandon MRP?

Today’s Complex Supply Chains

But how can we bring MRP into the highly complex and volatile demand driven world?
The Five Components of DDMRP

Demand Driven Material Requirements Planning

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic Inventory Positioning</td>
<td>Buffer Profiles and Levels</td>
<td>Dynamic Adjustments</td>
<td>Demand Driven Planning</td>
<td>Visible and Collaborative Execution</td>
</tr>
</tbody>
</table>

Modeling/Re-modeling the Environment  Plan  Execute
Strategic Inventory Positioning

Where?
(Position)

BEFORE

How Much?
(Quantity)

When?
(Timing)
Answering “Where?”

6 Factors

1. Customer Tolerance Time
2. Market Potential Lead Time
3. Supply and Demand Variability
4. Inventory Flexibility and Matrix BOM
5. Supply and Distribution Net Structure
6. Critical Resource Considerations
New Lead Time Definition

Problem: MRP uses overestimated (CLT) or underestimated (MLT) lead times for end items and subcomponents

ASR Lead Time = The longest unprotected sequence in the BOM

Matrix Bill of Material depicts relationships between ALL child and parent items
Lead Time and Variability

Suppliers

Manufacturing

Machine

Assemble

Distribution Centers
Buffering Materials

Suppliers

Machine

Assemble

Distribution Centers

No buffer necessary
Buffering Intermediates
Buffering End Items

Suppliers

Distribution Centers

Machine

Assemble

DDMRP Intro
Buffering Distributed Items

Suppliers

Distribution Centers

Machine

Asemble

DDMRP Intro
Failure to properly position inventory is a huge source of waste for most manufacturing and supply chain companies.

Position and Pull
Buffer Profiles, Levels and Zones

Group Trait Inputs + Individual Part/SKU Inputs

Lead Time Category
Make, Buy or Distributed
Variability Category
Significant Order Multiples

Average Daily Usage
Appropriate Discrete Lead Time
Ordering Policy (min, max, multiple)
Location (distributed parts)

Stock Out ALERT! Rebuild OK Too Much
Component 3: Dynamic Adjustments

- **Dynamic Buffer Adjustment**
- **Available Stock Position**
- **Average Daily Usage**

- **Seasonality**
- **Ramp Up**
- **Ramp Down**

- **Effectivity Date**

- **Planned Adjustments**

- **Buffer Profiles and Levels**
- **Dynamic Adjustments**
- **Demand Driven Planning**
- **Visible and Collaborative Execution**
Demand Driven Planning

Supply generation is based on what zone the available stock equation places the part.

Available stock = on-hand + on-order – demand (past due, due today, and qualified spikes)

<table>
<thead>
<tr>
<th>Part</th>
<th>Open Supply</th>
<th>On-hand</th>
<th>Demand</th>
<th>Available Stock</th>
<th>Recommended Supply Qty</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>r457</td>
<td>5453</td>
<td>4012</td>
<td>1200</td>
<td>8265</td>
<td>0</td>
<td>No Action</td>
</tr>
<tr>
<td>f576</td>
<td>3358</td>
<td>4054</td>
<td>540</td>
<td>6872</td>
<td>3128</td>
<td>Place New Order</td>
</tr>
<tr>
<td>h654</td>
<td>530</td>
<td>3721</td>
<td>213</td>
<td>4038</td>
<td>2162</td>
<td>Place New Order</td>
</tr>
<tr>
<td>r672</td>
<td>2743</td>
<td>1732</td>
<td>623</td>
<td>3852</td>
<td>0</td>
<td>Expedite Open Supply (Execution)</td>
</tr>
</tbody>
</table>

Order Spike Horizon

1. Strategic Inventory Positioning
2. Buffer Profiles and Levels
3. Dynamic Adjustments
4. Demand Driven Planning
5. Visible and Collaborative Execution
DDMRP Planning Simulation
Highly Visible & Collaborative Execution

Problem: Priority by DUE DATE

Would you rather have your suppliers never stock you out or be 100% on time?

<table>
<thead>
<tr>
<th>Order #</th>
<th>Order Type</th>
<th>Due Date</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>MO 12367</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12379</td>
<td>MTO</td>
<td>5/12/2011</td>
<td>Super Tech</td>
</tr>
<tr>
<td>MO 12465</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12401</td>
<td>Stock</td>
<td>5/14/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12411</td>
<td>Stock</td>
<td>5/16/2011</td>
<td>Internal</td>
</tr>
</tbody>
</table>

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<th>Due Date</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>MO 12367</td>
<td>Stock</td>
<td>Due NOW</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12379</td>
<td>MTO</td>
<td>5/12/2011</td>
<td>Super Tech</td>
</tr>
<tr>
<td>MO 12465</td>
<td>Stock</td>
<td>Due NOW</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12401</td>
<td>Stock</td>
<td>Due NOW</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12411</td>
<td>Stock</td>
<td>Due NOW</td>
<td>Internal</td>
</tr>
</tbody>
</table>
Highly Visible & Collaborative Execution
Solution: Priority by Buffer Status

<table>
<thead>
<tr>
<th>Order #</th>
<th>OH Buffer Status</th>
<th>Order Type</th>
<th>Due Date</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>MO 12379</td>
<td>MTO</td>
<td>5/12/2011</td>
<td>Super Tech</td>
<td></td>
</tr>
<tr>
<td>MO 12401</td>
<td>12% (RED)</td>
<td>Stock</td>
<td>5/14/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12465</td>
<td>27% (RED)</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12367</td>
<td>33% (YELLOW)</td>
<td>Stock</td>
<td>5/12/2011</td>
<td>Internal</td>
</tr>
<tr>
<td>MO 12411</td>
<td>41% (YELLOW)</td>
<td>Stock</td>
<td>5/16/2011</td>
<td>Internal</td>
</tr>
</tbody>
</table>

Priority 1:
Priority 2:
Priority 3:
Priority 4:
Priority 5:
## What Execution Looks Like

### Purchased Items

<table>
<thead>
<tr>
<th>Order #</th>
<th>Due Date</th>
<th>Buffer Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO 820-89</td>
<td>05/12/09</td>
<td>Critical 13%</td>
</tr>
<tr>
<td>PO 891-84</td>
<td>05/12/09</td>
<td>Med 39%</td>
</tr>
<tr>
<td>PO 276-54</td>
<td>05/12/09</td>
<td>Med 41%</td>
</tr>
</tbody>
</table>

### Manufactured Items

<table>
<thead>
<tr>
<th>Order #</th>
<th>Due Date</th>
<th>Item #</th>
<th>Buffer Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>WO 819-87</td>
<td>05/24/09</td>
<td>FPA</td>
<td>Critical 13%</td>
</tr>
<tr>
<td>WO 832-41</td>
<td>05/22/09</td>
<td>SAD</td>
<td>Critical 17%</td>
</tr>
<tr>
<td>WO 211-72</td>
<td>05/22/09</td>
<td>ICB</td>
<td>Med 34%</td>
</tr>
</tbody>
</table>

### Distributed Items

<table>
<thead>
<tr>
<th>Item #</th>
<th>Location</th>
<th>Buffer Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPA</td>
<td>Region 1</td>
<td>Critical 11%</td>
</tr>
<tr>
<td>FPA</td>
<td>Region 2</td>
<td>Med 41%</td>
</tr>
<tr>
<td>FPA</td>
<td>Region 3</td>
<td>Med 36%</td>
</tr>
</tbody>
</table>

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### Bill of Materials

- **Supplier 1**
  - Purchased Parts List
  - PPE
  - PPC
  - PPB
  - PPD
  - PPA
  - PPI
  - PPC
  - PPF
  - PPH

- **Supplier 2**
  - FPA

- **Supplier 3**
  - FPA

### Regions

- **Region 1**
  - WO 211-72
  - ICB

- **Region 2**
  - WO 819-87
  - FPA

- **Region 3**
  - WO 832-41
  - SAD
The Power of DDMRP

Effective

Ineffective

Stock Out:
- Stock-out
- Back orders
- Missed sales

ALERT!

Rebuild:
- Too much
- Cash, capacity
- And space tied up in inventory

OK:

Too Much
### How is this Different Than Safety Stock?

<table>
<thead>
<tr>
<th>Safety Stock</th>
<th>Replenishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A <strong>supplementary</strong> inventory position designed to make up for misalignments between planned orders, actual demand and supply orders</td>
<td>Are <strong>strategic and primary</strong> inventory position designed to decouple areas in order to compress lead times and dampen variability</td>
</tr>
</tbody>
</table>

**Safety Stock** = ![Fire Extinguisher]

**Replenishment Buffer** = ![Firewall]
Supply order signals based directly on the composition of the buffer and typical the size of the green zone.

This picture represents a snapshot of a safety stock position. It looks to have a similar composition as the Replenishment buffer, but...

- The entire buffer flexes.
- Independent of planned orders.
- Independent of planned orders (no forecast).
- Directly related to planned orders.
- Only this can be dynamic (typically not).

When on-hand goes below red an EXISTING supply order is EXPEDITED.

When on-hand goes below safety stock a supply order is LAUNCHED and EXPEDITED.
Re: VARIABILITY ABSORPTION

Replenishment Buffers are Firewalls on both sides

The win for suppliers

Aggregated and Steadier Supply Requirements

The win for consumers

Reliable Availability

Compressed Lead Time

Cumulative Supply Variability

Cumulative Demand Variability

Green

Yellow

Red

Supplier of Stock

Consumer of stock

Safety Stock is designed to protect only one side of the equation and may even exacerbate variability.
Re: LEAD TIME COMPRESSION

Safety Stock

Demand Signals

Supplier -> Supply -> Manufacturer

Forecasted Order

Safety Stock Order

Aggregated Supply Order Signal Based On Actual Consumption and Order Spikes

Supplier -> Supply -> Consumer

Actual Orders/ Consumption

Lead Time

DDMRP Intro
Re: LEAD TIME IMPACTS
Dampened Variability

Compressed Lead Times

Supplier
Raw Stock
Mfg
Intermediate Stock
Mfg
Finished Stock
DC

Partially Dampened Variability

Safety Stock

Open Supply
On-Hand
Safety Stock

Un-Compressed Lead Times
Some DDMRP Early Adopters
Early Adopter Results
Early Adopter Results

Low Inventories  
High Service  
Fewer Expedites

High Inventories  
Shortages  
Massive Expedites

Longview Inv  
Longview TR

Houston Inv  
Houston TR
Synchronization and Flow Challenge

Distortions & amplification in demand requirements reverberate backward.

Supply Variability

Steel Products

Component Supply (H/L)

Mining Products

Drilling Systems

Forestry Products

Offshore Products

End Item Assembly inherits the amplifying upstream variability.

C = Customer

= Remote Location

Lead Time before DDMRP

DDMRP Intro
= Strategic Replenishment Buffers
= Time Buffer

C = Customer
= Remote Location

SP

Suppliers

CS

FP

MP

DS

OP

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Before Demand Driven – FMCG Example

Purchase Orders → Mix Room → Pack 1 → DC
Purchase Orders → Mix Room → Pack 2 → DC
Purchase Orders → Mix Room → Pack 3 → DC

Planned Orders (MRP) → Mix Room → Pack 1 → DC
Planned Orders (MRP) → Mix Room → Pack 2 → DC
Planned Orders (MRP) → Mix Room → Pack 3 → DC

Manufacturing Orders → Mix Room → Pack 1 → DC
Manufacturing Orders → Mix Room → Pack 2 → DC
Manufacturing Orders → Mix Room → Pack 3 → DC

Expedites/Schedule Break-ins → Mix Room → Pack 1 → DC
Expedites/Schedule Break-ins → Mix Room → Pack 2 → DC
Expedites/Schedule Break-ins → Mix Room → Pack 3 → DC

50+ Days
The Shift to Demand Driven MRP - FMCG

- **Raw**
- **Pack**
- **Mix**
- **Pack 1**
- **Pack 2**
- **Pack 3**
- **Central Stock**

1 week 1 week

Transportation Time
Immediate Results for Materials - FMCG

300 Materials are buffered without increase in RPW inventory. Lead-times de-coupled

Dampened the bull whip, now operating more effectively, and inventory optimized

Replenishment lead time has been reduced 82% to 9 days from 50 days, becoming Responsive
Early Adopter Results

Mountain House Division:
- Sales increased 20%
- Customer Fill Rate improved from 79% to 99.6%
- 60% reduction in inventory

Industrial Ingredient Division:
- 60% reduction in make to order lead time
- 100% On-Time-Delivery
- 20% reduction in inventory

Raw Material
No out of stock
Reduced inventory $2.5M+
DDMRP – Tube Forgings of America

Tube Forgings of America, Inc. (TFA) has been manufacturing welding fittings since 1955. TFA’s customer base varies from oil refining to chemical and petro-chemical processing, from gas transmission to power generation, including nuclear, and from shipbuilding to a broad assortment of commercial construction applications. Tube Forgings of America is a mid-range closely held manufacturing enterprise.

60% of items are make to stock

Supplier lead times are 4-6 months for strategic items

Customers expect shipment of product in 1-3 days

“Using this method, we have REDUCED inventory and decreased WIP, while increasing serviceability to customers.”

“Inventory planning adjusts quickly and smoothly, with very visible and easy to understand signals.”

“We have been VERY successful during the recent economic crisis.”

“Our customers have learned to rely on our delivery promises, therefore allowing THEM to change their buying habits, switching to order less more often.”
Summary

Bottom Line Benefits Without Tradeoffs
New Operational Equation Elements and Emphasis
Fundamental Planning Changes
Fundamental Principal

ROCE▲

DDMRP

High Service
Lower Inventory
Fewer Expedites

Lead Time
Buffer Status
Order Minimums

Sales Orders
Decoupling Points

FLOW