Rex Materials Group
Case Study

Adapting DDMRP to ETO & MTO
August 26, 2015
Our Business….

- 3 locations – Kansas, Virginia, Michigan
- Manufacturer of custom refractory products for OEM’s and the process industry
- 90% of products are designed for a specific customer
- Serving 14 different industries in 32 different countries
- Produce over 100 different materials for use at temperatures between 1000°F and 3000°F
- High Involvement Org across all functions
History

- In Business 60+ Years
- Largest Vacuum Former of Ceramic Fiber Shapes in the World
  - 100+ Different Formulations
  - Organic and Inorganic System
  - Density from 12 pcf to 125 pcf
- State of the Art Fused Silica Operation
  - High Purity Formulations
Product Delivery....

• Sell 6,000+ different items each year.
• 99%+ of all products are made to order (MTO).
• Mfg cycle time ranges from 1 day to 3 wks.
• 40% of orders made and shipped <5 days.
• 30% of line items for < 5 pcs of an item.
• 30% of line items for >500 pcs of an item.
Pyrolite® / Moldatherm

- Vacuum-Formed Ceramic Fiber Product
- Over 100 Compositions
- No Post Treated Density Range 12 to 20 pcf (0.22 to 0.32 g/cm³)
- Post Treated Densities up to 50 pcf (0.8 g/cm³)
- Variety of shapes and sizes
- Temperatures up to 3000°F
Pyroform™

- Tamped High Density Ceramic Fiber: 65 pcf (1.04 g/cm$^3$) to 73 pcf (1.17 g/cm$^3$).
- Unique Combination of Thermal Insulating Properties and Durability.
- Lower Conductive Heat Losses compared to both Fused Silica and Castable materials.
- Extremely Low Thermal Mass.
- Aluminum Industry
Specialty Heaters

• Industrial, Laboratory, Hobby, and specialty heat processing markets
• Our Electrically Heated Components such as Panels, Modules, and Cylinders come in a variety of standard & Custom thicknesses and sizes.
• They can achieve chamber temperatures up to 2200 F and watt loadings to 3 KW per sq. ft. of heated surface area depending on element design and material selected.
Business Strategy

• Theory of Constraints
  – Focus on Matching Production to Customer Consumption
  – Reduce Cycle Time to Customer Tolerance Time
  – Do Not Make Orders Early
  – Focus on the Bottleneck
  – Increase Throughput
Business Strategy

- Application Knowledge is KEY!
- Understanding Customer Requirements
- Must use the ‘Right” Material
- Mfg Delivers as Promised
  - 98%+ On-Time Delivery
  - Delivering to Customer Needs
- Continually Improve Key Processes/Materials
## Why TOC?

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<td>91</td>
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DDMRP History

2011- Added DDMRP to TOC
  • TOC was highly successful, continuous improvement says keep going.

Why DDMRP?
RMG as an ETO/MTO must have an agile supply chain. We must remain close to the customer and vendor, ready to respond.
  – Inventory performance was low.
    • Forecasts are always inaccurate.
    • Expediting waste from improper inventory positioning.
    • Lost business opportunity due to long lead time out of stock materials.
      – Customer tolerance times reduced.
    • Obsolete inventory due to short product life cycles.
Step 1: Strategic Stock vs. Lead Time Managed

*Inventory is not bad, reducing inventory is not the goal. Make it move and fast.*

– Stock Strategically
  * Customer Tolerance Time
  * Market Potential Lead Time
  * Variability, Demand & Supply
  * Flexibility in Manufacturing
  * Protect the Drum

– Lead Time Managed
Step 2: Buffer Profiling

- Parts are grouped by family to set buffer profiles.
  - Make/Buy
  - Variability
  - Lead Time
- Buffer levels and zones are set using standard DDMRP calculations.

*It became very obvious very quickly that not all families would be protected using ADU. ETO/MTO was causing major distortion to ADU.*
ADU distortion in ETO/MTO

Typical order sizes must be protected, ADU would not protect due to the distortion of the average.
Buffer Profiling - Adapted

Why:
• We needed to adapt some of the calculations to align with our environment.
  – Inventory needs to provide protection, ADU does not provide protection for all of our item families.

How:
• Started by reviewing options.
  – Trial and Error
    • Max consumption
    • ADU + variability days

Stayed true to the DDMRP theory, the protection is provided through variability adaptation.
Step 3: Dynamic Adjustments

Existing Item → Periodic Review → Expedite Request

1. IT provides consumption on all parts at month end for rolling 12 month period.
2. Enter ADU, MAX, Variability information into Excel© with pre-set calculations.
3. Calculate ADU and MAX based on sales data.

New Item → Demand Driven Manufacturing Software (Synchrono)

LIVE SYSTEM UPDATES REQUIRED
## Buffer Profiling & Adjustments

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<th>Item Number</th>
<th>Vendor #</th>
<th>Vendor Name</th>
<th>Max</th>
<th>Avg</th>
<th>Midpoint</th>
<th>Planning Volume</th>
<th>1-3 Late</th>
<th>4-7 Late</th>
<th>8+ Late</th>
<th>Lead Time</th>
<th>Vendor Variability</th>
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<th>Days Inv.</th>
<th>Buffer</th>
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Step 4: Demand Driven Planning

- RMG utilizes a real-time, demand driven planning, scheduling and execution software program.
  - Synchronized workflow driven from demand – not forecast.
  - Clearly defines priorities.
  - Manages against multiple considerations.
    - Promise Date
    - Supply constraints
    - Resource constraints
Step 5: Visible & Collaborative Execution

- Global visibility, allows real time, instant access across the organization.
- Provides the required information for sound decision making, without scheduling software.
  - Web based
  - Visual
    - Red/Yellow/Green buffer zoning
  - Synchronized
    - Priorities
    - Constraints
    - Alerts
SUCCESS!

supplier

RMG

Supplier

RM

Customer

FG

Customer

Customer

RMG

Customer
But....

What about our Vendors?

We are the middle of our supply chain!

What about our Customers?

Could DDMRP help with our vendor and customer supply chains?
Customer Case #1

• Expedite Requests
  – Demand Orders being built at RMG using flexible capacity, driving overtime.
  – Added freight cost through airfreight and expedited LTL shipments.
  – Administrative distraction; buyers, planners, customer service, production managers.

• Inventory not providing protection.
  – Too much of the wrong inventory, driving costs at both RMG and the customer.
Perspectives

RMG:
“Hey, we’re not a non-profit!”
Not happy with customer ordering policies that drive OT and Expediting Costs!

Customer:
Happy with our performance
Not really on their radar.
Approaching the Customer

What if we can minimize or eliminate shortages?
What if we can keep production lead times as short as possible?
What if we can keep working capital synchronized with demand?

Would you hear us out?
The Action Items

• Gain visibility and understanding of the customers operating model.
• Identify a team to lead the effort to align the supply chain at both RMG and the customer.
• Define how the customer and RMG measure success as related to improved flow in the supply chain.
The Team

Customer Team
• Director of Supply Chain, Lead
  – Buyer
  – Master Scheduler

RMG Team
• Supply Chain – CDDP, Lead
  – IT
  – Customer Service
  – Manufacturing Manager
Gaining Visibility

• Data Collection
  – Master Scheduler at the customer location provided forecast data, actual consumption, and on hand inventory for 6 months.
  • RMG spent this time analyzing and understanding what was actually happening on the customer manufacturing floor vs. MRP.
As suspected we found...Chaos.
Forecast Inaccuracy

- Up to and including 100% inaccuracy
- MRP was ordering materials based on an inaccurate forecast.
  - The wrong materials were being ordered and built.
    - Expedites followed the orders because now they needed the right materials.
    - Inventory carried was roughly 3-4 months.
      - RMG facility 2 shipping days away.
      - RMG cycle time – 2 days.
Supply Chain Solution Requirements

The solution...

• Must allow production the flexibility to respond to market needs.
• Cannot rely on forecasts, they are inaccurate.
• Must be simple, and consider demands on peoples time.
• Cannot drive costs for RMG or Customer.
The Solution is Demand Driven

- Strategic inventory positioned at the customer location.
- Inventory levels based on ADU + variability.
- Inventory level adjustments made based on ramp up/down and seasonality.
- Demand orders placed based on ACTUAL demand/consumption.
- Quarterly meetings to insure that the supply chain remains agile by staying close to the customer and ready to respond.
What happened to Inventory?

• Right Sizing Inventory – does not always mean that inventory turns will increase.
• In this case inventory turns did increase.
  – Current on hand vs. buffer profile at time of analysis was a reduction of 67%.
  – Operating inventory went from 6 weeks on hand to 2 weeks average on hand per DDMRP calculations.
Measuring Success and Launching

• Measuring Success
  – Expedites, eliminated.
  – Short lead time, smaller batches, smooth flow.
  – Inventory right sized, reduced.

The only remaining question from our customer, “How soon can you have this in place?”
Customer/Vendor Case #2

The opportunity:

• Customer orders TL quantities due to International shipments, catalog “sales”, and seasonal demand.
  – Requires short lead times due to market tolerance and demand variability.

• Large batch sizes created long lead times, huge spikes, and absorption of flex capacity at RMG.
  – Demand on shared resources depletes capacity, putting other customer orders in jeopardy.
  – Raw material lead times do not meet customer tolerance time.
    • If all raw material were kept at RMG the cost would be excessive, turns infrequent, not optimally performing.
Demonstrated DDMRP

• Meeting Request
  – Invited customer to our KS facility to view our manufacturing process.
  • Demonstrated DDMRP
    – Strategic inventory placement
    – Small batch, swift Flow

CEO attended the meetings, quickly saw the advantages and agreed to the approach with a handshake.
Implemented DDMRP

Buffer Profiling, Replacement Inventory at RMG and at Vendor location

RMG Raw Material  RMG Semi-Fin  RMG Fin Goods  CUSTOMER
Measuring Success

• RMG Manufacturing
  – Smaller batches
  – Improved flow

• Inventory Performance
  – Providing excellent protection
  – Optimized by small amounts in numerous locations

• Customer Lead Time Expectations
  – Before DDMRP – 12 week TL Lead Time
  – After DDMRP – 4 week TL Lead Time
Next Steps

Internal implementation of DDMRP has proven to be extremely successful. Downstream and upstream implementations of DDMRP at customer and vendors has proven to be beneficial to both RMG and the customer or vendor.

• Continuous improvement
  – Implementing replenishment module within Synchrono® SyncManufacturing software to automate dynamic inventory profile adjustments
  – Determine how to measure which customer and vendor opportunities bring the most value in adapting DDMRP.
  • Several new customer and vendor opportunities are being pursued.
“The power of DDMRP is that the conflict between planning (predictability) and flexibility (responsiveness) is finally broken. Now it is possible for a company to plan materials effectively while increasing its responsiveness to the market.” – Orlicky's Material Requirement Planning 3rd Edition